

PROJECT MANUAL

HISTORIC FIRE STATION NO. 1 RENOVATION PROJECT

PETALUMA FIRE STATION NO. 1

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SECTION 01 11 00

SUMMARY OF WORK

PART 1 - GENERAL**1.1 SUMMARY**

- A. Fire Station 1, located at 198 East D Street, was originally constructed and placed into service in 1938. The original Station, designed by Brainerd Jones, consisted of a one-story, four-bay fire house intended to enclose fire apparatus and fire personnel living quarters. Subsequently, the Station had one building addition and one building remodel. The building addition completed in 1970 included two additional apparatus bays, offices, day rooms, and living quarters. The building remodel completed in 1991 included interior remodel of additional living quarters, lockers, and a main level accessible restroom.

The site is approximately 0.26 acres, and the building is approximately 10,034 square feet.

The building is a wood framed structure. Steel trusses span four of the original apparatus bays. Exterior building finish throughout is painted stucco. Exterior windows are a combination of steel and aluminum frames with single-pane glazing. Roof covering is a combination of single-ply membrane and asphalt shingles.

The proposed scope of work includes both interior and exterior building renovations broadly summarized as follows:

Interior building renovations include:

- Voluntary seismic upgrades including foundations, steel moment frames, and shear walls
- Mandatory seismic upgrades to shear wall construction where required by building code
- Apparatus Bay concrete floor slab replacement
- First floor ADA access upgrades
- First and second floor restroom renovation
- First floor kitchen renovation
- Second floor sleeping quarter renovation
- Second floor locker and laundry facilities
- Dedicated decontamination area and turnout gear storage
- Dedicated exercise fitness room
- Dedicated historic vehicle display area
- Automatic fire sprinkler installation including monitoring panel

Exterior building improvements include:

- Apparatus concrete apron replacement
- Apparatus Bay door replacement
- Exterior window restoration, rehabilitation, or replacement

Meter, switch gear, and stand by emergency generator replacement
Partial replacement of building addition exterior plaster
Exterior brick veneer restoration and replacement
Exterior building paint
Trash enclosure
Wrought iron fencing

- B. There are known existing hazardous materials present throughout the building. Abatement of existing hazardous building materials is included as part of the scope of work. Specification Section 02 82 10 includes a project specific Limited Hazardous Building Materials Survey conducted by Ninyo & Moore, dated March 13, 2024. Known hazardous materials include:
 - 1. Asbestos Containing Materials (ACM)
 - 2. Lead-Based or Lead-Containing Paint (LBP) (LCP)
 - 3. Universal Hazardous Waste and Polychlorinated Biphenyls (UWR) (PCB)
- C. Owner reserves right to remove and retain possession of existing building improvements (scheduled for removal) prior to start of Contract.
- D. Division 1: Where provisions of General Conditions relate to Project administration or work-related requirements of the Contract, those paragraphs are expanded in Division 1 - General Requirements.
 - 1. General Conditions, Supplementary Conditions and Division 1 - General Requirements contain information necessary for completion of every part of Project.
 - 2. Where items of Work are done under subcontracts, each item shall be subject to these conditions.

1.2 REQUIREMENTS INCLUDED

- A. This section includes administrative provisions:
 - 1. Work sequence.
 - 2. Contractor use of premises.
 - 3. Owner occupancy.
 - 4. Field engineering.
 - 5. Regulatory requirements and reference standards.
 - 6. Special definitions.

1.3 WORK SEQUENCE

- A. Coordinate construction schedule and operations with Owner and Architect.
 - 1. Construct Work to accommodate Owner's partial or beneficial occupancy requirements during construction period.

- B. Perform construction or Work in one continuous operation.

1.4 CONTRACTOR USE OF PREMISES

- A. Full use of entire premises for Work and construction operations. General Contractor to allow for:
 - 1. Partial building occupancy or use by Owner.
 - 2. Work by other Owner hired Contractors, Subcontractors, or Consultants.
 - 3. Authorized access to restricted areas.
- B. Coordinate use of premises and access to site under direction of Owner or Architect.

1.5 BUILDING OCCUPANCY

- A. Building will not be occupied by Owner during construction for fire department operations, except for partial or beneficial occupancy noted above.

1.6 FIELD ENGINEERING

- A. Provide field engineering services; establish lines and levels by use of recognized engineering survey practices.
- B. Locate and protect control and reference points.

1.7 REGULATORY REQUIREMENTS AND REFERENCE STANDARDS

- A. Regulatory Requirements:
 - 1. Architect has contacted governing authorities and reviewed design requirements of local, state and federal agencies for applicability to Project.
 - 2. Contractor shall be responsible for contacting governing authorities directly for necessary information and decisions bearing upon performance of Work.
- B. Reference Standards:
 - 1. For Products specified by association or trade standards, comply with requirements of referenced standard, except when more rigid requirements are specified or are required by applicable codes.
 - 2. Applicable date of each standard is that in effect as of date on proposal or date on Contract where no proposal is available, except when a specific date is specified.

1.8 SPECIAL DEFINITIONS

- A. Approved: Approved, directed, selected, required, ordered, designated, accepted, acceptable, and satisfactory shall require written action by Architect.
- B. Equal, or Approved Equal: Equal and approved equal shall require requests for substitutions for products or manufacturers not specified.

1. Requests for substitutions shall be in accordance with requirements of Section 01 63 00 - Substitutions.
- C. Furnish: Furnish means supply and deliver to Project, unless otherwise defined in greater detail.
- D. Install: Install is used to describe operations at Project, from inspecting and unloading, to completion in place, ready for intended use.
- E. Provide: Provide means furnish and install, complete and ready for intended use, unless otherwise defined in greater detail.

END OF SECTION

SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS

PART 1 - GENERAL**1.1 SUMMARY**

- A. This section describes general procedural requirements for ongoing submittals.
 - 1. Construction progress schedules.
 - 2. Schedule of values.
 - 3. Shop drawings.
 - 4. Product data.
 - 5. Samples.
 - 6. Manufacturers' certificates.
- B. Related Requirements:
 - 1. Section 01 40 00: Test reports, manufacturer's field reports, and mock-ups.
 - 2. Section 01 63 00: Product substitution request procedures.
 - 3. Section 01 70 00: Manufacturers' instructions.
 - 4. Section 01 77 00: Closeout requirements including Project Record Documents.
 - 5. Section 01 78 00: Warranties.

1.2 PROCEDURES

- A. Submittals: Transmit each item under form furnished by or acceptable to Architect; where Contractor proposes to use customized submittal transmittal form or no form is furnished, submit sample to Owner and Architect for approval prior to use.
 - 1. Identify Project, Contractor, subcontractor, major supplier.
 - a. Date and attach sequential identification number for each new submittal.
 - b. Identify each resubmittal using original submittal number and sequential identification clearly indicating item is resubmitted.
 - 2. Identify pertinent Drawing sheet and detail number, and Specification section number as appropriate.
 - 3. Identify deviations from Contract Documents.
 - 4. Provide space for Contractor and Architect review stamps.

5. Contractor: Review and stamp submittals from subcontractors prior to submitting to Architect.
 - a. Review submittals and indicate where conflicts occur with Contract Documents and with work of other subcontractors.
 - b. Return submittals that vary significantly from Contract Documents for correction and resubmittal prior to submitting to Architect.
 - c. Submittals that vary significantly from Contract Documents and that fail to indicate thorough Contractor review prior to submission to Architect will be returned without review.
 - d. cursory review and stamping of subcontractor submittal by Contractor shall not be acceptable.
- B. Initial Schedules: Submit initial progress schedule and schedule of value in duplicate within 15 working days after award of Contract.
 1. After review by Owner and Architect revise and resubmit where required.
- C. Comply with progress schedule for submittals related to Work progress. Coordinate submittal of related items.
- D. After Architect review of submittal, revise and resubmit as required, identify changes made since previous submittal.
- E. Distribute copies of reviewed submittals to concerned persons. Instruct recipients to promptly report any inability to comply.

1.3 CONSTRUCTION PROGRESS SCHEDULES

- A. Submit construction progress schedule with separate item for each major trade and operation, identifying first day of each week.
 1. Show complete sequence of construction by activity, identifying work of separate stages and logically grouped activities.
 2. Show projected percentage of completion for each item of Work as of time of each progress Application for Payment.
 3. "Submittal Schedule": Show Contractor submittal dates required for shop drawings, product data, and samples, and product delivery dates; deliver to Architect per approved "Submittal Schedule."
 - a. "Submittal Schedule" may be incorporated into construction progress schedule or may be separate, Contractor option.
 - b. Architect's Review Period: Architect will be expedient in review, however, Contractor shall schedule submittals recognizing possibility Architect may reject and may require resubmittal.

- c. Contract extension shall not be allowed for Contractor's failure to properly schedule submittals to allow for Architect requiring resubmittal.
- B. Progress Schedule Format: Horizontal bar chart as approved.
 - 1. Submit revised progress schedules with each Application for Payment reflecting changes since previous submittal, not less than monthly.

1.4 SCHEDULE OF VALUES

- A. Submit typed schedule on AIA Form G703 or another Owner and Architect pre-approved 8-1/2" by 11" paper format; Contractor's standard media-driven printout will be considered on request. Submit within 15 days after award of Contract.
- B. Format: Table of Contents of this Project Manual, with modifications as pre-approved by Owner and Architect; identify each line item with number and title of major Specification sections.
- C. Revise schedule to list change orders for each Application for Payment.

1.5 SHOP DRAWINGS

- A. Submit three reproducible prints; minimum sheet size 8-1/2" by 11".
- B. After review, reproduce and distribute.

1.6 PRODUCT DATA/MANUFACTURERS' LITERATURE

- A. Mark each copy to identify applicable Products, models, options, and other data; supplement manufacturers' standard data to provide information unique to the Work.
- B. Include manufacturers' installation instructions only when required by Specifications or specifically requested by Architect.
 - 1. Maintain copy of manufacturer installation instructions and recommendations in Contractor's field office for review.
- C. Submit number of copies Contractor requires, plus one copy to be retained by Architect.

1.7 SAMPLES

- A. Submit full range of manufacturers' standard colors, textures, and patterns for Architect's selection.
- B. Submit samples to illustrate functional characteristics of Product, with integral parts and attachment devices.
- C. Coordinate submittal of different categories for interfacing work.
- D. Include identification on each sample, giving full information.
- E. Submit number of samples required by Contractor plus one to be retained by Architect.

1. Maintain one set of approved samples at Project Field Office.
 - F. Sizes: Provide following sizes unless otherwise specified.
 1. Flat or Sheet Products: Minimum 6" square, maximum 12" by 12".
 2. Linear Products: Minimum 6", maximum 12" long.
 3. Bulk Products: Minimum one pint, maximum one gallon.
 - G. Full size samples may be used in the Work upon approval.
- 1.8 MANUFACTURERS' CERTIFICATES
- A. Submit certificates, in duplicate in accordance with requirements of each Specification section.

END OF SECTION

SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL**1.1 SUMMARY**

- A. Section Includes: Description of Project management and coordination including but not necessarily limited to the following:
 - 1. General Project coordination procedures.
 - 2. Staff names.
 - 3. Administrative and supervisory personnel.
 - 4. Project meetings.
- B. Related Sections:
 - 1. Section 01 30 00: Administrative requirements.

1.2 COORDINATION

- A. Coordination: Coordinate construction operations included in various Specifications sections to ensure efficient and orderly installation of each part of Work.
 - 1. Coordinate construction operations that depend on each other for proper installation, connection, and operation.
 - 2. Coordinate work to assure efficient and orderly sequence of installation of construction elements.
 - 3. Make provisions for accommodating items installed by Owner or under separate contracts.
- B. Prepare memoranda for distribution to each party involved as needed, outlining special procedures required for coordination.
 - 1. Include required notices, reports, and list of attendees at meetings; include Architect and Owner in distribution.
- C. Verify characteristics of interrelated operating equipment are compatible; coordinate work having interdependent responsibilities for installing, connection to, and placing such equipment in service.
- D. Coordinate space requirements and installation of mechanical and electrical work indicated diagrammatically on Drawings.
 - 1. Follow routing shown for pipes, ducts, and conduits as closely as possible; make runs parallel with lines of building.
 - 2. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

- E. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated; coordinate locations of fixtures and outlets with finish elements.
- F. Administrative Procedures: Coordinate scheduling and timing of administrative procedures with other construction activities and activities of other contractors to avoid conflicts and ensure orderly progress of Work.

1.3 SUBMITTALS

- A. Staff Names: Immediately after receipt of notice to proceed or immediately after signing of Contract by Owner and Contractor, submit list of principal staff assignments, including superintendent and other personnel in attendance at Project site.
 - 1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone.

1.4 SUPERVISORY AND ADMINISTRATIVE PERSONNEL

- A. Provide supervisory personnel, in addition to Project Superintendent, as required for proper and timely performance of Work and coordination of subcontracts.
- B. Provide administrative staff as required to allow Project Superintendent and supervisory personnel to allocate maximum time to Project supervision and coordination.

1.5 PROJECT MEETINGS

- A. Schedule and administer Project meetings throughout progress of Work:
 - 1. Pre-construction meeting.
 - 2. Progress meetings at weekly intervals.
 - 3. Pre-installation conferences.
 - 4. Coordination meetings.
 - 5. Special meetings.
- B. Make physical arrangements for meetings, prepare agenda with copies for participants, preside at meetings, record minutes and distribute copies within two days to Architect, Owner, participants, and those affected.
- C. Attendance: Job superintendent, major subcontractors and suppliers as appropriate to agenda; Architect, Owner, and Owner and Architect's consultants as appropriate to agenda topics for each meeting.
- D. Suggested Agenda: Review of Work progress, status of progress schedule and adjustments, delivery schedules, submittals, requests for information, maintenance of quality standards, pending changes and substitutions, and issues needing resolution.

END OF SECTION

SECTION 01 35 00

SPECIAL ENVIRONMENTAL REQUIREMENTS

PART 1 - GENERAL**1.1 SUMMARY**

- A. Section Includes: Work includes special environmental “Green” building practices related to energy efficiency, indoor air quality, and resource efficiency, including following special requirements.
 - 1. Maximize inclusion of recycled content in materials, products, and systems.
 - 2. Provide wood from certified sustainably harvested sources.
 - 3. Establish special practices to ensure final Project indoor air quality.
 - 4. Maximize use of reusable and recyclable packaging.
 - 5. Maximize use of durable products.
 - 6. Maximize use of products requiring low embodied (production, manufacturing, and transportation) energy.
- B. Green Building Requirements: Comply with Richmond Green Building Ordinance for special environmental “Green” building practices related to energy efficiency, indoor air quality, and resource efficiency, including following special requirements.
- C. Related Requirements:
 - 1. Section 01 74 00: Waste Management and Recycling Program.

1.2 DEFINITIONS

- A. Carcinogens: Materials that contain chemicals listed in following.
 - 1. California Environmental Protection Agency, Air Resources Board (ARB), list of Toxic Air Contaminants (California Air Toxics).
 - 2. California Health and Welfare Agency, Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65), which lists chemicals known to cause cancer and reproductive toxicity.
 - 3. International Agency on Research and Cancer (IARC) List of Chemical Carcinogens.
 - 4. National Toxicology Program carcinogen list.

1.3 ENVIRONMENTAL GOALS

- A. Owner has established general environmental goals for design and for construction of Project; Design team and construction team are encouraged to participate to maximum degree possible to realize Owner's environmental goals.
 - 1. Contract Documents are not intended to limit alternative means of achieving environmental goals.
 - a. Suggestions from Contractor, subcontractors, suppliers, and manufacturers for implementing goals are encouraged; team approach is also encouraged.
- B. Environmental Goals:
 - 1. Refer to specific Specifications sections for more detailed construction requirements related to specific materials and systems.
 - a. Energy Efficiency (Throughout Project Life): Materials and systems are intended to maximize energy efficiency for operation of Project throughout service life (substantial completion to demolition).
 - b. Indoor Air Quality: Materials are selected and processes specified, such as preconditioning and temporary ventilation, to maximize healthy indoor air quality.
 - c. Resource Efficiency (Project Construction): Materials and systems are to maximize environmental construction techniques, including waste recycling, reusable delivery packaging, and reusability of selected materials.
- C. Use resources efficiently.
 - 1. Reuse existing building materials to extent feasible within concept expressed in Contract Documents.
 - 2. Select materials that use resources efficiently.
 - 3. Use construction practices that achieve most efficient use of resources and materials.
 - 4. Provide materials that utilize recycled content to maximum degree possible without being detrimental to product performance.
- D. Avoid scarce, irreplaceable, and endangered resources.
 - 1. Select materials from abundant resources.
 - 2. Select replaceable materials, renewable materials, and materials which can be replenished.
 - 3. Select materials that minimize damage to natural habitats and the natural environment.

- E. Use durable materials.
 - 1. Select materials with longest usable life.
 - 2. Select materials that can be re-used or may be recycled.
- F. Use resource efficient materials; consider energy use over life cycle of material including harvesting, mining, manufacturing, transport, installation, use, operations, recycling and disposal.
 - 1. Select materials that use less energy to manufacture.
 - 2. Select materials that save energy during building operations.
 - 3. Select locally made materials.
- G. Select materials that generate least amount of pollution; consider pollution and volatile organic compound (VOC) emissions generated during harvesting, mining, manufacturing, transport, installation, use, and disposal.
 - 1. Avoid materials that contain ozone depleting chemicals and that emit potentially harmful volatile organic compounds (VOC) emissions.
 - 2. Employ construction practices that minimize dust production and combustion byproducts.
 - 3. Avoid materials that can leach harmful chemicals into ground water; do not allow potentially harmful chemicals to enter sewers nor storm drains.
 - 4. Protect soil against erosion and top soil depletion.
 - 5. Minimize noise generation during construction; screen mechanical equipment to block noise.
 - 6. Select materials that can be reused or recycled and materials with significant percentage of recycled content; set specific recycled content percentages for individual materials; avoid materials difficult to recycle.
 - 7. Protect natural habitats; restore natural habitats where feasible within scope of Project.
- H. Wood Products: Use woods from certified sustainably harvested sources.
 - 1. Certified Wood Products: Wood products to be from forests certified “well-managed” by an agency accredited by Forest Stewardship Council (FSC) including SmartWood Program and Forest Conservation Program.

1.4 SUBMITTALS

A. Resource Efficient Product Data:

1. Environmental Issues Data: Submit data and manufacturer's certifications verifying information and test data, where Specifications sections require data relating to environmental issues including but not limited to:
 - a. Project Recyclability: Submit information to assist Owner and Contractor in recycling materials involved in shipping, handling, and delivery, and for temporary materials necessary for installation of products.
 - b. Recycled Content: Submit information regarding product recycled content information, post industrial recycled and post consumer recycled.
 - c. Product Recyclability: Submit information regarding product and product's component's recyclability including potential sources accepting recyclable materials.
2. Volatile Organic Compound (VOC) Emissions: Identify volatile organic compound emissions, total (TVOC) and individual (IVOC) emissions, which have been identified as carcinogens, and identify VOC emissions that may cause reproductive toxicity.
3. MSDS: Furnish manufacturer's Materials Safety Data Sheets.

B. IAQ Data:

1. Environmental Issues Data: Furnish material safety data sheets (MSDS).
2. Environmental Issues: Submit test data by approved laboratory listing indoor air quality requirements including emissions test data on volatile organic compounds, total (TVOC) emissions and individual (IVOC) emissions.

C. Certificates:

1. General Environmental Issues Certifications:
 - a. Submit documentation certifying accuracy of recycled content, and recyclability.
 - b. Submit documentation certifying cleaning materials have low volatile organic compound (VOC) emissions and have low odor.
2. Certification Prior to Final Completion:
 - a. Submit certificate signed by corporate office holder (i.e. President or Vice President, or similar position of authority) of Contractor, subcontractor, supplier, or manufacturer indicating:
 - 1) Post-industrial and post-consumer recycled content as applicable.
 - 2) Product recyclability.
 - 3) Indoor air quality requirements.

- b. Certification shall state products and materials provided are same as, and contain same components as products and materials tested.
 - c. Certification shall state products and materials provided meet Project requirements for indoor air quality, for recycled content, and for recyclability.
- 3. Comply with requirements specified in Section 01 77 00 – Closeout Procedures.
- D. Closeout Submittals: Submit data relating to environmental issues.
 - 1. Submit environmental product certifications, in two forms:
 - a. Two CD-ROMs organized by CSI Division Format.
 - b. Four three-ring binders organized by CSI Division Format with Table of Contents and with dividers for each division.

1.5 QUALITY ASSURANCE

- A. Environmental Project Management and Coordination: Contractor to identify one person on Contractor's staff to be responsible for environmental issues compliance and coordination.
 - 1. Experience: Environmental project manager to have experience relating to "Green" building construction.
 - 2. Responsibilities: Carefully review Contract Documents for environmental issues, coordinate work of trades, subcontractors, and suppliers; instruct workers relating to environmental issues; and oversee Project Environmental Goals.
 - 3. Meetings: Discuss Environmental Goals at following meetings.
 - a. Pre-construction meeting.
 - b. Pre-installation meetings.
 - c. Regularly scheduled job-site meetings.
- B. Environmental Issues Criteria: Comply with requirements listed in various Specification sections.
- C. Approved Environmental Issues Testing Laboratories:
 - 1. Air Quality Sciences, Inc., 1337 Capital Circle, Atlanta, Georgia 30067, telephone 770.933.0638; facsimile (fax) 770.933.0641; e-mail aqs@mindspring.com.
 - 2. Berkeley Analytical, 904 Wright Avenue, Suite 12, Richmond, California 94804, telephone 510.236.2325.
- D. Environmental Issues Tests:
 - 1. Provide large and small chamber tests using ASTM E5116, Standard Test Methodology for Determining Volatile Organic Compound Emission Factors.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Environmental Issues: Take special care to prevent accumulation of moisture on materials and within packaging during delivery, storage, and handling to prevent development of mold and mildew on packaging and on products.
- B. Use packaging that is reusable or recyclable.

1.7 PROJECT CONDITIONS

A. Certifications:

1. Environmental Product Certification:

- a. Include manufacturer certification indicating product contains maximum recycled content possible without being detrimental to product performance.
- b. Include certification indicating cleaning materials are environmentally benign.

B. Construction Ventilation and Preconditioning:

1. Temporary Construction Ventilation: Maintain sufficient temporary ventilation of areas where materials having volatile organic compound (VOC) emissions for 24 hours before installation, continuously during installation, and for emissions after installation.

- a. Period after installation to be sufficient to dissipate odors and volatile organic compounds.
- b. Ventilate areas directly to outside; ventilation to other enclosed areas is not acceptable.

2. Preconditioning: Allow products which have odors and which have significant volatile organic compound emissions to off-gas in ventilated warehouse for sufficient period to dissipate odor and VOC emissions prior to delivery to Project.

- a. Store products in warehouse without containers and without packaging to maximize off-gassing and to prevent contamination of containers and packaging.
- b. Comply with substitution requirements for consideration of other locations for preconditioning than ventilated warehouse.

C. Protection and Packaging:

1. Protection: Take special care to prevent accumulation of moisture on materials and within packaging during delivery, storage, and handling to prevent development of molds and mildew on packaging and on products.

- a. Immediately remove from site materials showing signs of mold and signs of mildew, including materials with moisture stains.

2. Packaging: Deliver materials in recyclable or in reusable packaging such as cardboard, wood, paper, or reusable blankets, which will be reclaimed by supplier or manufacturer for recycling.
 - a. General: Minimize packaging materials to maximum extent possible while still ensuring protection of materials during delivery, storage, and handling.
 - 1) Unacceptable Packaging Materials: Polyurethane, polyisocyanurate, polystyrene, polyethylene, and similar plastic materials such as “foam” plastics and “shrink-fit” plastics.
 - b. Reusable Blankets: Deliver and store materials in reusable blankets and mats that are reclaimed by manufacturers or suppliers for reuse where program exists or where program can be developed for such reuse.
 - c. Pallets: Where pallets are used, suppliers shall be responsible to ensure pallets are removed from site for reuse or for recycling.
 - d. Cardboard and Paper: Where paper products are used, either recycle as part of construction waste management recycling stream, or recycle for use by manufacturer or supplier where program is available for such recycling.
 - e. Sealant, Paint, Primers, Adhesives, and Coating Containers: Return to supplier or manufacturer for reuse where such program is available.

1.8 SEQUENCING

A. Environmental Issues:

1. On-Site Application: Where high volatile organic compound (VOC) emitting products and where odorous products are applied on-site, apply prior to installation of porous materials.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General Environmental Issues:

1. Mold and Mildew: Materials that have evidence of growth of molds or of mildew are not acceptable, including both stored and installed materials; immediately remove from site.
2. Moisture Stains: Materials that have evidence of moisture damage, including stains, are not acceptable, including both stored and installed materials; immediately remove from site.

- B. Ducts: Seal ducts during construction to prevent accumulation of construction dust and construction debris inside ducts.

2.2 SUBSTITUTIONS

- A. Substitutions Environmental Issues: Requests for substitutions shall comply with requirements specified in Section 01 63 00 – Product Substitution Procedures, with following additional information required where environmental issues are specified.
 - 1. Indicate each proposed substitution complies with requirements for volatile organic compounds, both TVOC and IVOC.
 - 2. Owner and Architect reserve right to reject proposed substitutions where TVOC and IVOC information is not provided and where TVOC or IVOC are higher than specified materials.
 - 3. Comply with specified recycled content and other environmental requirements.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

- A. Building Flush Out: Just prior to Substantial Completion, flush out building using 100 percent tempered outside air for minimum 14 calendar days, and up to 28 calendar days where construction schedule permits.
 - 1. Construction schedule permits extended period where building is fully enclosed, mechanical equipment is operational, and materials producing volatile organic compound (VOC) emissions have been installed.

3.2 CLEANING

- A. Final Cleaning Environmental Issues:
 - 1. Clean interior and exterior surfaces exposed to view; remove temporary labels, stains, and foreign substances; polish transparent and glossy surfaces using solvent-free materials low volatile organic compound (VOC) emitting materials, low odor materials, and materials environmentally benign.
 - 2. Clean equipment and fixtures to sanitary condition using materials solvent free materials, low VOC emitting materials, and low odor materials.
 - 3. Vacuum carpeted and soft surfaces with high efficiency particulate arrestor (HEPA) vacuum.
 - 3. Clean ducts using HEPA vacuum immediately prior to Substantial Completion and prior to using ducts to circulate air.
 - 4. Replace filters just prior to Substantial Completion.
 - 5. Remove and properly dispose of recyclable materials using construction waste management program described in Section 01 74 00 – Waste Management and Recycling Program.

3.3 PROTECTION

A. Environmental Issues:

1. Protect interior materials from water damage; where interior products not intended for wet applications are exposed to moisture, immediately remove from site.
2. Protect installed products using methods that do not support growth of molds and mildews.
 - a. Immediately remove from site materials with mold and materials with mildew.

END OF SECTION

SECTION 01 40 00**QUALITY REQUIREMENTS**

PART 1 - GENERAL**1.1 SUMMARY**

- A. This section describes general quality control requirements.
 - 1. General quality control.
 - 2. Manufacturers' field services.
 - 3. Mock-ups.
 - 4. Independent testing laboratory services.
- B. Related Requirements:
 - 1. Refer to applicable codes and Specifications sections for test requirements.

1.2 QUALITY CONTROL, GENERAL

- A. Maintain quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

1.3 MANUFACTURER'S FIELD SERVICES

- A. When specified in respective Specification sections, require manufacturer or supplier to have qualified personnel provide on-site observations and recommendations.
 - 1. Observe field conditions, including conditions of surfaces and installation.
 - 2. Observe quality of workmanship.
 - 3. Provide recommendations to assure acceptable installation and workmanship.
 - 4. Where required, start, test, and adjust equipment as applicable.
- B. Representative shall submit written report to Architect listing observations and recommendations.

1.4 MOCK-UPS

- A. Erect field samples and field mock-ups at locations on site as approved in advance and in accordance with requirements where included in Specifications section.
 - 1. Test mock-ups requiring special equipment may be erected at location having access to necessary equipment; coordinate with Architect.
- B. Field samples and mock-ups not approved and not capable of being acceptably revised shall be removed from site.
- C. Approved field samples and mock-ups may be used as part of Project.

1.5 TESTING LABORATORY SERVICES

- A. An independent testing laboratory shall perform inspections, tests, and other services required by applicable codes and various Specification sections.
 - 1. Owner or Architect may also require independent testing of items where doubts exists that product or system does not conform to Contract Documents.
 - 2. Owner will employ and pay for testing laboratory to provide Project specific testing under applicable codes and Specification sections except where indicated otherwise.
 - a. Owner employment of testing laboratory shall not relieve Contractor of obligation to perform Work in accordance with requirements of applicable codes and Contract Documents.
 - 1) Laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - b. Retesting required because of non-conformance to specified requirements shall be performed by Owner's testing laboratory.
 - 1) Payment for retesting shall be charged to Contractor by deducting inspection and testing charges from Contract amount.
 - 2) Contractor Option: Pay Owner's testing laboratory directly for costs of retesting where acceptable to Owner and testing laboratory.
 - c. Owner provided testing shall be limited to Project specific testing and shall not include general tests or approvals of materials, equipment or systems.
- B. Services shall be performed in accordance with requirements of governing authorities and with specified standards.
- C. Reports will be submitted to Architect in duplicate giving observations and results of tests, indicating compliance or non-compliance with specified standards and with Contract Documents.
 - 1. Where required, testing laboratory will submit copy of test results directly to enforcing agency.
- D. Contractor shall cooperate with testing laboratory personnel; furnish tools, samples of materials, design mix, equipment, storage and assistance as requested.
 - 1. Notify Owner, Architect and testing laboratory sufficiently in advance of expected time for operations requiring testing services.

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL**1.1 SUMMARY**

- A. This section describes temporary construction facilities and temporary controls.
 - 1. Electricity and lighting.
 - 2. Heat and ventilation.
 - 3. Water and sanitary facilities.
 - 4. Construction aids.
 - 5. Temporary enclosures.
 - 6. Barriers.
 - 7. Cleaning during construction.
 - 8. Project identification.
 - 9. Field telephone service, and storage.
- B. Related Requirements:
 - 1. Section 01 30 00: Administrative Requirements
 - 2. Section 01 31 00: Project Management and Coordination
 - 3. Section 01 70 00: Execution Requirements
- C. Provide temporary construction facilities and temporary controls as required to conform to applicable authorities and as required to complete Project in accordance with Contract Documents.
 - 1. Authorities: Contact governing authorities to establish extent of temporary facilities and temporary controls required by authorities.

1.2 ELECTRICITY AND LIGHTING

- A. Provide electrical service required for construction operations, with branch wiring and distribution boxes located to allow service and lighting by means of construction-type power cords.
 - 1. Connection to existing electrical service is permitted.
 - 2. Owner will pay costs of energy used from existing on-site services.
- B. Provide lighting for construction operations.
 - 1. Permanent lighting may be used during construction; maintain lighting and make routine repairs.

1.3 HEAT AND VENTILATION

- A. Provide heat and ventilation as required to maintain specified conditions for construction operation, to protect materials and finishes from damage due to temperature and humidity.
- B. Coordinate use of existing facilities with Owner.
 - 1. Supplement with temporary units as required to maintain specified conditions for construction operations, and to protect materials and finishes from damage due to temperature or humidity.
- C. Owner will pay costs of energy used from existing on-site services.

1.4 WATER AND SANITARY FACILITIES

- A. Provide water service required for construction operations; extend branch piping with outlets located so water is available by use of hoses.
 - 1. Connection to existing facilities is permitted.
 - 2. Owner will pay for water used from existing on-site services.
- B. Provide and maintain required sanitary facilities and enclosures.
 - 1. Existing facilities shall not be used.

1.5 CONSTRUCTION AIDS

- A. Noise, Dust and Pollution Control: Provide materials and equipment necessary to comply with local requirements for noise, dust and pollution control.
- B. Fire Protection: Maintain on-site fire protection facilities as required by applicable authorities and insurance requirements.
- C. Use of Existing Facilities: Verify availability of existing facilities for construction operations with Owner prior to beginning on-site construction.

1.6 ENCLOSURES

- A. Temporary Closures: Provide temporary weather-tight closures for exterior openings for acceptable working conditions, for protection for materials, to protect interior materials from dampness, for temporary heating, and to prevent unauthorized entry.
 - 1. Provide doors with self-closing hardware and locks.

- B. Temporary Partitions: Provide temporary partitions as required to separate work areas from occupied areas, to prevent penetration of dust and moisture into occupied areas, and to prevent damage to existing areas and equipment.
 - 1. Construction: Framing and sheet materials with closed joints and sealed edges at intersections with existing surfaces; Flame Spread Rating of 25 in accordance with ASTM E84.
 - 2. Paint surfaces exposed to view in occupied areas.

1.7 BARRIERS

- A. Barriers: Provide barriers as required to prevent public entry to construction areas and to protect adjacent properties from damage from construction operations.
- B. Barricades: Provide barricades as required by governing authorities.
- C. Tree Protection: Provide barriers around trees and plants designated to remain; protect against vehicular traffic, stored materials, dumping, chemically injurious materials, and puddeling or continuous running water.

1.8 CLEANING DURING CONSTRUCTION

- A. Control accumulation of waste materials and rubbish; recycle or dispose of off-site.
- B. Clean interior areas prior to start of finish work, maintain areas free of dust and other contaminants during finishing operations.

1.9 PROJECT IDENTIFICATION

- A. Signs: Subject to approval of Owner and Architect.

1.10 FIELD TELEPHONE SERVICE, AND STORAGE

- A. Field Telephone Service: Provide cellular telephone service for Contractor's on-site manager at all times during construction operations.
 - 1. Submit to Owner and Architect list of on-site managers, their schedules, and their cellular telephone numbers so Owner and Architect can call on-site manager at all times during construction operations.
- B. Storage for Tools, Materials, and Equipment: Limit on-site storage to Project area; provide weather-tight storage, with heat and ventilation for products requiring controlled conditions.
 - 1. Maintain adequate space for organized storage and access.
 - 2. Provide lighting for inspection of stored materials.

1.11 REMOVAL

- A. Remove temporary materials, equipment, services, and construction prior to Substantial Completion Inspection.
- B. Clean and repair damage caused by installation or use of temporary facilities.
- C. Restore existing facilities used during construction to specified or original condition.

END OF SECTION

SECTION 01 60 00**PRODUCT REQUIREMENTS**

PART 1 - GENERAL**1.1 SUMMARY**

- A. This section describes basic product requirements governing material and equipment.
 - 1. General product requirements.
 - 2. Product list.
 - 3. Quality assurance.
 - 4. Delivery, storage, and handling.
- B. Related Requirements:
 - 1. Section 01 30 00: Administrative Requirements.
 - 2. Section 01 63 00: Product Substitution Procedures.
 - 3. Section 01 77 00: Closeout Procedures.

1.2 GENERAL PRODUCTS REQUIREMENTS

- A. Products include material, equipment, and systems.
- B. Comply with Specifications, referenced standards, and applicable codes and regulations as minimum requirements.
- C. Provide new materials except as specifically allowed by Contract Documents.
- D. Materials to be supplied in quantity within a Specification section shall be by one manufacturer, shall be the same, and shall be interchangeable.
- E. Provide equipment and systems composed of materials from a single manufacturer except where otherwise recommended by equipment or systems manufacturer or where otherwise indicated in Contract Documents.

1.3 SUBMITTALS

- A. Product List: Within 35 days after award of Contract, submit to Owner and Architect a complete list of major products proposed for installation, with name of manufacturer, trade name, and model.
 - 1. Tabulate products by Specification number and title.
- B. Substitutions: Refer to Section 01 63 00 - Product Substitution Procedures.

1.4 QUALITY ASSURANCE

- A. Comply with industry standards and applicable codes except when more restrictive tolerances or requirements indicate more rigid standards or precise workmanship.
- B. Perform work by persons qualified to produce workmanship of specified quality.
- C. Install products straight, true-to-line, and in correct relationship to adjacent materials, with hairline joints, free of rough, sharp and potentially hazardous edges.
- D. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.
 - 1. Seismic Anchors: Conform to code requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Transport products by methods to avoid product damage, deliver in undamaged condition in manufacturer's unopened containers or packaging.
- B. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible.
- C. Store sensitive products in weather-tight enclosures; maintain within temperature and humidity ranges required by manufacturer's instructions.
- D. For exterior storage of fabricated products, place on sloped supports above ground.
- E. Store loose granular materials on solid surfaces in a well-drained area; prevent mixing with foreign matter.
- F. Arrange storage to provide access for inspection; periodically inspect to assure products are undamaged and are maintained under required conditions.
- G. Provide equipment and personnel to handle products by methods to prevent soiling and prevent damage.
- H. Promptly inspect shipments to assure products comply with requirements, quantities are correct, and products are undamaged.
- I. Immediately remove from Project products damaged, wet, stained, and products with mold and products with mildew.
 - 1. Take special care to prevent absorbent products such as gypsum board and acoustical ceiling units from becoming wet.

END OF SECTION

SECTION 01 63 00**PRODUCT SUBSTITUTION PROCEDURES**

PART 1 - GENERAL**1.1 SUMMARY**

- A. Provide products listed in Contract Documents, products by manufacturers listed in Contract Documents, and products meeting specified requirements.
 - 1. Contract Amount: Base on materials and products included in Contract Documents.
 - a. Where listed in Contract Documents, materials and products by manufacturers not listed shall not be used without Owner's and Architect's approval of Contractor's written request for substitution.
 - 2. Purpose: After bidding, substitutions will only be considered where Owner will receive benefit or because specified materials are no longer available due to no fault of Contractor.
 - a. Owner benefits either from a Contractor proposed reduction of the Contract amount or from a reduction in Contract time based on acceptance of proposed substitution.
 - b. List proposed cost or time reductions on request for substitution.
 - c. Requests not including a proposed cost or time reduction will not be considered unless Contractor submits supporting information indicating specified materials are not available.
- B. Procedures are described for requesting substitution of unlisted materials in lieu of materials named in Specifications or approved for use in addenda.
 - 1. Refer to Section 01 35 00 - Special Environmental Requirements for substitutions affecting green building practices.

1.2 CONTRACTOR'S OPTIONS

- A. Products Identified by Reference Standards: Select product meeting referenced standard for products specified only by reference standard.
- B. Named Manufacturers and Named Products: Select products of any named manufacturer meeting Specifications for products specified by naming one or more products or manufacturers.
- C. Substitutions for Named Manufacturers and Named Products: Submit request for substitution for products and for manufacturers not specifically named where products or manufacturers are named in Specifications.

- D. "Or Equal" Clauses: Submit request for substitution for product or manufacturer not specifically named in Specifications where terms "or equal", "or approved equal", or similar references are made.

1.3 SUBSTITUTIONS

- A. Within a period of 35 days after award of Contract, Owner and Architect will consider formal requests for substitutions only from Contractor as specified in 1.1 Summary.
 - 1. Owner and Architect will consider only one request for substitution for each material; where requests are denied Contractor shall be required to provide specified materials.
 - 2. After initial 35 day period, requests will be considered only when a product becomes unavailable through no fault of Contractor; more than one request for substitution will be considered if necessary.
- B. Submit each request with sequentially numbered "Substitution Request Transmittal" acceptable to Owner and Architect; submit separate request for each product and support each request with:
 - 1. Product identification with manufacturer's literature and samples where applicable.
 - 2. Name and address of similar projects on which product has been used, and date of installation.
- C. Submit itemized comparison of proposed substitution with product specified and list significant variations.
- D. Submit data relating to changes in construction schedule.
- E. Note effect of substitution on other work, products, or separate contracts.
 - 1. Note if acceptance of substitution could require revision of Contract Documents, Drawings, details or Specifications.
- F. Include accurate cost data comparing proposed substitution with product and amount of net change in Contract price.
 - 1. Include costs to other contractors and costs for revisions to Drawings, details or Specifications.
- G. Substitutions will not be considered for acceptance when:
 - 1. They are indicated or implied on submittals without a formal request from Contractor.
 - 2. They are requested directly by a subcontractor or supplier.
 - 3. Acceptance will require substantial revision of Contract Documents.

- H. Substitute products shall not be ordered without written acceptance of Owner and Architect.
- I. Owner and Architect will determine acceptability of proposed substitutions and reserves right to reject proposals due to insufficient information.

1.4 CONTRACTOR'S REPRESENTATION

- A. Requests constitute a representation that Contractor:
 - 1. Has investigated proposed product and determined it meets or exceeds, in all respects, specified product.
 - 2. Will provide same warranty or longer warranty for substitution as for specified product.
 - 3. Will coordinate installation and make other changes that may be required for Work to be complete in all respects.
 - 4. Waives claims for additional costs that subsequently become apparent.
 - 5. Will pay costs of changes to Contract Documents, Drawings, details and Specifications required by accepted substitutions.

1.5 ARCHITECT'S DUTIES

- A. Review Contractor's requests for substitutions with reasonable promptness.
 - 1. Architect will recommend that Owner accept or reject substitution request.
 - 2. Upon request, Architect will provide cost for changes to Contract Documents, Drawings, details and Specifications required for substitutions.
- B. Notify Contractor in writing of decision to accept or reject requested substitution.

END OF SECTION

SECTION 01 70 00

EXECUTION REQUIREMENTS

PART 1 - GENERAL**1.1 SUMMARY**

A. This section describes execution requirements.

1. Subcontractor or Installer qualifications.
2. Examination.
3. Manufacturer's instructions.
4. Installation.
5. Cleaning.
6. Protection.

1.2 SUBCONTRACTOR OR INSTALLER QUALIFICATIONS

A. Experienced Subcontractors and Installers: Subcontractors or Installers to have minimum five years successful experience installing items similar to those required for this Project on at least five projects of similar size and value, except for individuals in training under direct supervision of experienced installer.

1. Upon request, provide a detailed summary of subcontractor or installer qualifications including, but not limited to, work history, project name, size, date of completion, and current reference contact information.

1.3 EXAMINATION

A. Acceptance of Conditions: Beginning installation of a product signifies installer has examined substrates, areas, and conditions for compliance with manufacturer requirements for tolerances and other conditions affecting performance.

B. Field Measurements: Take field measurements as required to fit Work properly; recheck measurements prior to installing each product.

1. Where portions of Work are to fit to other construction verify dimensions of other construction by field measurements before fabrication; allow for cutting and patching in order to avoid delaying Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

1.4 MANUFACTURERS' INSTRUCTIONS

A. Manufacturer's Recommendations: When work is specified to comply with manufacturers' recommendations or instructions, distribute copies to persons involved and maintain one set in field office.

1. Conform to requirements specified in Section 01 30 00 for submittal of recommendations or instructions to Architect; submit to Architect only where specified or where specifically requested.
- B. Perform work in accordance with details of recommendations and instructions and specified requirements.
 1. Should a conflict exist between Specifications and recommendations or instructions consult with Architect.
- C. Where manufacturer's information notes special recommendations in addition to installation instructions, comply with both recommendations and instructions.

1.5 INSTALLATION

- A. Pre-Installation Meetings: Installers and suppliers are to attend pre-installation meetings scheduled by Contractor.
- B. Comply with manufacturers written recommendations and installation instructions unless more restrictive requirements are specified.
- C. Locate Work and components accurately, in correct alignment and elevation.
 1. Make vertical work plumb and horizontal work level.
 2. Install components to allow space for maintenance and ease of removal for replacement.
- D. Install products at time and under conditions to ensure best possible results; maintain conditions required for product performance until Substantial Completion.
- E. Conduct operations so no part of Work is subject to damaging operations or loading in excess of that expected during normal conditions.
- F. Securely anchor permanent construction in place, accurately located and aligned with other portions of Work.
- G. Allow for building movement including thermal expansion and contraction.
- H. Make joints of uniform width; arrange joints as indicated, for best visual effect where not otherwise indicated; fit exposed connections together to form hairline joints except where otherwise indicated.

1.6 CLEANING

- A. Cleaning During Construction: Specified in Section 01 50 00 - Temporary Facilities and Controls.

- B. Progress Cleaning: Keep installed areas clean using cleaning materials specifically recommended by manufacturers of product being cleaned; where not otherwise recommended use nontoxic materials that will not damage surfaces.
 - 1. Remove debris from concealed spaces before enclosing space.
 - 2. Supervise construction operations to assure no part of construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during construction period.
- C. Final Cleaning: Execute final cleaning at Substantial Completion.
 - 1. Clean interior and exterior surfaces exposed to view; remove temporary labels, stains and foreign substances; polish transparent and glossy surfaces; vacuum carpeted and soft surfaces.
 - a. Vacuuming Equipment: Type with high efficiency particulate arrestor (HEPA) type filters; properly maintained.
 - 2. Clean equipment and fixtures to a sanitary condition, clean filters of mechanical equipment, replace filters where cleaning is impractical.
 - a. Clean ducts.
 - 3. Clean site; sweep paved areas.
 - 4. Remove waste, surplus materials and rubbish from Project and site; recycle to maximum extent feasible.

1.7 PROTECTION

- A. Protect products subject to deterioration with impervious cover. Provide ventilation to avoid condensation and trapping water.
- B. Take care to use protective covering and blocking materials that do not soil, stain, or damage materials being protected.
- C. After installation, provide coverings to protect products from damage from traffic and construction operations, remove when no longer needed.
- D. Protect interior materials from water damage; immediately remove wet materials from site to prevent growth of mold and mildew on site.

END OF SECTION

SECTION 01 73 00**CUTTING AND PATCHING**

PART 1 - GENERAL**1.1 SUMMARY**

- A. Contractor shall be responsible for cutting, fitting and patching required to complete Work and to:
 - 1. Make its parts fit together properly.
 - 2. Uncover work to provide for installation of ill-timed work.
 - 3. Remove and replace defective work.
 - 4. Remove and replace work not conforming to Contract Documents.
 - 5. Remove samples of installed work as required for testing.
 - 6. Provide routine penetrations of non-structural surfaces for installation of piping and electrical conduit.
- B. Related Requirements:
 - 1. Section 01 40 00: Quality Requirements
 - 2. Section 01 70 00: Execution Requirements

1.2 SUBMITTALS

- A. Submit a written request to Architect well in advance of executing cutting or alteration which affects:
 - 1. Work of Owner or separate contractor.
 - 2. Structural value or integrity of any element of Project.
 - 3. Integrity of weather-exposed or moisture-resistant elements.
 - 4. Efficiency, operational life, maintenance or safety of operational elements.
 - 5. Visual qualities of sight-exposed elements.
- B. Request shall include:
 - 1. Identification of Project and description of affected work.
 - 2. Necessity for cutting or alteration.

3. Effect on work of Owner or separate contractor.
4. Effect on structural integrity, or weatherproof integrity of Project.
5. Alternatives to cutting and patching.
6. Cost proposal, when applicable.
7. Written permission of separate contractor whose work will be affected.
8. Description of proposed work including:
 - a. Scope of cutting, patching, alteration, or excavation.
 - b. Products proposed to be used.
 - c. Extent of refinishing to be included.
- C. Should conditions of Work or schedule indicate a change of products from original installation, Contractor shall submit request for substitution as specified in Section 01 63 00 - Product Substitution Procedures.
- D. Submit written notice to Architect designating date and time work will be uncovered.

PART 2 - PRODUCTS**2.1 MATERIALS**

- A. Comply with Specifications and standards for each specific product involved.
- B. Where Specifications and standards have not been provided, provide materials and fabrication consistent with quality of Project and intended for commercial construction.
- C. Provide new materials for cutting and patching unless otherwise indicated.

PART 3 - EXECUTION**3.1 INSPECTION**

- A. Inspect existing conditions of Project, including elements subject to damage or to movement during cutting and patching.
- B. After uncovering work, inspect conditions affecting installation of products, or performance of work.
- C. Report unsatisfactory or questionable conditions to Architect in writing; do not proceed with work until Architect has provided further instructions.

3.2 PREPARATION

- A. Provide adequate temporary support as necessary to assure structural value or integrity of affected portion of Work.

1. Provide services of licensed engineer for designing temporary support where required by applicable authorities for temporary supports and for shoring; submit engineering calculations directly to applicable authorities upon request.

B. Protect other portions of Project from damage.

3.3 PERFORMANCE

- A. Execute cutting by methods that provide proper surfaces to receive installation of repairs and finishes.
- B. Employ same installer or fabricator to perform cutting and patching work as employed for new construction for:
 1. Weather-exposed or moisture resistant elements.
 2. Sight-exposed finished surfaces.
- C. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.
- D. Restore work that has been cut or removed; install new products to provide completed Work in accordance with requirements of Contract Documents.
- E. Fit work tight to pipes, sleeves, ducts, conduit and penetrations through surfaces.
- F. Refinish entire surfaces as necessary to provide even finish to match adjacent finishes:
 1. For continuous surfaces, refinish to nearest intersection.
 2. For an assembly, refinish entire unit.

END OF SECTION

SECTION 01 74 00

WASTE MANAGEMENT AND RECYCLING PROGRAM

PART 1 - GENERAL**1.1 SUMMARY**

- A. Waste Management: Comply with Local or Regional Green Building Ordinance for diverting Project waste from landfill; aim for waste management goal of 80% or higher.
 - 1. Inform Owner and Architect where Waste Management Program requirements could detrimentally impact construction schedule.
 - 2. Provide separate itemization of costs related to Site Waste Management Program.
 - 3. Effect optimum control of solid wastes.
 - 4. Prevent environmental pollution and damage.
- B. Related Work:
 - 1. Section 01 50 00: Temporary Facilities and Controls
 - 2. Section 01 73 00: Cutting and Patching
 - 3. Section 02 41 19: Selective Demolition

1.2 DEFINITIONS

- A. Inert Fill: A permitted facility that accepts inert waste such as asphalt and concrete exclusively.
- B. Class III Landfill: A landfill that accepts non-hazardous waste such as household, commercial, and industrial waste, including construction, remodeling, repair, and demolition operations.
- C. Construction and Demolition Waste: Includes solid wastes, such as building materials, packaging, rubbish, debris, and rubble resulting from construction, remodeling, repair, and demolition operations.
 - 1. Rubbish: Includes both combustible and noncombustible wastes, such as paper, boxes, glass, crockery, metal and lumber scrap, tin cans, and bones.
 - 2. Debris: Includes both combustible and noncombustible wastes, such as leaves and tree trimmings that result from construction or maintenance and repair work.
- D. Chemical Waste: Includes petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals and inorganic wastes.

E. Sanitary Wastes:

1. Garbage: Refuse and scraps resulting from preparation, cooking, distribution, or consumption of food.
2. Sewage: Domestic sanitary sewage.

1.3 SUBMITTALS

A. Waste Management and Recycling Program: Prior to commencement of Work, schedule and conduct meeting with Owner and Architect to discuss proposed Waste Management and Recycling Program.

1. Develop mutual understanding relative to details of recycling, and rebate programs.
2. Review all Specification requirements, Contract Documents and site conditions and estimate total Project C&D materials to be generated, names of landfills where Project C&D materials would normally be disposed of. Indicate types and quantities of materials under the Work that are anticipated to be feasible for on-site processing, and source-separation for re-use or recycling. Indicate procedures that will be implemented in this program to effect jobsite source-separation, such as, identifying a convenient location where dumpsters would be located, signage to identify materials to be placed in dumpsters, etc.,

B. Prepare a Waste Management and Recycling Plan that includes, but is not limited to, the following:

- Contractor's name and project identification information;
- Procedures to be used;
- Materials to be re-used and recycled;
- Estimated total quantities of materials generated in Project;
- Names and locations of landfills, re-use and recycling facilities/sites;
- Tonnage calculations that demonstrate that Contractor will re-use and recycle a minimum of 80% by weight of C&D materials generated in the Work.

C. Submit a Contractor's Reuse, Recycling, and Disposal Report or Summary with each application for progress payment that includes recycling activities. Failure to submit the form and its supporting documentation will render the application for progress payment incomplete and delay progress payments. If applicable, include manifests, weight tickets, receipts, and invoices specifically identifying the Project for re-used and recycled materials:

- On-site crushing of asphalt and concrete for use off-site;
- Reuse of building materials or salvageable items;
- Source-separated recycling facilities;
- Mixed debris recycling facilities;
- Recycling of material, including soils, as landfill alternative daily cover;
- Delivery of soils or mixed inerts to an inert landfill or other use;

- Disposal of soils or other materials at a landfill or transfer station;
1. Contractor's Reuse, Recycling, and Disposal Report must quantify all materials generated in the Work, disposed in Class III Landfills, or diverted from disposal through recycling. Indicate zero (0) if there is no quantity to report for a type of material. As indicated on the form:
 - Report disposal or recycling either in tons or in cubic yards: if scales are available at disposal or recycling facility, report in tons; otherwise, report in cubic yards. Report in units for salvage items when no tonnage or cubic yard measurement is feasible.
 - Indicate locations to which materials are delivered for reuse, salvage, recycling, accepted as daily cover, inert backfill, or disposal in landfills or transfer stations.
 - Provide legible copies of weigh tickets, receipts, or invoices that specifically identify the project generating the material. Said documents must be from recyclers and/or disposal site operators that can legally accept the materials for the purpose of re-use, recycling, or disposal.
 - D. Revise and resubmit Waste Management and Recycling Program as required by Owner and Architect.
 1. Review of Contractor's Waste Management and Recycling Program will not relieve Contractor of responsibility for control of pollutants and other environmental protection measures.
 - E. If necessary, prepare 3-ring binder with rebate information and product documentation as required for Owner to qualify for rebate programs; submit binder with final closeout submittals.

1.4 RECYCLING PROGRAM

- A. Recycling: Implement recycling program that includes separate collection of waste materials of types as applicable to Project; recycling program to be applied by Contractors and subcontractors.
- B. Recycling: Implement recycling program that includes separate collection of waste materials of following types as applicable to Project; recycling program to be applied by Contractors and subcontractors.
 1. Concrete and Concrete Masonry Units.
 2. Plaster.
 3. Ferrous metal.
 4. Non-ferrous metal.
 5. Plastics.
 6. Other materials as appropriate.
- C. Handling: Keep materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to recycling process.

1. Clean materials contaminated prior to placing in collection containers.
 2. Arrange for collection by or delivery to appropriate recycling center or transfer station that accepts construction and demolition waste for purpose of recycling.
- D. Participate in Re-Use Programs: Rebates, tax credits, and other savings obtained for recycled or re-used materials shall accrue to Contractor.

END OF SECTION

SECTION 01 77 00**CLOSEOUT PROCEDURES**

PART 1 - GENERAL**1.1 SUMMARY**

A. This section describes Contract closeout procedures.

1. Substantial completion.
2. Final completion.
3. Project record documents.
4. Material and finish data.
5. Operation and maintenance data.

B. Related Requirements:

1. Section 01 78 00: Warranties.

1.2 SUBSTANTIAL COMPLETION

- A. Immediately prior to Substantial Completion, schedule agency reviews as required for "temporary certificate of occupancy" or for "certificate of occupancy".
- B. When Contractor considers the Work or a designated portion thereof is substantially complete, submit written notice, with list of items to be completed or corrected.
1. List ("Punch List"): Format pre-approved by Owner and Architect; tabular form with each space listed required.
- C. Within a reasonable time, Owner and Architect will inspect status of completion and may add to "Punch List".
- D. Should Owner and Architect determine Work is not substantially complete, Contractor will be promptly notified in writing, giving reasons.
- E. Contractor shall remedy deficiencies and send a second written notice of substantial completion; Architect will re-inspect Work.
1. Contractor shall pay for Architect's time and direct expenses where more than one Substantial Completion inspection is required.
- F. When Architect determines Work is substantially complete, a Certificate of Substantial Completion will be prepared in accordance with General Conditions.

1.3 FINAL COMPLETION

- A. When Work is complete, submit written certification indicating:
 - 1. Work has been inspected for compliance with Contract Documents.
 - 2. Work has been completed in accordance with Contract Documents and deficiencies listed (in 'Punch List') with Certificate of Substantial Completion have been corrected.
 - 3. Equipment and systems have been tested in presence of Owner's representative and are operational.
 - 4. Work is complete and ready for final inspection.
- B. Special Submittals: In addition to submittals required by Contract, submit following.
 - 1. Provide submittals required by governing authorities to governing authorities with copies included in Project Record Documents.
 - 2. Submit final statement of accounting giving total adjusted Contract Sum, previous payments, and sum remaining due.

1.4 PROJECT RECORD DOCUMENTS

- A. Keep documents current; do not permanently conceal any work until required information has been recorded.
 - 1. Owner will provide Contractor with a separate set of Drawings to maintain for Project Record Documents.
 - 2. Store reproducible Drawings, one set of Project Manual, and one copy of each Change Order separate from documents used for construction, for use as Project Record Documents.
 - 3. Indicate actual work on Drawings; indicate actual products used in Project Manual, including manufacturer, model number and options.
 - 4. Update Project Record Documents daily and allow for Architect inspection at least once a month.
- B. At Contract close-out submit documents with transmittal letter containing date, Project title, Contractor's name and address, list of documents, and signature of Contractor.

1.5 MATERIAL AND FINISH DATA

- A. Provide data for primary materials and finishes.
- B. Submit two sets prior to final inspection, bound in 8-1/2" by 11" three-ring binders with durable plastic covers, clearly identified regarding extent of contents.

1. Electronic Format: Where available in electronic format, submit computerized compact disk (CD's) of material and finish data.
 - C. Arrange by Specification division and give names, addresses, and telephone numbers of subcontractors and suppliers. List:
 1. Trade names, model or type numbers.
 2. Cleaning instructions.
 3. Product data.
- 1.6 OPERATION AND MAINTENANCE DATA
- A. Provide data for:
 1. Electrically operated items.
 2. Mechanical equipment and controls.
 3. Electrical equipment and controls.
 - B. Submit two sets prior to final inspection, bound in 8-1/2" by 11" three-ring binders with durable plastic covers, clearly identified regarding extent of contents.
 - C. Provide a separate volume for each system, with a table of contents and index tabs for each volume.
 - D. Arrange by Specification division and gives names, addresses, and telephone numbers of subcontractors and suppliers. List:
 1. Appropriate design criteria.
 2. List of equipment and parts lists.
 3. Operating and maintenance instructions.
 4. Shop drawings and product data.
 - E. Electronic Format: Where available in electronic format, submit computerized compact disk (CD's) of operation and maintenance data in PDF format.

END OF SECTION

SECTION 01 78 00**WARRANTIES**

PART 1 - GENERAL**1.1 SUMMARY**

- A. Compile required and incidental warranties required by Contract Documents.
- B. These warranties shall be in addition to and not a limitation of other rights Owner may have against Contractor under Contract Documents and which may be prescribed by law, regardless of wording of warranty.

1.2 FORM OF SUBMITTAL

- A. Provide duplicate copies, notarized or on Contractor and Manufacturer's letterhead.
 - 1. Assemble documents executed by subcontractors, installers, suppliers, and manufacturers.
 - 2. Provide table of contents and assemble in binder with durable plastic cover, clearly identified regarding extent of contents.
 - 3. Electronic Format: Submit computerized compact disk (CD's) of warranties, in Microsoft Word, Microsoft Excel, or in PDF formats.
- B. Warranty Form: Use form acceptable to Owner; completed form shall not detract from or confuse interpretations of Contract Documents.
 - 1. Manufacturer shall countersign warranty.
 - 2. Subcontractor and installer shall countersign warranty where specified.
 - a. Provide required warranties for waterproofing and roofing systems countersigned by subcontractor and installer.
- C. Submit final warranties prior to final application for payment.
 - 1. For equipment put into use with Owner's permission during construction, submit within ten days after first operation.
 - 2. For items of Work delayed materially beyond Date of Substantial Completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.
- D. Provide information for Owner's personnel regarding proper procedure in case of failure and instances that might affect validity of warranty.
- E. Size: 8-1/2" by 11" for three-ring binder; fold larger sheets to fit.

1.3 WARRANTIES

- A. Warranties are intended to protect Owner against failure of work and against deficient, defective and faulty materials and workmanship, regardless of sources.
- B. Limitations: Warranties are not intended to cover failures that result from:
 - 1. Unusual or abnormal phenomena of the elements.
 - 2. Owner's misuse, maltreatment or improper maintenance of work.
 - 3. Vandalism after substantial completion.
 - 4. Insurrection or acts of aggression including war.
- C. Related Damages and Losses: Remove and replace work which is damaged as result of failure, or which must be removed and replaced to provide access for correction of warranted work.
- D. Warranty Reinstatement: After correction of warranted work, reinstate warranty for corrected work to date of original warranty expiration, but not less than half original warranty period.
- E. Replacement Cost: Replace or restore failing warranted items without regard to anticipated useful service lives.
- F. Rejection of Warranties: Owner reserves right to reject unsolicited and coincidental product warranties that detract from or confuse interpretations of Contract Documents.

1.4 WARRANTY PERIOD

- A. Prime Contractor
 - 1. The blanket warranty period for all materials and workmanship for the entire project is one year (365 calendar days) from the Date of Substantial Completion as identified by the Owner.
 - a. This warranty period may be revised, modified, or enhanced by specific warranty requirements indicated within each Specification Section.
 - b. Subcontractors and Product Manufacturers
 - 1) Workmanship and material warranties as indicated within each Specification Section.

END OF SECTION

SECTION 02 41 19**SELECTIVE DEMOLITION**

PART 1 - GENERAL**1.1 SUMMARY****A. Section Includes Selective demolition as follows:**

1. Remove exterior and interior building architectural, structural, plumbing, fire protection, mechanical, electrical materials and equipment as indicated on the plans or required for new construction including but not limited to:
 - a. Exterior or interior gypsum board and plaster wall assemblies
 - b. Interior gypsum board and plaster ceiling assemblies
 - c. Gypsum sheathing
 - d. Acoustical ceiling tile
 - e. Wood framing and furring
 - f. Wood beams
 - g. 1x diagonal wall sheathing
 - h. Plywood wall sheathing and decking
 - i. Rigid roof insulation
 - j. Single-ply roof membrane
 - k. Sheet metal flashing
 - l. Ceramic wall tile and trim including thick-set mortar beds or cement backer board.
 - m. Ceramic floor tile and trim including thick-set mortar beds
 - n. Base and upper wood cabinets
 - o. Countertops
 - p. Hollow metal or wood door frames and doors
 - q. Steel window frames with glazing
 - r. Aluminum window frames with glazing
 - s. Access hatches
 - t. Interior and exterior concrete floor slabs, raised concrete curbs including saw cutting and base
 - u. Asphalt paving and base
 - v. Vinyl composition sheet or tile flooring
 - w. Restroom partitions
 - x. Restroom accessories
 - y. Plumbing supply lines, vent pipes, clean outs, and drain lines
 - z. Plumbing fixtures
 - aa. Floor-mounted plumbing fixtures set on or in concrete curbs and floor slabs
 - bb. Gas piping
 - cc. HVAC units
 - dd. HVAC ductwork
 - ee. Exhaust fans and ducts
 - ff. Electrical distribution panels
 - gg. Electrical lighting fixtures, remote ballasts, brackets, and supports

- hh. Electrical conduit, wire, boxes, and convenience outlets
 - ii. Low voltage communications devices, including alarms, speakers, and wiring
- 2. Saw cut and removal of existing building assemblies to accommodate installation of new or scheduled Plumbing Systems, HVAC Systems, and Electrical Systems and where necessary to prepare for subsequent work.
 - 3. Cut and patch of existing roof assemblies for new roof curbs, mechanical, and electrical penetrations.
 - 4. Disconnect, remove, cap and identify utilities for later reconnection.

B. Demolition Recycling:

- 1. Demolition materials recycling requirements: The Work of this contract shall provide for a minimum of 80% by weight of the solid waste generated in the Work to be diverted from landfill disposal through a combination of re-use and recycling activities.

C. Related Work:

- 1. Division 01 Section "General Requirements."
- 2. Division 01 Section "Special Procedures."
- 3. Section 01 74 00 - Waste Management and Recycling Program
- 4. Section 02 82 13 – Asbestos Abatement
- 5. Section 02 83 19 – Lead-Based/Lead-Containing Paint Abatement
- 6. Section 02 84 16 – PCB/Mercury Ballasts and Lamps

1.2 SUBMITTALS

- A. Proposed dust-control measures.
- B. Noise-control measures.
- C. Schedule of demolition activities indicating the following:
 - 1. Submit schedule indicating proposed sequence of operations for selective demolition work to Project Manager for review prior to start of work.
 - 2. Include coordination dates for shutoff, capping, and continuation of utility services, and details for dust and noise control.
 - 3. Coordinate the scheduling of work of Section with the work of other sections.
- D. Contractor's Waste Management and Recycling Plan:

1. Review, Section 01 74 00 requirements, Contract Documents and site conditions and estimate total Project C&D materials to be generated, names of landfills where Project C&D materials would normally be disposed of. Indicate types and quantities of materials under the Work that are anticipated to be feasible for on-site processing, and source-separation for re-use or recycling. Indicate procedures that will be implemented in this program to effect jobsite source-separation, such as, identifying a convenient location where dumpsters would be located, signage to identify materials to be placed in dumpsters, etc.,
 2. As per Section 01 74 00, Waste Management and Recycling Plan must include, but not be limited to, the following:
 - Contractor's name and project identification information;
 - Procedures to be used;
 - Materials to be re-used and recycled;
 - Estimated total quantities of materials generated in Project;
 - Names and locations of landfills, re-use and recycling facilities/sites;
- F. As per Section 01 74 00, submit a Contractor's Reuse, Recycling, and Disposal Report with each application for progress payment. Failure to submit the form and its supporting documentation will render the application for progress payment incomplete and delay progress payments. If applicable, include manifests, weight tickets, receipts, and invoices specifically identifying the Project for re-used and recycled materials:
- On-site crushing of asphalt and concrete for use off-site;
 - Reuse of building materials or salvageable items;
 - Source-separated recycling facilities;
 - Mixed debris recycling facilities;
 - Recycling of material, including soils, as landfill alternative daily cover;
 - Delivery of soils or mixed inerts to an inert landfill or other use;
 - Disposal of soils or other materials at a landfill or transfer station;
1. Contractor's Reuse, Recycling, and Disposal Report must quantify all materials generated in the Work, disposed in Class III Landfills, or diverted from disposal through recycling. Indicate zero (0) if there is no quantity to report for a type of material. As indicated on the form:
 - Report disposal or recycling either in tons or in cubic yards: if scales are available at disposal or recycling facility, report in tons; otherwise, report in cubic yards. Report in units for salvage items when no tonnage or cubic yard measurement is feasible.
 - Indicate locations to which materials are delivered for reuse, salvage, recycling, accepted as daily cover, inert backfill, or disposal in landfills or transfer stations.
 - Provide legible copies of weigh tickets, receipts, or invoices that specifically identify the project generating the material. Said documents must be from recyclers and/or disposal site operators that can legally accept the materials for the purpose of re-use, recycling, or disposal:

1.3 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: Engage a licensed demolition contractor and an experienced firm that has successfully completed demolition Work similar to that indicated for this Project.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before starting demolition. Comply with hauling and disposal regulations of authorities having jurisdiction. Obtain and pay for all permits required.

1.4 MATERIALS OWNERSHIP

- A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain property of the Owner, demolished materials shall become the Contractor's property and shall be removed, recycled, or disposed from Project site in an appropriate and legal manner.

PART 2 – PRODUCTS NOT USED**PART 3 – EXECUTION****3.1 EXAMINATION**

- A. Verify that utilities have been disconnected and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of demolition and recycling required.
- C. Survey condition of the building to determine whether removing any element might result in a structural deficiency or unplanned collapse of any portion of the structure or adjacent structures during demolition.
 - 1. Retain a licensed and qualified civil or structural engineer to provide analysis, including calculations, necessary to ensure the safe execution of the demolition work.
 - 2. Perform surveys as the Work progresses to detect hazards resulting from demolition activities.

3.2 PRE-DEMOLITION CONFERENCE

- A. Conduct conference at Project site.
 - 1. Review the environmental goals of this Project with Owner's Representatives, Contractors, subcontractors, and waste haulers and make a proactive effort to increase awareness of these goals among all labor forces on site.

3.3 PREPARATION

- A. As part of the project scope, the Contractor shall prepare all drawings, documents, and applications and shall obtain all government agency approvals and permits required for demolition activities.
- B. Conduct demolition operations and remove C&D materials to ensure minimum interference with roads, streets, walks, and other adjacent occupied and utilized facilities.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or utilized facilities without permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
- C. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around demolition area.
 - 1. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
 - a. Maintain temporary protection to people at exterior areas of the existing building where decorative medallion removal work is being done.
 - 2. Protect existing site improvements, appurtenances, and landscaping that are designated to remain in place.
- D. Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of buildings to be demolished and adjacent buildings to remain.
 - 1. Strengthen or add new supports when required during progress of demolition.
- E. Provide and maintain temporary weather protection during interval between demolition and removal of existing construction on exterior surfaces and installation of new construction to ensure that no water leakage or damage, or wind damage occurs to structure or interior areas of existing building.
 - 1. Cover roof penetrations with plywood and visqueen to provide a weathertight enclosure until roof equipment is completely installed and roofing work in the area can be completed the same day.
- F. Provide and maintain temporary barriers and security devices.
- G. Use periodic light water mist, temporary enclosures, and other suitable methods to limit dust and dirt. Comply with applicable environmental protection regulations.
- H. Provide and maintain temporary partitions to prevent spread of dust, odors and noise.

- I. Maintain path of travel for debris removal dust free and clean at all times.
- J. Cover and protect windows and walls that are adjacent to areas to be demolished.
- K. Protect smoke alarms and fire sprinklers from dust intrusion.
- L. Maintain parking areas, driveways, exterior walkways, exit paths, and landscaping in a clean, undisturbed condition. Any debris caused by selective demolition work shall be removed each day.
- M. Field verify the exact location of existing concealed utilities. Use caution if working in or about concealed or exposed utilities.
 - 1. Disconnect, remove, and cap designated utility lines within demolition areas. Mark locations of disconnected utilities. Identify utilities and indicate capping locations on Project Record Documents

3.4 EXPLOSIVES

- A. Use of explosives will not be permitted.

3.5 EXECUTION

- A. Comply with federal, state and local regulations pertaining to water, air, solid waste, recycling, chemical waste, sanitary waste, sediment and noise pollution.
- B. Protection of Natural Resources: Preserve the natural resources within the project boundaries or restore to an equivalent condition.
 - 1. Confine demolition activities to areas defined by public roads, easements, and work area limits indicated on the drawings.
 - a. Temporary Construction: Remove indications of temporary construction facilities, such as haul roads, work areas, structures, stockpiles or waste areas.
 - 2. Water Resources: Comply with applicable regulations concerning the direct or indirect discharge of pollutants to underground and natural surface waters.
 - a. Oily Substances: Prevent oily or other hazardous substances from entering the ground, drainage areas, or local bodies of water in such quantities as to affect normal use, aesthetics, or produce a measurable ecological impact on the area.
 - 1) Store and service construction equipment at areas designated for collection of oil wastes.
 - 3. Dust Control, Air Pollution, and Odor Control: Prevent creation of dust, air pollution and odors.

- a. Use temporary enclosures and other appropriate methods to limit dust and dirt rising and scattering in air to lowest practical level.
 - b. Store volatile liquids, including fuels and solvents, in closed containers.
 - c. Properly maintain equipment to reduce gaseous pollutant emissions.
4. Noise Control: Perform demolition operations to minimize noise.

- a. Repetitive, high level impact noise will be permitted only between the hours of 8:00 a.m. and 6:00 p. m. Repetitive impact noise on the property shall not exceed the following dB limitations:

<u>Sound Level in dB</u>	<u>Time Duration of Impact Noise</u>
70	More than 12 minutes in any hour
80	More than 3 minutes in any hour

- b. Provide equipment, sound-deadening devices, and take noise abatement measures that are necessary to comply with the requirements of this Contract.
 - c. At least once every five successive working days while work is being performed above 55 dB noise level, measure sound level for noise exposure due to the demolition. Measure sound levels on the 'A' weighing network of a General Purpose sound level meter at slow response. To minimize the effect of reflective sound waves at buildings, measurements may be taken three to six feet in front of any building face. Submit the recorded information to the State noting any problems and the alternatives before mitigating actions.
5. Salvage, Re-Use, and Recycling Procedures
- a. Identify re-use, salvage, and recycling facilities: Provide Owner's Representative a list of local reuse organizations and C&D recycling companies.
 - b. Develop and implement procedures to re-use, salvage, and recycle demolition materials, based on the Contract Documents, the Contractor's Waste Management and Recycling Plan, estimated quantities of available materials, and availability of recycling facilities. Procedures may include on-site recycling, source-separated recycling, salvage, and/or mixed debris recycling efforts.
 - c. Identify materials that are feasible for salvage, determine requirements for site storage, and transportation of materials to a salvage facility.
 - d. Source-separate new construction, excavation and demolition materials including, but not limited to the following types:

- ◆ Asphalt
- ◆ Concrete, Concrete Block, Concrete Masonry Units (CMU), Slump Stone (Decorative Concrete Block), and Rocks
- ◆ Asphalt Concrete
- ◆ Paper: Bond, Newsprint, Cardboard, Paper, Packing Materials, and Packaging
- ◆ Cement Fiber Products: Shingles, Panels, Siding
- ◆ Paint
- ◆ Rigid Foam
- ◆ Glass
- ◆ Plastics
- ◆ Carpet and Carpet Padding
- ◆ Beverage Containers
- ◆ Insulation
- ◆ Gypsum Board
- ◆ Porcelain Plumbing Fixtures
- ◆ Fluorescent Light Tubes: per Department of Toxic Substances Control Regulations
- ◆ Green Materials (i.e. tree trimmings and land clearing debris)
- ◆ Metal (ferrous and non-ferrous)
- ◆ Red Clay Brick
- ◆ Soil
- ◆ Wood, Clean Dimensional Wood, Pallet Wood
- ◆ Sheet Wood: Plywood, Oriented Strand Board (OSB), Particle Board
- ◆ Other materials as appropriate

- e. Develop and implement a program to transport loads of mixed (commingled) demolition materials that cannot be feasibly source separated to a mixed materials recycling facility.

6. Disposal Practices and Waste Hauling

- a. Legally transport and dispose of materials that cannot be delivered to a source-separated or mixed recycling facility to a transfer station or disposal facility that can legally accept the materials for the purpose of disposal.
- b. Use a permitted waste hauler or Contractor's trucking services and personnel. To confirm valid permitted status of waste haulers, contact the Owner's Representative.
- c. Become familiar with the conditions for acceptance of new construction, excavation and demolition materials at recycling facilities, prior to delivering materials.
- d. Deliver to facilities that can legally accept new construction, excavation and demolition materials for purpose of re-use, recycling, composting, or disposal.

- f. Do not burn, bury or otherwise dispose of rubbish and waste materials on project site.

7. Revenue

- a. Revenues or other savings obtained from recycled, re-used, or salvaged materials shall accrue to Contractor unless otherwise noted in the Contract Documents.
- b. Remove and transport C&D materials in a manner that will prevent spillage on adjacent surfaces, streets, and areas or dust being emitted into the atmosphere.
- c. Clean adjacent streets of dust, dirt, and C&D materials caused by demolition operations. At the end of each work day, return adjacent areas to condition existing before start of demolition.

3.6 DEMOLITION

- A. Selective Demolition: Demolish selective portions of the building as referenced on the drawings completely and remove from the site. Use methods required to complete Work within limitations of governing regulations and as follows:
 - 1. Locate demolition equipment throughout the building and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 - 2. Demolish concrete and masonry in sizes that will be suitable for acceptance at recycling or disposal facilities.
 - 3. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 - 4. Break up and remove concrete slabs on grade in small sizes, suitable for acceptance at recycling or disposal facilities, unless otherwise shown to remain.
 - 5. Remove all disconnected, abandoned utilities on site.
- B. Damages: Promptly repair damages to adjacent building components or facilities caused by demolition operations.

3.7 HANDLING OF DEMOLISHED MATERIALS

- A. General: Promptly re-use, salvage, recycle, or dispose of demolished materials. Do not allow demolished materials to accumulate or be stored on-site for more than 20 working days.
- C. Burning: Do not burn demolished materials.
- D. Disposal: Transport demolished materials off Owner's property and legally reuse, salvage, recycle, or dispose of materials.

3.8 DISPOSAL AND CLEANUP

- A. Material removed which is not to be salvaged or reused in the Project shall become the property of the Contractor and shall be promptly removed from the site. Do not store or permit debris to accumulate at the site.
- B. Maintain temporary shoring until new construction has been installed.
- C. Upon completion, clean the entire area of demolition residue satisfactory for the continuation of the Work.

END OF SECTION

SECTION 02 50 00**PRESSURE WASHING**

PART 1 - GENERAL**1.1 SUMMARY**

- A. Work under this contract shall include the furnishing of all labor, equipment, supplies, parts, tools, and transportation for pressure washing services for the following building surfaces or components of Petaluma Fire Station No. 1:
 - 1. Exterior Concrete Flatwork
 - 2. Plaster Walls
 - 3. Exterior Brick Veneer
 - 4. Exterior Steel Window Frames
 - 5. Exterior Doors and Frames
- B. Pressure washing shall be a combination of high-pressure high-volume and low-pressure high-volume systems depending on the building's surface material.
- C. Scope of pressure washing shall include labor and materials for the following:
 - 1. Prep area for pressure washing
 - 2. Cover and block drains
 - 3. Police and remove all debris for proper disposal
 - 4. Install safety signs and cones
 - 5. Apply approved de-greaser to all areas requiring additional cleaning
 - 6. Provide supervision on site at all times
 - 7. Waste water removal. All waste water will be disposed of within strict guidelines set forth by the City of Petaluma, State of California, and all applicable Federal requirements.
 - 8. Removal of minor surface mold on exterior only building surfaces
 - 9. Removal of bird nests and bird contamination on exterior only building surfaces

1.2 PERMITS AND CERTIFICATES

- A. Contractor shall provide copies of all EPA or OSHA issued permits.
- B. Contractor pressure washing and water recovery equipment has been inspected, approved and permitted by the City of Petaluma.
- C. Unless specifications state otherwise successful Contractor shall be responsible for securing any and all specialized or environmental permits for proposed work (excluding building permit as issued by the City of Petaluma Building Department). Any fee charged for these specialized or environmental permits shall be the responsibility of the Contractor and not the City of Petaluma.

1.3 REFERENCE STANDARDS

- A. Acknowledge, by the executing of the Contract, awareness and familiarity with the contents and requirements of the following regulations, codes, and standards, and assume responsibility for the performance of the Work in strict compliance therewith and for every instance of failure to comply therewith.
- B. Where conflict among requirements or with the Contract Documents exists, the more stringent requirements shall apply.
 - 1. USEPA Regional National Emissions Standards for Hazardous Air Pollutants (NESHAPS)
 - 2. U.S. Occupational and Safety and Health Administration (OSHA)
 - 3. U.S. EPA Office of Pesticide and Toxic Substances Guidance Document
 - 4. U.S. Department of Transportation, Hazardous Substances: Final Rule (49 CFR 171 and 172), Federal Register November 21, 1986 and corrected February 17, 1987.
 - 5. Statutes of the State in which the Work is to be performed: Licensure for Asbestos Consultants and Contractors.
 - 6. All state, county, and city codes and ordinances as applicable. Make available for review at the site one copy of EPA, OSHA, and applicable State, County, and City Regulations governing the Work.

1.4 SAFETY

- A. All Contractor and Sub-Contractor personnel shall wear personal protective equipment in the performance of their duties to include safety vests, protective eye wear or face shields, respiratory protection as necessary, gloves and protective clothing.
- B. Contractor shall be responsible for adhering to all local, state and federal safety guidelines and observe all safety precautions when performing services on City of Petaluma or Bart property, roadways and right-of-ways to include safe location of parked vehicles, use of safety cones, signage, flag personnel as necessary, use of safety vests on all personnel and vehicles which are clearly identifiable as belonging to the Contractor.

1.5 HOURS OF OPERATIONS

- A. Pressure washing services to be performed Monday - Friday between the hours of 7 AM – 5 PM and on Saturday and Sunday between the hours of 6:00 AM – 6:00 PM

1.6 TEST PANELS

- A. Contractor to test all pressure washing settings on various building surfaces in inconspicuous locations to verify correct nozzle selection, wand distance, wand angle, and recommended PSI setting. Adjust settings as necessary to preserve and protect the existing building color and finish.

1.7 WARRANTY

- A. The Contractor shall guarantee all of the work that is performed under this contract, including all materials, workmanship, for a minimum of one (1) year from the date of full acceptance of the work.
- B. All work shall be performed and completed in a thorough, workmanlike manner and in accordance with the latest proven practices of the trade by thoroughly skilled and experienced workmen.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Materials/supplies shall meet or exceed the standard in the industry for improvement for the services to be performed and conforms with respects to the specifications.
 - 1. Polyethylene/Plastic sheeting shall be of the thicknesses specified, in sizes to minimize the frequency of joints. Utilize reinforced plastic sheeting in specified thicknesses on floors.
 - 2. Tape shall be glass fiber or other type capable of sealing joints of adjacent sheets of plastic and for attachment of plastic sheet to finished or unfinished surfaces of dissimilar materials under both dry and wet conditions.
 - 3. Sodium Hypochlorite ("bleach")
 - 4. Impermeable Containers shall be suitable to receive and retain contaminated materials until disposal at an approved site and shall be labeled in accordance with U.S. DOT 49 CFR 171 and 172, and containers shall be both air- and water-tight.
 - a. Use a minimum of two types of impermeable containers: 1) six millimeter-thick (mil) plastic bags sized to fit within the drum; and 2) metal or fiber drums with tightly fitting lids.
 - 5. Other Materials: Provide all other materials that may be required to construct and dismantle temporary pressure washing and decontamination areas and the barriers that isolate the work area(s).

PART 3 - EXECUTION

3.1 PRESSURE WASHING

- A. All flatwork shall be rinsed so that no debris remains after cleaning. Any debris in the area shall be picked up and thrown away at any time (around buildings, parking areas, plant beds, etc.).

- B. When buildings/structures with light fixtures are pressure washed, all light fixtures on perimeter of buildings shall also be cleaned so that they are bug/debris free. This will require opening the protective cover of fixture and hand cleaning each lens.
- C. Contractor shall report any and all items needing attention (broken building components, receptacles needing repair or refinishing, broken fixtures, surface deterioration, etc.). Contractor shall report any maintenance item that affects the appearance of the area or the safety, health and welfare of the building occupants..
- D. PSI shall range between 1,000 and 3,000 depending on surface material.
 - 1. PSI shall not exceed 4,000 under any circumstance.
 - 2. Field verify pressure settings via test panels prior to proceeding with the work.
- E. Pressure washing nozzle shall have a 25-40 degree spray pattern depending on surface material.
 - 1. Nozzle to be between 12 and 24 inches from surface material.
 - 2. Spray surface at a 30-45 degree nozzle angle.
 - 3. Field verify nozzle settings via test panels prior to proceeding with the work.
- F. Contractor to use a non-bleach cleaning solution unless noted otherwise.

3.2 PRESSURE WASHING SCHEDULE:

- A. Concrete Flatwork (high-pressure high-volume)
 - 1. 2,500-3,500 PSI
 - 2. Material mix for cleaning:
 - a. Detergent approved by City of Petaluma representative
 - 3. Rinse Agent:
 - a. Water
 - b. 1 ½ % Chlorine – 2 oz. per gallon of water or ¼ cup per gallon of water
- B. Painted or Pre-Finishes Aluminum (low-pressure high-volume)
 - 1. 1,000-1,500 PSI (avoid peeling paint)
 - 2. Hot water 130° - 160°, only to be used on flat work and lower bands
 - 3. Material mix for cleaning:
 - a. Detergent approved by City of Petaluma representative (Sodium Per carbonate or Calcium Hypochlorite)
 - 4. Rinse Agent:
 - a. Water
 - b. 1 ½ % Chlorine – 2 oz. per gallon of water or ¼ cup per gallon of water
- C. All Latex or Enamel Painted Surfaces (low-pressure high-volume)
 - 1. 1,000-1,500 PSI (avoid peeling paint)
 - 2. Hot water 130° - 160°, only to be used on flat work and lower bands
 - 3. Material mix for cleaning:
 - a. Detergent approved by City of Petaluma representative (Sodium Per carbonate or Calcium Hypochlorite)
 - 4. Rinse Agent:
 - a. Water
 - b. 1 ½ % Chlorine – 2 oz. per gallon of water or ¼ cup per gallon of water

- D. Brick Pavers/Masonry (low-pressure high-volume)
 - 1. 300-700 PSI
 - 2. 160° max water temperature
 - 3. Material mix for cleaning:
 - a. Detergent approved by City of Petaluma representative (Sodium Per carbonate or Calcium Hypochlorite)
 - 4. Rinse Agent:
 - a. Water
 - b. 1 ½ % Chlorine – 2 oz. per gallon of water or ¼ cup per gallon of water
- E. Stucco or Plaster (low-pressure high-volume)
 - 1. 500-1,000 PSI
 - 2. 160° max water temperature
 - 3. Material mix for cleaning:
 - a. Detergent approved by City of Petaluma representative
 - 4. Rinse Agent:
 - a. Water
 - b. 1 ½ % Chlorine – 2 oz. per gallon of water or ¼ cup per gallon of water
- F. Efflorescence Removal
 - 1. Use muriatic acid per instructions
 - 2. Then use permeable sealer to maintain

3.3 EXTERIOR SURFACE MOLD REMOVAL

- A. It is assumed that only exterior open-air building surfaces shall be encountered or addressed during performance of the work.
 - 1. Notify the City of Petaluma if any mold accumulation is observed within the building enclosure.
- B. Exterior and isolated areas exhibiting surface mold growth are assumed to be between 0- 30 square feet. Notify the City of Petaluma representative any area of mold growth encountered exceeds 30 square feet.
- C. Non-porous (e.g., metals, glass, and hard plastics) and semi-porous (e.g., wood, and concrete) materials that are structurally sound and are visibly moldy can be cleaned and reused.
 - 1. Cleaning shall be done using a detergent solution approved by City of Petaluma representative.
- D. Porous materials with more than a small area of contamination shall be removed and discarded. Porous materials that can be cleaned, can be reused, but should be discarded if possible.
 - 1. A professional restoration consultant shall be contacted when restoring porous materials with more than a small area of fungal contamination.
 - 2. All materials to be reused shall be dry and visibly free from mold.
- E. Removal or remediation shall be conducted by the Contractor. Those performing the work shall receive training on proper clean-up methods, personal protection, and potential health hazards.

1. Training can be performed as part of a program to comply with the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200).
- F. Worker Protection: All workers performing mold remediation shall adhere to the following:
1. Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended.
 2. Gloves and eye protection shall be worn.
 3. Full-face respirators with HEPA cartridges and disposable protective clothing covering both head and shoes shall be worn if contamination is greater than 30 square feet.
- G. The immediate surrounding work area shall be or remain unoccupied.
1. Vacating people from spaces adjacent to the work area is not necessary but is highly recommended.
 2. The work area shall be isolated with a plastic sheet(s) and sealed with tape before remediation, to contain dust/debris.
 3. Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.
 4. Contaminated materials that cannot be cleaned shall be removed from the building in sealed plastic bags. There are no special requirements for the disposal of moldy materials.
 5. The work area and areas used by remedial workers for egress shall be HEPA vacuumed (a vacuum equipped with a High-Efficiency Particulate Air filter) and cleaned with a damp cloth and/or mop and a detergent solution.
 6. All areas shall be left dry and visibly free from contamination and debris.

END OF SECTION

SECTION 02 82 13
ASBESTOS ABATEMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Specification for the abatement of identified asbestos-containing materials (ACMs) within various apartments at the Willows Apartment buildings located at 886 Paula Street in San Jose, California.

Note: This specification is based upon the *Limited Hazardous Building Materials Survey, City of Petaluma Fire Station 1, 198 D Street, Petaluma, California (Ninyo & Moore, March 13, 2024)*, and associated sample location maps. In the likelihood that other suspect hazardous building materials are encountered during planned demolition activities at the site buildings, these materials should be sampled and analyzed to determine their status (asbestos-containing, lead-containing, etc.), or assumed to be hazardous and handled as such.

The following identified ACMs and ACCMs are to be removed from the site building:

- Tan 9-inch vinyl floor tile (VFT) (samples ASB-05 and ASB-06) located in the first-floor central office floor area, containing 2% chrysotile asbestos.
- Yellow 12-inch VFT (sample ASB-10) located in the first-floor hallway outside the central office floor area, containing 2% chrysotile asbestos. This VFT is located underneath 12-inch white VFT (ASB-09) in the same area.
- Joint compound on gypsum wallboard located throughout the first-floor of FS 1 (samples ASB-11, ASB-12, ASB-19 and ASB-37), containing 2% chrysotile asbestos. Sample ASB-11 was re-analyzed via PLM 400-point count on a composite basis (with the wallboard layer) and reported at <0.25% chrysotile asbestos. Sample ASB-37 (joint compound layer) was re-analyzed via PLM 400-point count and reported to contain <0.25% chrysotile asbestos. Based upon the analytical results associated with the re-analyses, the first-floor wallboard/joint compound assemblies are considered ACCMs. Additionally, in sample ASB-37, a layer of stucco was a part of the sampled material assembly. The stucco layer was reported as non-detect for asbestos.
- Wall texture on gypsum wallboard located throughout the first-floor of FS 1 (samples ASB-13, ASB-14, ASB-15 and ASB-16), containing from 2-5% chrysotile asbestos. These samples were requested to be re-analyzed via PLM 400-point count. However, there was not enough material left over from the original PLM analyses to conduct the re-analyses for samples ASB-13 and ASB-15. Texture from samples ASB-14 and ASB-16 was re-analyzed via PLM 400-point count and both were reported to contain 0.25% chrysotile asbestos. Based upon the analytical results associated with the re-analyses, the first-floor texture on wallboard is considered an ACCM.
- Transite wall sheeting (with a square-pattern, samples ASB-20 and ASB-21) located on the walls of the Apparatus Bay/Room, containing up to 35% chrysotile asbestos.
- Red 9-inch VFT (sample ASB-30) located under red carpet in the first-floor southwest storage area, containing 5% chrysotile asbestos.

- Red/black 9-inch VFT (sample ASB-39) and associated black mastic located in the Day room on the first-floor, both containing 5% chrysotile asbestos.
- Brown linoleum/flooring (sample ASB-48) located in a western second-floor restroom, containing 10% chrysotile asbestos.

1.02 REFERENCES

- A. United States Environmental Protection Agency (USEPA) regulations.
- B. General Industry Safety and Health Standards, 29 CFR Part 1910.
- C. Safety and Health Standards for the Construction Industry, 29 CFR Part 1926.
- D. The USEPA National Emission Standard for Hazard Air Pollutants, National Emission Standard for Hazardous Air Pollutants, National Emission Standard for Asbestos, Title 40 CFR Part 6,1 (a) and (m).
- E. Bay Area Air Quality Management Client (BAAQMD) regulations.
- F. The Occupational Safety and Health Standards for Asbestos, 29 CFR 1910.1001 and 1926.1101.
- G. The Occupational Safety and Health Standards, for Respiratory Protection (OSHA), 29 CFR 1910.134.
- H. California Code of Regulations, Title 8, Section 1529, Asbestos in Construction.
- I. The Transportation Safety Act, Hazardous Material Transportation Act, Title 49 CFR Parts 106, 107, 171-179.

Whenever there is a conflict or overlap of the above references, the most stringent provision is applicable.

1.03 PERMITS

- A. Obtain all special permits and licenses and make all required notifications to the appropriate government regulatory agencies (Bay Area Air Quality Management District, etc.) required for performance and completion of the abatement work.

1.04 SUBMITTALS

- A. Prior to the start of abatement activities, the contractor shall submit three (3) copies of the training, medical, and respiratory fit-testing documentation, described below, for each supervisor/worker who will be on-site for this project. Contractor shall use only workers medically qualified and trained for asbestos work and respirator usage.
- B. Contractor shall submit statements from the examining physician that each abatement supervisor/worker is fit to wear a respirator in accordance with 8 OCR 5144 from within the last six months.
- C. Prior to the start of abatement activities, the contractor shall submit three (3) copies of the Manufacturer's Product Data for:

- 1) Local exhaust equipment
 - 2) Vacuum equipment
 - 3) Respirators
 - 4) Pressure differential monitor(s)
- D. Prior to the start of abatement activities, the contractor shall submit three (3) copies of the work plan for removal of the identified ACMs, including a detailed plan of work procedures, work areas and proposed timelines for removal activities.
- E. Prior to the start of abatement activities, the contractor shall submit names and qualifications of each party responsible for transporting, storing, treating, and/or disposing of the resultant asbestos waste. Include the facility location and a twenty-four hour point of contact. Furnish two (2) copies of federal, state, and local permit applications, permits, and corresponding identification numbers.
- F. The following field test reports shall be submitted during the course of the work:
- 1) Air Sampling Results: Fiber counting shall be completed via Phase Contrast Microscopy (PCM) in general accordance with NIOSH Method 7400 (analysis of airborne fibers) by an analytical laboratory accredited through NVLAP for the analysis of air samples. The results shall be reviewed by the Client and/or the Client's representative **within 24 hours**. The Client's representative shall notify the contractor immediately of exposure to fibers in excess of 0.01 fibers per cubic centimeter (0.01 f/cc).
 - 2) Pressure Differential Recordings for Local Exhaust Systems: The contractor shall review and report the pressure differential recordings within 24 hours from the end of each day. Negative pressure within the abatement work areas shall be maintained at -0.02" of water at all times. All exceedances of -0.02" of water shall be reported to/reviewed by the Client's representative.
 - 3) Asbestos Disposal Quantity Report: The contractor shall review and report to the Client within 24 hours from the end of each day, the amount of ACMs and/or ACCMs removed during the previous day.
 - 4) Sign-In/Sign-Out Log: The contractor shall maintain a sign-in/sign-out log in the immediate vicinity of the change room or any decontamination area or other isolated and restricted work area. This log shall be maintained from the time the first activity is performed involving the disturbance of ACMs and/or ACCMs until acceptance of the final air test results. All persons entering the work area, including the contractor's workers, Client, and Client's representatives or authorities having jurisdiction, shall be required to sign in and out each time upon entering and leaving the Work area. All persons shall indicate name, time, company or agency represented, and reason for entering the Work area.
 - 5) Daily Activity Report: The contractor shall maintain a daily activity report describing work performed, materials and methods used, inspections made, test taken, and any unusual conditions or problems.

1.05 SITE CONDITIONS

- A. Furnish all labor, materials, facilities, equipment, services, employee training and testing, permits and agreements necessary to perform the removal and disposal of identified ACMs in accordance with the latest applicable federal, state, and local government regulations and this specification and as detailed in the ***Ninyo & Moore March 13, 2024 HBMS Report***. The contractor shall also be responsible for all quantity take-offs to determine actual quantities.
- B. The contractor warrants that he/she is familiar with the codes and requirements applicable to asbestos abatement work and shall give all notices and comply with all laws, ordinances, rules, and regulations applicable to the work. If the contractor observes that the specifications or plans are at variance therewith, he/she shall give written notice to the Client's representative describing such variance. If the contractor performs any work knowing it to be contrary to such laws, ordinances, rules, and regulations, and without written notice to the Client's representative, he/she shall bear all costs arising therefrom. The contractor's particular attention is directed to the applicable Cal-OSHA regulations found in 8 CCR 1529 and the necessity of complying with the regulations in the progress of his/her work. Failure or omission on the part of the contractor, or any of their representatives, either to discover or to bring to the attention of the Client any deviation from, omission from, or noncompliance with the requirements for asbestos abatement shall not be used by the contractor as defense for failure on his part to fulfill such requirements.
- C. The contractor shall assume full responsibility and liability for the compliance with all applicable Federal, State, and local regulations pertaining to work practices, hauling, disposal, and protection of workers, visitors to the site, and persons occupying areas adjacent to the site.
- D. Work shall be performed to comply with the most stringent provision of the regulations herein specified under Section 1.02, References.
- E. The work specified herein shall be performed by persons trained, knowledgeable, and qualified in state-of-the-art asbestos abatement techniques.

PART 2 - PRODUCTS

2.01 MATERIALS, EQUIPMENT, AND FACILITIES

- A. Polyethylene sheeting in sizes so as to minimize the frequency of joints.
- B. Tape: Glass fiber or other tape capable of sealing joints of adjacent plastic sheets and for attachment of plastic sheeting to finished or unfinished surfaces of dissimilar materials under both dry and wet conditions.
- C. Surfactant (Wetting Agent): Shall consist of materials that are non-toxic and non-irritating to skin and eye, and non-carcinogenic. The wetting agent shall consist of 50% polyoxyethylene or polyglycol ester and 50% polyoxyethylene ether, or the equivalent. Wetting agents shall be applied by means of an airless sprayer or equal.
- D. Encapsulant: Shall conform to USEPA requirements, shall contain no toxic or hazardous substances and no solvents.

- E. Impermeable Containers: Air and water-tight, suitable to receive and retain any asbestos-containing or contaminated materials until disposal at an approved site and labeled in accordance with applicable Cal-OSHA regulations (CCR Title 8, § 1529). Two types of impermeable containers shall be used:
 - Six (6) mil plastic bags
 - Metal or fiber drums with tightly fitting lids.
- F. Warning Labels and Signs: In conformance with applicable Cal-OSHA regulations (CCR Title 8, § 1529).
- G. Other Materials: Provide all other materials, such as lumber, nails, and hardware that may be required to construct and dismantle the decontamination area and the barriers that isolate the Work area.

2.02 SUBSTITUTION OF MATERIALS AND/OR METHODS

- A. Any substitution in materials and methods to those specified shall be approved by the Client prior to use. Requests for substitution shall be provided in writing to the Client.
- B. Procedures described and implied in this specification are to be utilized at all times. If specified procedures cannot be utilized, a request must be made in writing to the Client's representative providing details of the problem encountered and recommended alternatives. Alternative procedures shall provide equivalent or greater protection than procedures that are replaced. Any alternative procedure must be approved in writing by the Client's representative prior to the implementation of the procedure.

PART 3 - EXECUTION

3.01 GENERAL

In a work area, the Contractor shall:

- A. Remove and dispose of all ACMs and ACCMs in accordance with the methods and procedures outlined in CCR Title 8, § 1529.
- B. At all times keep the premises free from accumulation of waste materials or rubbish caused by their employees. Bags of asbestos waste and/or other waste material shall be removed immediately at the completion of work. Maintain surfaces of the work area free of debris and keep waste from being distributed outside of the immediate work area.
- C. Where appropriate, place airtight, enclosed work areas under differential air pressure for the duration of the asbestos removal and subsequent cleaning phases and until all removal areas have been air-tested and found to be in compliance with the specified final air quality clearance level as determined by the Client.
- D. Perform appropriate cleaning using HEPA vacuum or wet cleaning methods of all areas physically connected to areas receiving asbestos removal.
- E. Dispose of all contaminated or otherwise removed materials and wastes in sealed and labeled containers in an approved sanitary landfill.

- F. Never use high pressure water streams to remove any type of ACM (>1% asbestos) or ACCM (>0.1% asbestos but <1.0 % asbestos).
- G. After removal, all surfaces shall be cleaned using wet methods and HEPA vacuumed to remove residual accumulated material. After cleaning, surfaces shall appear free of visible material.
- H. Prior to the removal of the plastic sheeting from the wall and floor surfaces, apply approved sealant on all concrete substrates, structural steel, and piping surfaces from which the material was removed and to plastic sheeting prior to its removal.
- I. Eating, smoking or applying cosmetics shall not be permitted in the work areas.
- J. Where applicable, during removal and clean-up activities, air samples will be collected inside the work area, in the clean room, at the pressure differential exhaust, and outside the work area adjacent to critical barriers. Samples should be collected in these locations on a daily basis, whenever abatement activities are undertaken. These samples will be analyzed utilizing PCM.
- K. If, in the course of removing ACM and ACCM from the site, the contractor discovers any other ACM or ACCM, other than those described in plans, reports, or specifications, the contractor shall notify the Client's representative in writing and, after receiving Client's approval, the contractor will remove and dispose of such item(s) at the contract unit price identified by the contractor in his bid.

3.02 WORKER PROTECTION AND DECONTAMINATION

- A. The work detailed in this specification section is designated as Class I (removal of HVAC insulation from within an HVAC closet in Room 11 of Building B, removal of HVAC duct work insulation throughout the attic area of Building B, and the cleaning/removal of acoustical ceiling [and associated debris from Building B]) and Class II (removal of wall-board/joint compound assemblies from throughout Buildings B, C, 13/14 and the boys restroom and Room 17 of the Gym, 9-inch vinyl floor tiles [VFT] and associated black mastic from Buildings B and C, black tabletop material from Room 4 of Building B, gray sink undercoating from the kitchen area of the Gym, and the removal of the entire upper roof of the Gym). As a result, all worker protection and decontamination shall be performed in accordance with 8 CCR Section 1529.

Note: This specification is based upon the *Limited Hazardous Building Materials Survey, City of Petaluma Fire Station 1, 198 D Street, Petaluma, California (Ninyo & Moore, March 13, 2024)*, and associated sample location maps. In the likelihood that other suspect hazardous building materials are encountered during planned demolition activities at the site buildings, these materials should be sampled and analyzed to determine their status (asbestos-containing, lead-containing, etc.), or assumed to be hazardous and handled as such.

- B. The contractor will perform an exposure assessment in accordance with 8 CCR 1529. This includes, but is not limited to, collecting personal air samples to determine the employees' actual exposure to asbestos during renovation/demolition activities which will generate asbestos dust/fibers.
- C. Personal air samples will be collected by the contractor pursuant to OSHA regulations, and results made available to the Client's representative within three days of receipt from the laboratory.

- D. The contractor is responsible for decontamination of fixtures and equipment remaining in the work area.
- E. The contractor shall cooperate fully with Client representatives while conducting air monitoring and observation of procedures and abatement activities.
- F. The contractor shall provide a temporary change room unit with a separate equipment room, decontamination locker room (with shower), and a change room for personnel required to wear personal protective equipment (PPE) (Tyvek suits, etc.). This 3-stage decontamination unit will be observed/reviewed by the Client's representative prior to the start of abatement activities.

3.03 TAN, RED AND RED/BLACK 9-INCH VFT, AND YELLOW 12-INCH VFT AND ASSOCIATED ASBESTOS-CONTAINING MASTICS LOCATED ON THE FIRST-FLOOR OF FIRE STATION 1 (AS DESCRIBED IN THE NINYO & MOORE MARCH 13, 2024 HBMS REPORT).

The removal of the tan, red and red/black 9-inch VFT and the yellow 12-inch VFT and associated asbestos-containing mastics from first-floor areas within Fire Station 1 shall be performed in accordance with all regulations and guidelines governing asbestos abatement and disposal, as well as other applicable federal, state, and local government regulations. The VFTs described above shall be removed as Class II work, as defined by 8 CCR 1529 and shall be disposed as non-friable, asbestos waste. This includes, but is not limited to, the following:

- A. Post warning signs per 8 CCR 1532.1.
- B. Install critical barriers at openings inside the containments/work areas (as appropriate).
- C. Install a negative pressure enclosure in work area per 8 CCR 1529.
- D. Don appropriate PPE in accordance with 8 CCR 1529.
- E. Carefully mist area while removing the VFT materials described above so as to minimize dust or fiber release.
- F. Clean the area using a HEPA vacuum and wet wiping.

3.04 JOINT COMPOUND AND TEXTURE ON WALLBOARD FROM THROUGHOUT THE FIRST-FLOOR OF FIRE STATION 1.

The removal of the joint compound and texture on wallboard from throughout the first-floor of Fire Station shall be performed in accordance with all regulations and guidelines governing asbestos abatement and disposal, as well as other applicable federal, state, and local government regulations. The wallboard/joint compound assemblies shall be performed as Class II work, as defined by 8 CCR 1529 and shall be disposed as ACCM (as documented through the re-analyses in the ***Ninyo & Moore March 13, 2024 HBMS Report***). This includes, but is not limited to, the following:

- A. Post warning signs per 8 CCR 1532.1.
- B. Install critical barriers at openings inside the containments/work areas (as appropriate).
- C. Install a negative pressure enclosure in work area per 8 CCR 1529.
- D. Don appropriate PPE in accordance with 8 CCR 1529.

- E. Carefully mist area while removing the joint compound/texture/wallboard assemblies so as to minimize dust or fiber release.
- F. Clean the area using a HEPA vacuum and wet wiping.

3.05 BROWN LINOLEUM/FLOORING IN THE SECOND-FLOOR WESTERN BATHROOM AREA OF FIRE STATION 1.

The removal of the brown linoleum/flooring in the second-floor western bathroom area of Fire Station 1 shall be performed in accordance with all regulations and guidelines governing asbestos abatement and disposal, as well as other applicable federal, state, and local government regulations. These materials shall be removed as one assembly and as Class II work, as defined by 8 CCR 1529 and shall be disposed as friable, asbestos waste. This includes, but is not limited to, the following:

- A. Post warning signs per 8 CCR 1532.1.
- B. Install critical barriers at openings inside the containments/work areas.
- C. Install a negative pressure enclosure in work area per 8 CCR 1529.
- D. Don appropriate PPE in accordance with 8 CCR 1529.
- E. Carefully mist area while removing the brown/linoleum flooring so as to minimize dust or fiber release.
- F. Clean the area using a HEPA vacuum and wet wiping.

3.06 CLEARANCE

- A. A visual inspection shall be performed by the Client's representative following ACM removal in order to determine that each of the work areas has been cleaned of all identified ACM, ACCM and debris. If the work areas are not visibly clean, the contractor will re-clean using HEPA vacuums and wet wiping at no additional cost to the Client.
- B. Perimeter air samples shall be collected by the Client's representative. Dependent upon the scope of abatement work employed by the abatement contractor, clearance air samples will be collected. Clearance air samples shall only be collected upon satisfactory visual inspection.
- C. All clearance and perimeter and air samples shall be analyzed by PCM in accordance with the NIOSH 7400 Method. The contractor will not be released from the work area(s) until all samples collected are determined to have fiber concentrations less than 0.01 f/cc. Should air sample results indicate fiber concentrations greater than 0.01 f/cc, the contractor will be required to re-clean the work area at no additional cost to the Client. This process shall continue until clearance air samples indicate fiber concentration levels less than 0.01 f/cc.
- D. When clearance is achieved (***air and/or visual***) in each work area, any decontamination enclosure systems shall be removed, the area thoroughly cleaned using wet methods, and materials from any temporary equipment rooms and/or showers disposed of as hazardous waste. Any remaining barriers between contaminated and clean areas and all seals on openings into the work area and fixtures shall be removed and disposed of as hazardous waste.

Fire Station 1/198 D Street
Petaluma, California

END OF SECTION

LIMITED HAZARDOUS BUILDING MATERIALS SURVEY

City of Petaluma Fire Station 1
198 D Street
Petaluma, California 94541

City of Petaluma Fire Department
198 D Street
Petaluma, California 94541

March 13, 2024 | Project No. 404782001



Geotechnical | Environmental | Construction Inspection & Testing | Forensic Engineering & Expert Witness

Geophysics | Engineering Geology | Laboratory Testing | Industrial Hygiene | Occupational Safety | Air Quality | GIS

Ninyo & Moore
Geotechnical & Environmental Sciences Consultants

LIMITED HAZARDOUS BUILDING MATERIALS SURVEY

City of Petaluma Fire Station 1
198 D Street
Petaluma, California 94541

Mr. Jeff Schach
Fire Chief
City of Petaluma Fire Department
198 D Street
Petaluma, California 94541
March 13, 2024 | Project No. 404782001



William P. Larkin
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CDPH Certified Lead Inspector/Assessor and Project
Monitor (Nos. 1284/1285)

WPL

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APPENDICES

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B – Asbestos Laboratory Analytical Report and Chain-of-Custody Records

C – Lead-Containing Material Laboratory Analytical Report and Chain-of-Custody Records

D – Polychlorinated Biphenyl Laboratory Analytical Report and Chain-of-Custody Records

E – CDPH Form 8552 - Lead Hazard Evaluation Report

1 INTRODUCTION

Ninyo & Moore was retained by the City of Petaluma Fire Department (CPFD/Client) to conduct a limited hazardous building materials survey (HBMS) at Fire Station 1 (FS 1) located at 198 D Street in Petaluma, California (Figures 1 and 2).

The limited sampling activities were performed in accordance with established guidelines for the assessment of suspect asbestos-containing materials (ACMs), lead-containing materials (LCMs) and polychlorinated biphenyl-containing materials (PCBCMs) and are based upon conditions at FS 1 at the time of the surveying/assessment activities. Our objective and scope of work for the sampling activities are presented below.

1.1 Involved Parties

The sampling activities were performed on February 28, 2024 by Ninyo & Moore personnel. Mr. William Larkin provided principal-level oversight and quality review. Mr. Larkin is a State of California Department of Occupational Safety and Health (DOSH)-Certified Asbestos Consultant (No. 99-2688) and a State of California Department of Public Health (CDPH)-certified Lead Inspector/Assessor and Project Monitor (Nos. 1284/1285). Professional certifications are presented in Appendix A.

1.2 User Reliance

This report may be relied upon and is intended exclusively for use by CPFD. Any use or re-use of the findings, conclusions, and/or recommendations of this report by parties other than CPFD is undertaken at said parties' sole risk.

2 OBJECTIVE AND SCOPE OF SERVICES

The purpose of this assessment is to provide information regarding current conditions at FS 1 to assist the CPFD in implementing proposed renovation activities. Ninyo & Moore personnel performed the following services including:

- Visual reconnaissance of FS 1 to document homogeneous areas of suspect ACM, LCMs and PCBCMs.
- Collection of 54 bulk samples of suspect ACMs and submittal of these samples to a certified, independent laboratory for analysis of asbestos content.
- Collection of 21 suspect LCM samples and submittal of these samples to a certified, independent laboratory for analysis of lead content.
- Collection of 10 suspect PCBCM samples and submittal of these samples to a certified, independent laboratory for analysis of PCB content.

- Preparation of this limited HBMS report, which presents our data and summarizes the assessed building materials. The report includes a site description, laboratory testing information, findings, conclusions, and recommendations, sample/site location maps, tables summarizing the building materials assessed, and the estimated quantities of identified materials.

3 SITE DESCRIPTION

FS 1 is located at 198 D Street and encompasses approximately 9,120 square feet (SF) with two stories. The fire station is of stucco and wood construction with exterior stucco walls and wood ceilings (on a concrete pad/foundation). Office rooms, living quarters, restrooms/showers, storage rooms, laundry room, Day room, kitchen, bell tower, and apparatus bay are located in the main structure. Finishes in the office rooms include wood/plaster assemblies, wallboard/joint compound assemblies, vinyl floor tiles (VFT) and mastic, linoleum, wood flooring, and acoustical ceiling tiles. Finishes in the Day room and kitchen include wood/plaster assemblies, vinyl flooring, and wood ceilings. Finishes in the living quarters include wood/plaster assemblies, wood flooring and wood ceilings. Finishes in the first-floor restroom include plaster assemblies, ceramic walls/flooring, and wood ceilings. Finishes in the second-floor restroom/shower include plaster assemblies, linoleum flooring, and wood ceilings. Finishes in the bell tower include plaster assemblies, wood flooring, and plaster ceilings. Finishes in the storage areas include plaster assemblies, carpeted flooring/vinyl floor tile on top of concrete floors, and wood ceilings. Finishes for the apparatus bay include plaster assemblies, Transite sheeting (on interior walls), concrete flooring, and wood ceilings.

4 PHYSICAL LIMITATIONS

No physical limitations were encountered during the site sampling activities, except the building's roof. Per Client request, the roof of the building was not included in this assessment. Underground utilities, such as suspect cementitious water lines or suspect insulated/coated gas or electrical lines were not assessed during these survey activities. Non-destructive sampling techniques were implemented during these assessment activities. If additional suspect materials and/or surfaces are encountered during site building demolition/renovation activities that have not been assessed, they should be assumed to be asbestos and/or lead-containing and handled accordingly, or should be sampled and analyzed to assess whether they are hazardous (asbestos-containing, lead-containing and/or PCB-containing, etc.).

5 SAMPLE COLLECTION AND ANALYSES

On February 28, 2024, FS 1 was assessed for the presence of ACMs, LCMs and PCBCMs. The ACM, LCM and PCBCM surveys followed United States Environmental Protection Agency (EPA)

guidelines, and/or industry standards, within the limitations of the scope of this assessment. Survey activities are discussed below.

5.1 Asbestos Survey

A preliminary visual assessment and bulk sampling survey of suspect ACMs were performed by certified Ninyo & Moore personnel. Representative samples of suspect ACMs were collected after identification of homogeneous sampling areas (areas in which the materials are consistent in color, texture, construction or application date, and general appearance). Each homogeneous area was observed for material type, location, condition, and friability. Representative samples were collected from each requested area using EPA-recommended sampling procedures. The Client provided Ninyo & Moore with two previous sampling reports conducted within FS 1 by Clark Seif Clark (CSC) in June of 2010. Ninyo & Moore used these reports to help develop a sampling plan.

Fifty-four bulk samples were collected and analyzed. Building materials that were sampled and analyzed for the presence of asbestos are presented in Table 1.

After collection, the suspect ACM samples were transferred to EMSL Analytical, Inc., (EMSL) of San Leandro, California for analysis. EMSL is a laboratory accredited in the National Voluntary Laboratory Accreditation Program (NVLAP) for bulk asbestos fiber analysis. The samples were analyzed for the presence and quantification of asbestos fibers, using polarized light microscopy with dispersion staining (PLM/ds), in general accordance with EPA Method 600/R-93/116. The lower limit of reliable detection for asbestos using the PLM method is approximately 1 percent (1%) by volume. Currently, the EPA and the State of California stipulate that materials containing more than 1% asbestos constitute an ACM and the State of California further stipulates that a material containing greater than 0.1% asbestos constitutes an asbestos-containing construction material (ACCM). The locations from which bulk asbestos samples were collected are shown on Figures 3 and 4. Materials in which no asbestos was detected are defined in Table 1 as “ND” (for “None Detected”) in the “Asbestos Content” column. PLM 400- and/or 1,000-point count re-analyses were conducted to confirm some materials’ asbestos content as needed. Copies of the laboratory analytical reports and chain-of-custody records for suspect ACMs are presented in Appendix B. ACMs reported in the Ninyo & Moore survey are listed in Section 6.1 below.

5.2 Lead-Containing Materials Survey

A preliminary visual assessment and bulk sampling survey of suspect LCMs were performed by certified Ninyo & Moore personnel. After collection, the suspect LCM samples were also transferred to EMSL for analysis of total lead content by Flame Atomic Absorption Spectroscopy (Flame AAS, SW 846 3050B/7000B). EMSL is an American Industrial Hygiene Association-

accredited Environmental Lead Laboratory (AIHA ELLA). Currently, the EPA stipulates what concentrations of lead in non-volatile components of surface coatings or materials indicate whether a material is considered to be lead-containing. The EPA stipulates that paint containing an amount equal to or in excess of 1 milligram per square centimeter (1.0 mg/cm²), or more than half of one percent (0.5%) by weight (or 5,000 milligrams per kilogram [mg/kg]), constitute a lead-based paint (LBP). Coatings with any detectable amount of reported lead would be considered lead-containing paint (LCP). The locations from which bulk suspect LCM asbestos samples were collected are shown on Figures 3 and 4.

Paint that is chipping or peeling, or that may be readily removed from surfaces, and has a lead content equal to or more than 1,000 mg/kg, would require handling as a California Title 22 hazardous waste. The analytical results associated with paint chip samples collected from the building are summarized in Table 2 and copies of the laboratory analytical report and chain-of-custody record are presented in Appendix C.

5.3 Polychlorinated Biphenyl-Containing Materials Survey

The EPA has reported that there was widespread use of PCBCMs in buildings built or renovated between the years 1950 and 1979. The manufacture and use of PCBs were banned in the United States in 1976 and were phased-out in construction materials between 1978 and 1979. Building materials that were manufactured using PCBs and that contain PCB concentrations greater than or equal to ($\geq$) 50 mg/kg are defined as **PCB Bulk Product Waste** (40 Code of Federal Regulations Parts 761.3 and 761.61). Building materials that contain less than ($<$) 50 mg/kg PCBs are defined as **Excluded PCB Products** and may be disposed of as general construction debris. However, it is recommended that the laboratory results be provided to the selected disposal facility for final waste classification and acceptance determination.

After collection, the 10 suspect PCBCM samples were transferred to Enthalpy Analytical of Orange, California for analysis of PCB content via EPA Method 8082 and preparation method 3546. Currently, the EPA stipulates that the waste characterization level (WCL) for PCBs is 50 mg/kg. The analytical results associated with the 10 suspect PCBCM samples collected are shown in Table 3 and copies of the laboratory analytical report and chain-of-custody record are presented in Appendix D. Sample locations are shown on Figures 3 and 4.

5.4 Miscellaneous Hazardous Building Materials Survey

A visual assessment of potential mercury-containing thermostats/switches, PCB-containing items (transformers, light ballasts, etc.), fluorescent light tubes, exit signs, smoke detectors, air conditioning units, and FreonTM-containing refrigeration systems was performed at FS 1. Materials observed within FS 1 are listed in Table 4.

6 FINDINGS

6.1 Asbestos-Containing Materials

Based upon the analytical results associated with the bulk samples collected and observations made during these sampling activities, the following ACMs were identified within FS 1:

- Approximately 130 SF of tan 9-inch VFT (samples ASB-05 and ASB-06) located in the first-floor central office floor area, containing 2% chrysotile asbestos.
- Approximately 130 SF of yellow 12-inch VFT (sample ASB-10) located in the first-floor hallway outside the central office floor area, containing 2% chrysotile asbestos. This VFT is located underneath 12-inch white VFT (ASB-09) in the same area.
- Joint compound on gypsum wallboard located throughout the first-floor of FS 1 (samples ASB-11, ASB-12, ASB-19 and ASB-37), containing 2% chrysotile asbestos. Sample ASB-11 was re-analyzed via PLM 400-point count on a composite basis (with the wallboard layer) and reported at <0.25% chrysotile asbestos. Sample ASB-37 (joint compound layer) was re-analyzed via PLM 400-point count and reported to contain <0.25% chrysotile asbestos. Based upon the analytical results associated with the re-analyses, the first-floor wallboard/joint compound assemblies are considered ACCMs. Additionally, in sample ASB-37, a layer of stucco was a part of the sampled material assembly. The stucco layer was reported as non-detect for asbestos.
- Wall texture on gypsum wallboard located throughout the first-floor of FS 1 (samples ASB-13, ASB-14, ASB-15 and ASB-16), containing from 2-5% chrysotile asbestos. These samples were requested to be re-analyzed via PLM 400-point count. However, there was not enough material left over from the original PLM analyses to conduct the re-analyses for samples ASB-13 and ASB-15. Texture from samples ASB-14 and ASB-16 was re-analyzed via PLM 400-point count and both were reported to contain 0.25% chrysotile asbestos. Based upon the analytical results associated with the re-analyses, the first-floor texture on wallboard is considered an ACCM.
- Approximately 3,900 SF of Transite wall sheeting (with a square-pattern, samples ASB-20 and ASB-21) located on the walls of the Apparatus Bay/Room, containing up to 35% chrysotile asbestos.
- Approximately 120 SF of red 9-inch VFT (sample ASB-30) located under red carpet in the first-floor southwest storage area, containing 5% chrysotile asbestos.
- Approximately 1,000 SF of red/black 9-inch VFT (sample ASB-39) and associated black mastic located in the Day room on the first-floor, both containing 5% chrysotile asbestos.
- Approximately 140 SF of brown linoleum/flooring (sample ASB-48) located in a western second-floor restroom, containing 10% chrysotile asbestos.

As shown in the reported analytical results, wallboard/joint compound and wall texture on the second floor of the structure were reported as non-detect for asbestos.

As mentioned above, CSC conducted sampling at FS 1 in June of 2010. Thermal system insulation (TSI) on HVAC ducting from the bell tower area of FS 1 was sampled and reported to contain up to 50% chrysotile asbestos. A total of eleven linear feet of TSI on HVAC ducting was reported in the CSC June 2010 reports. No sample location maps were included in the CSC reports. Ninyo & Moore personnel looked in the bell tower area (including attic areas), but could not find the afore-mentioned TSI. It is assumed that the TSI was abated or that it is in an inaccessible wall area.

6.2 Lead-Containing Materials

A total of 19 paint chip samples and two ceramic tile samples were collected for analysis of lead content. Six of the 19 paint samples were reported with lead concentrations at less than their associated limits of detection (<0.008 by weight, or <80 mg/kg).

Three paint chip samples were reported with lead concentrations at greater than 0.5% by weight (or 5,000 mg/kg). Green paint from a western metal window sill (LBP-09) was reported with a lead concentration of 2.3% by weight (or 23,000 mg/kg). Blue paint located on a concrete wall in the in the first-floor Apparatus Bay/Room (LBP-11) was reported with a lead concentration of 0.7% by weight (or 7,000 mg/kg). White paint located on a stucco wall in a first-floor northwest restroom (LBP-15) was reported with a lead concentration of 1.3% by weight (or 13,000 mg/kg). Samples LBP-09, LBP-11 and LBP-15 are considered LBP.

The remaining 10 paint chip samples were reported with lead concentrations ranging from 0.015% by weight (or 150 mg/kg) to 0.44% by weight (or 4,400 mg/kg). These paint samples are considered LCP. Both of the ceramic tile samples were reported to contain lead at less than their associated lead detection limits (<0.008, or <80 mg/kg).

Occupational Health and Safety Administration (OSHA) regulations apply whenever materials/paint with any detectable amounts of lead are disturbed. A copy of the CDPH form 8552 "Lead Hazard Evaluation Report" for FS 1 is included in Appendix E.

6.3 Potential Polychlorinated Biphenyl-Containing Materials

The analytical results associated with the 10 bulk PCBCM samples collected at FS 1 were reported at less than the 50 mg/kg WCL (all reported as non-detect). The materials collected and analyzed are considered **Excluded PCB Products** and may be disposed of as general construction debris.

6.4 Miscellaneous Hazardous Building Materials

Observed miscellaneous hazardous building materials included fluorescent light tubes and associated light ballasts, fire doors and a refrigerator. These materials are listed in Table 4.

7 RECOMMENDATIONS

Based upon the reported analytical results and observations associated with this assessment, ACMs, LCMs and miscellaneous hazardous building materials have been reported within FS 1. The following recommendations/precautions are provided:

- The identified ACMs/ACCMs within FS 1 should not be disturbed. Any ACMs/ACCMs in damaged condition should be promptly repaired or abated. Prior to renovation or demolition work that would disturb the ACMs/ACCMs, a licensed asbestos abatement removal contractor should remove the ACMs/ACCMs in compliance with the most recent applicable federal, state, and local laws, regulations, standards, and/or codes governing abatement, transport, and disposal of ACMs/ACCMs. The removal work scope and requirements should be included in a work plan/specification developed by a California Certified Asbestos Consultant (CAC). ***While Ninyo & Moore provided an estimate of the quantity of ACMs/ACCMs within FS 1 (Table 1), it is the abatement contractor's responsibility to assess the actual ACM quantities present.***
- The identified LCMs reported within FS 1 should not be disturbed. Any LCMs found in a damaged or non-intact condition should be abated and/or stabilized. Prior to renovation or demolition work that would disturb the identified LCMs a licensed lead abatement removal contractor should stabilize and/or remove the identified LCMs in compliance with the most recent applicable federal, state, and local laws, regulations, standards, and/or codes governing abatement, transport, and disposal of LCMs. All lead waste must be properly characterized prior to disposal to determine waste classification, packaging, transportation, and disposal requirements. ***While Ninyo & Moore provided an estimate of the quantity of LCMs present within FS 1 (Table 2), it is the abatement contractor's responsibility to assess the actual LCM quantities present.***
- Prior to demolition or renovation activities, potential mercury-containing thermostats/switches, PCB-containing items (light ballasts, transformers, etc.), fluorescent light tubes, exit signs, air conditioning units, and Freon™-containing refrigeration systems should be removed and properly recycled or disposed of by a licensed contractor according to applicable federal, state, and local laws/regulations. Light fixtures should be

visually inspected, prior to disposal, to determine if they contain PCBs (checked for “No PCBs” or “PCB free” stickers). ***While Ninyo & Moore provided an estimate of the quantity of miscellaneous hazardous building materials present within FS 1 (Table 4), it is the abatement contractor’s responsibility to confirm the quantities of items present.***

- There is a possibility that additional suspect ACMs, LCMs and/or PCBCMs may be discovered during building renovation and/or demolition activities. Therefore, Ninyo & Moore recommends that, should additional suspect materials not sampled or assessed in this report be uncovered during demolition/renovation activities, (a) samples of suspect materials should be collected for laboratory analysis and activities that may impact the materials should cease until laboratory analytical results are reviewed or (b) the materials should be assumed to be hazardous and handled as such.

8 LIMITATIONS

Ninyo & Moore's opinions and recommendations regarding environmental conditions, as presented in this report, are based on limited sampling and chemical analysis. Further assessment of potential adverse environmental impacts may be accomplished by conducting a more comprehensive assessment. The samples collected and used for testing, and the observations made, are believed to be representative of the areas evaluated. However, if additional suspect hazardous building materials are encountered during renovation/demolition activities, these materials should be sampled by qualified personnel, and analyzed for content prior to further disturbance. ***In addition, please note that the quantities of impacted hazardous building materials are approximate. It is the contractor’s responsibility to assess the actual quantities of hazardous building materials present.***

The environmental services described in this report have been conducted in general accordance with current regulatory guidelines and the standard of care exercised by environmental consultants performing similar work in the project area. No warranty, expressed or implied, is made regarding the professional opinions presented in this report. Variations in site conditions may exist and conditions not observed or described in this report may be encountered during subsequent activities.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Ninyo & Moore should be contacted if the reader requires any additional information, or has questions regarding content, interpretations presented, or completeness of this document.

The environmental interpretations and opinions contained in this report are based on the results of laboratory tests and analyses intended to detect the presence and concentration of specific chemical or physical constituents in samples collected from the subject site. The testing and analyses have been conducted by an independent laboratory that is certified by the State of California to conduct such tests. Ninyo & Moore has no involvement in, or control over, such testing and analysis. Ninyo & Moore, therefore, disclaims responsibility for any inaccuracy in such laboratory results.

Our findings, opinions, and recommendations are based on an analysis of the observed site conditions. It should be understood that the conditions of a site can change with time as a result of natural processes or the activities of man at the subject site or nearby sites. In addition, changes to the applicable laws, regulations, codes, and standards of practice may occur due to government action or the broadening of knowledge. The findings of this report may, therefore, be invalidated over time, in part or in whole, by changes over which Ninyo & Moore has no control.

Table 1 - Bulk Asbestos Sampling Results							
Sample I.D.	Date	Material Location	Sample Description	Friable Y/N	Quantity	Condition	Asbestos Content
ASB-01	3/8/2024	Exterior West Wall Area	Wall Texture	NA	NA	NA	ND
ASB-02	3/8/2024	Exterior Southwest Exterior Wall Area	Wall Texture	NA	NA	NA	ND
ASB-03	3/8/2024	1st Floor - Central Office Center Ceiling Area	12" x 12" Acoustical Ceiling Tile (ACT)	NA	NA	NA	ND
ASB-04	3/8/2024	1st Floor - Office Hallway North Ceiling Area	12" x 12" ACT	NA	NA	NA	ND
ASB-05	3/8/2024	1st Floor - Central Office West Floor Area	9" x 9" Tan Vinyl Floor Tile (VFT) with Mastic	N	130 SF	Good	VFT - 2% CH Mastic - ND
ASB-06	3/8/2024	1st Floor - Central Office East Floor Area	9" x 9" Tan VFT with Mastic	N	Same as ASB-05	Good	VFT - 2% CH Mastic - ND
ASB-07	3/8/2024	1st Floor - Central Office Center Ceiling Area	Brown "Puck" Ceiling Mastic	NA	NA	NA	ND
ASB-08	3/8/2024	1st Floor - Central Office Center Ceiling Area	Wallboard and Joint Compound (WB/JC)	NA	NA	NA	ND
ASB-09	3/8/2024	1st Floor - Hallway Outside of Central Office Floor Area	12" x 12" White VFT with Mastic	NA	NA	NA	ND
ASB-10	3/8/2024	1st Floor - Under ASB-09	12" x 12" Yellow VFT with Mastic	N	130 SF	Good	VFT - 2% CH Mastic - ND
ASB-11	3/8/2024	1st Floor - Office Hallway Far North Wall Corner	WB/JC	Y	2,400 SF	Good	Wallboard - ND Joint Compound - 2% CH ($<0.25\%$ CH)*
ASB-12	3/8/2024	1st Floor - West Office Northeast Wall Corner	WB/JC	Y	Same as ASB-11	Good	Wallboard - ND Joint Compound - 2% CH
ASB-13	3/8/2024	1st Floor - Office Hallway Far North Wall Area	Wallboard/Texture	Y	1,500 SF	Good	Wallboard - ND Texture - 2% CH**
ASB-14	3/8/2024	1st Floor - Office Hallway - Central Wall Area	Wall Texture	Y	Same as ASB-13	Good	3% CH (0.25% CH)**
ASB-15	3/8/2024	1st Floor - West Office Northeast Wall Area	Wallboard/Texture	Y	Same as ASB-13	Good	Wallboard - ND Texture - 2% CH**
ASB-16	3/8/2024	1st Floor - Office Hallway West Wall Area	"Carpeted" Wall Texture	Y	150 SF	Good	5% CH (0.25% CH)**
ASB-17	3/8/2024	1st Floor - Apparatus Bay East Central Floor	Concrete	NA	NA	NA	ND
ASB-18	3/8/2024	1st Floor - Apparatus Bay West Central Floor	Concrete	NA	NA	NA	ND
ASB-19	3/8/2024	1st Floor - Apparatus Bay West Pillar	WB/JC	Y	150 SF	Good	Wallboard - Not Present Joint Compound - 2% CH ($<0.25\%$ CH)**
ASB-20	3/8/2024	1st Floor - Apparatus Bay East Wall Area	Transite Wall Paneling	N	3,900 SF	Good	20% CH

Table 1 - Bulk Asbestos Sampling Results							
Sample I.D.	Date	Material Location	Sample Description	Friable Y/N	Quantity	Condition	Asbestos Content
ASB-21	3/8/2024	1st Floor - Apparatus Bay West Wall Area	Transite Wall Paneling	N	Same as ASB-20	Good	35% CH
ASB-22	3/8/2024	Apparatus Bay Southwest Exterior Floor Area	Concrete	NA	NA	NA	ND
ASB-23	3/8/2024	Apparatus Bay Southeast Exterior Floor Area	Concrete	NA	NA	NA	ND
ASB-24	3/8/2024	1st Floor - Apparatus Bay East Window	Window Putty	NA	NA	NA	ND
ASB-25	3/8/2024	1st Floor - Apparatus Bay West Wall Area	Gypsum Wallboard	NA	NA	NA	ND
ASB-26	3/8/2024	1st Floor - Apparatus Bay Southwest Wall Area	Stucco	NA	NA	NA	ND
ASB-27	3/8/2024	1st Floor - Apparatus Bay Northeast Wall Area	Stucco	NA	NA	NA	ND
ASB-28	3/8/2024	1st Floor Apparatus Bay Southwest Lower Wall Area	Concrete	NA	NA	NA	ND
ASB-29	3/8/2024	1st Floor - Storage Southwest Floor Area	Red Carpet with Mastic	NA	NA	NA	ND
ASB-30	3/8/2024	1st Floor- Storage Under ASB-29	9"x 9" Red VFT with Black Mastic	N	120 SF	Good	VFT - 5% CH Mastic - ND
ASB-31	3/8/2024	1st Floor - Storage Southwest Wall Area	Stucco	NA	NA	NA	ND
ASB-32	3/8/2024	1st Floor - Tank Room Northeast Window Caulking	Window Caulking	NA	NA	NA	ND
ASB-33	3/8/2024	Northwest Stairs Window Area	Window Caulking	NA	NA	NA	ND
ASB-34	3/8/2024	Northwest Stairs Window Area	Window Putty	NA	NA	NA	ND
ASB-35	3/8/2024	1st Floor - Restroom Floor Area	1" x 1" Gray Ceramic Floor Tile	NA	NA	NA	ND
ASB-36	3/8/2024	1st Floor - Restroom Wall Area	4" x 4" White Ceramic Wall Tile	NA	NA	NA	ND
ASB-37	3/8/2024	1st Floor Restroom - Northwest Wall Area	Stucco/Joint Compound	N	120 SF	Good	Stucco - ND Joint Compound - 2% CH (<0.25% CH)**
ASB-38	3/8/2024	1st Floor - Kitchen West Floor Area	12" x 12" White/Blue VFT with Mastic	NA	NA	NA	ND
ASB-39	3/8/2024	1st Floor - Day Room Northwest Floor Area	9" x 9" Red/Black VFT with Mastic	N	1,000 SF	Good	VFT - 5% CH Mastic - 5% CH
ASB-40	3/8/2024	Tower - Crawl Space Area	Black Vapor Barrier	NA	NA	NA	ND
ASB-41	3/8/2024	Tower - Central Ceiling Area	Stucco	NA	NA	NA	ND
ASB-42	3/8/2024	Tower - West Wall Duct Area	Pink Batt Insulation	NA	NA	NA	ND
ASB-43	3/8/2024	Tower - Crawl Space Area	White/Yellow Batt Insulation	NA	NA	NA	ND

Table 1 - Bulk Asbestos Sampling Results							
Sample I.D.	Date	Material Location	Sample Description	Friable Y/N	Quantity	Condition	Asbestos Content
ASB-44	3/8/2024	Tower - Southwest Wall Area	Stucco	NA	NA	NA	ND
ASB-45	3/8/2024	2nd Floor - Dorm Room South Wall Area	Wall Texture	NA	NA	NA	ND
ASB-46	3/8/2024	2nd Floor - Hallway South Wall Area	Stucco	NA	NA	NA	ND
ASB-47	3/8/2024	2nd Floor - Restroom/Shower East Floor Area	Yellow Linoleum Flooring with Mastic	NA	NA	NA	ND
ASB-48	3/8/2024	2nd Floor - Restroom West Floor Area	Brown Linoleum Flooring with Mastic	N	140 SF	Good	Linoleum - 10% CH Mastic - ND
ASB-49	3/8/2024	2nd Floor - Restroom/Shower Northwest Window Area	Window Caulking	NA	NA	NA	ND
ASB-50	3/8/2024	2nd Floor - Dorm West Wall Area	Wall Texture	NA	NA	NA	ND
ASB-51	3/8/2024	2nd Floor - Captain's Room Northwest Wall Area	Wall Texture	NA	NA	NA	ND
ASB-52	3/8/2024	2nd Floor - Restroom/Shower Northwest Window Area	Window Putty	NA	NA	NA	ND
ASB-53	3/8/2024	2nd Floor - Laundry Room South Wall Area	Stucco	NA	NA	NA	ND
ASB-54	3/8/2024	2nd Floor - Captain's Room Northwest Wall Area	WB/JC	NA	NA	NA	ND

NOTES:

Analysis by Polarized Light Microscopy (PLM/EPA 600/R-93/116 Method).

* = re-analysis via PLM 400-point count on a composite basis

** = re-analysis via PLM 400-point count

NA = Not Applicable

ND = None detected

CH = Chrysotile

Table 2 - Lead-Containing Material Sampling Results

Sample I.D.	Building	Sample Location	Substrate/Surface	Sample Description (Color / # of Layers / Substrate)	Estimated Surface Area (Square Feet [SF] or Linear Feet [LF])	Condition	Total Lead	
							Weight Percent	Parts per Million (or mg/kg)
LBP-01	Fire Station 1	West Exterior Wall Area	Stucco	White/2/Stucco	9,120 SF	Intact	0.066	660*
LBP-02	Fire Station 1	Southwest Exterior Wall Area	Stucco	White/2/Stucco	Same as LBP-01	Intact	0.08	800*
LBP-03	Fire Station 1	1st Floor - Office Hallway/Far North Wall Area	Wood	Cream/2/Wood	2,400 SF	Intact	0.17	1,700*
LBP-04	Fire Station 1	1st Floor - Central Office/Southwest Wall Area	Wood	Blue/2/Wood	100 SF	Intact	<0.0080	<80
LBP-05	Fire Station 1	1st Floor - Apparatus Bay/West Wall Area	Wood	Green/2/Wood	130 SF	Intact	0.076	760*
LBP-06	Fire Station 1	1st Floor - Apparatus Bay/West Wall Area	Wood	White/2/Stucco	130 SF	Intact	0.042	420*
LBP-07	Fire Station 1	1st Floor - Apparatus Bay/Central Floor Area	Concrete	Red/1/Concrete	500 SF	Intact	<0.080	<80
LBP-08	Fire Station 1	1st Floor - Apparatus Bay/Exterior Floor Area	Concrete	Red/1/Concrete	Same as LBP-07	Intact	<0.080	<80
LBP-09	Fire Station 1	1st Floor - Apparatus Bay/West Window Sill	Metal	Green/1/Metal	28 SF	Intact	2.3	23,000
LBP-10	Fire Station 1	1st Floor - Apparatus Bay/West Window Sill	Wood	Grey/2/Wood	5 SF	Intact	0.33	3,300*
LBP-11	Fire Station 1	1st Floor - Apparatus Bay/Southwest Lower Wall Area	Concrete	Blue/1/Concrete	4,200 SF	Intact	0.7	7,000
LBP-12	Fire Station 1	1st Floor - Storage/West Wall Area	Stucco	White/2/Stucco	125 SF	Intact	0.015	150*
LBP-13	Fire Station 1	1st Floor - Tank Room/Northeast Window Area	Metal	Grey/1/Metal	28 SF	Intact	0.44	4,400*
LBP-14	Fire Station 1	1st Floor - Stairs/Window Area	Stucco	White/2/Stucco	Same as LBP-01	Intact	0.27	2,700*
LBP-15	Fire Station 1	1st Floor - Restroom/Northwest Wall Area	Stucco	White/2/Stucco	170 SF	Intact	1.3	13,000
LBP-16	Fire Station 1	1st Floor - Restroom/East Floor Area	Ceramic Floor	1" x 1" Grey Ceramic Floor Tile	100 SF	Intact	<0.0080	<80
LBP-17	Fire Station 1	1st Floor - Restroom/Floor East Wall Area	Ceramic Wall	4" x 4" White Ceramic Wall Tile	250 SF	Intact	<0.0080	<80
LBP-18	Fire Station 1	1st Floor - Corridor Locker Area	Wood	Blue/2/Wood	100 SF	Intact	<0.0080	<80
LBP-19	Fire Station 1	2nd Floor - Tower/Lower Wall Area	Stucco	White/1/Stucco	500 SF	Intact	<0.0080	<80
LBP-20	Fire Station 1	2nd Floor - Dormitory/South Wall Area	Stucco	White/2/Stucco	500 SF	Intact	<0.0080	<80
LBP-21	Fire Station 1	2nd Floor - Laundry Room/South Wall Area	Stucco	White/2/Stucco	125 SF	Intact	0.23	2,300*

NOTES:

Total lead analyzed via Flame Atomic Absorption Spectroscopy/Flame AAS (EPA Test Method EPA SW-846 3050B/7000B).

mg/kg = Milligrams per kilogram

Bold concentrations indicate paint that is greater than 5,000 mg/kg

SF = Square feet

* indicates lead-containing paint that is less than 5,000 mg/kg (or <0.5% by weight)

Estimated quantities are not intended for use in bidding calculations.

Table 3 - Bulk Polychlorinated Biphenyl Sampling Results

Sample I.D.	Building/Room	Date Sampled	Material Location	Sample Description	Quantity	Condition	PCB Content* (milligrams/kilogram)
PCB-01	1st Floor Storage	2/28/2024	Southeast Floor Area	Red Carpet with Mastic	NA	NA	<50 mg/kg (No Detections)
PCB-02	1st Floor Tank Room	2/28/2024	North Window Area	Window Caulking	NA	NA	<50 mg/kg (No Detections)
PCB-03	1st Floor Apparatus Bay	2/28/2024	North Window Area	Window Putty	NA	NA	<50 mg/kg (No Detections)
PCB-04	North Stairs	2/28/2024	West Window Area	Window Caulking	NA	NA	<50 mg/kg (No Detections)
PCB-05	North Stairs	2/28/2024	West Window Area	Window Putty	NA	NA	<50 mg/kg (No Detections)
PCB-06	2nd Floor Restroom Shower	2/28/2024	West Window Area	Window Caulking	NA	NA	<50 mg/kg (No Detections)
PCB-07	2nd Floor Restroom Shower	2/28/2024	West Window Area	Window Putty	NA	NA	<50 mg/kg (No Detections)
PCB-08	Tower Area	2/28/2024	West Crawl Space Area	Black Vapor Barrier with Insulation	NA	NA	<50 mg/kg (No Detections)
PCB-09	Tower Area	2/28/2024	West Crawl Space Area	Yellow Batt Insulation	NA	NA	<50 mg/kg (No Detections)
PCB-10	Tower Area	2/28/2024	West Duct/Wall Area	Pink Batt Insulation with Silver Vapor Barrier	NA	NA	<50 mg/kg (No Detections)

NOTES:

Analysis for PCB content via USEPA Method 8082 with preparation Method 3550B

PCB = Polychlorinated Biphenyl

*Lab analytes include Aroclor 1016, Aroclor 1221, Aroclor 1232, Aroclor 1242, Aroclor 1248, Aroclor 1254, Aroclor 1260, Aroclor 1262, and Aroclor 1268

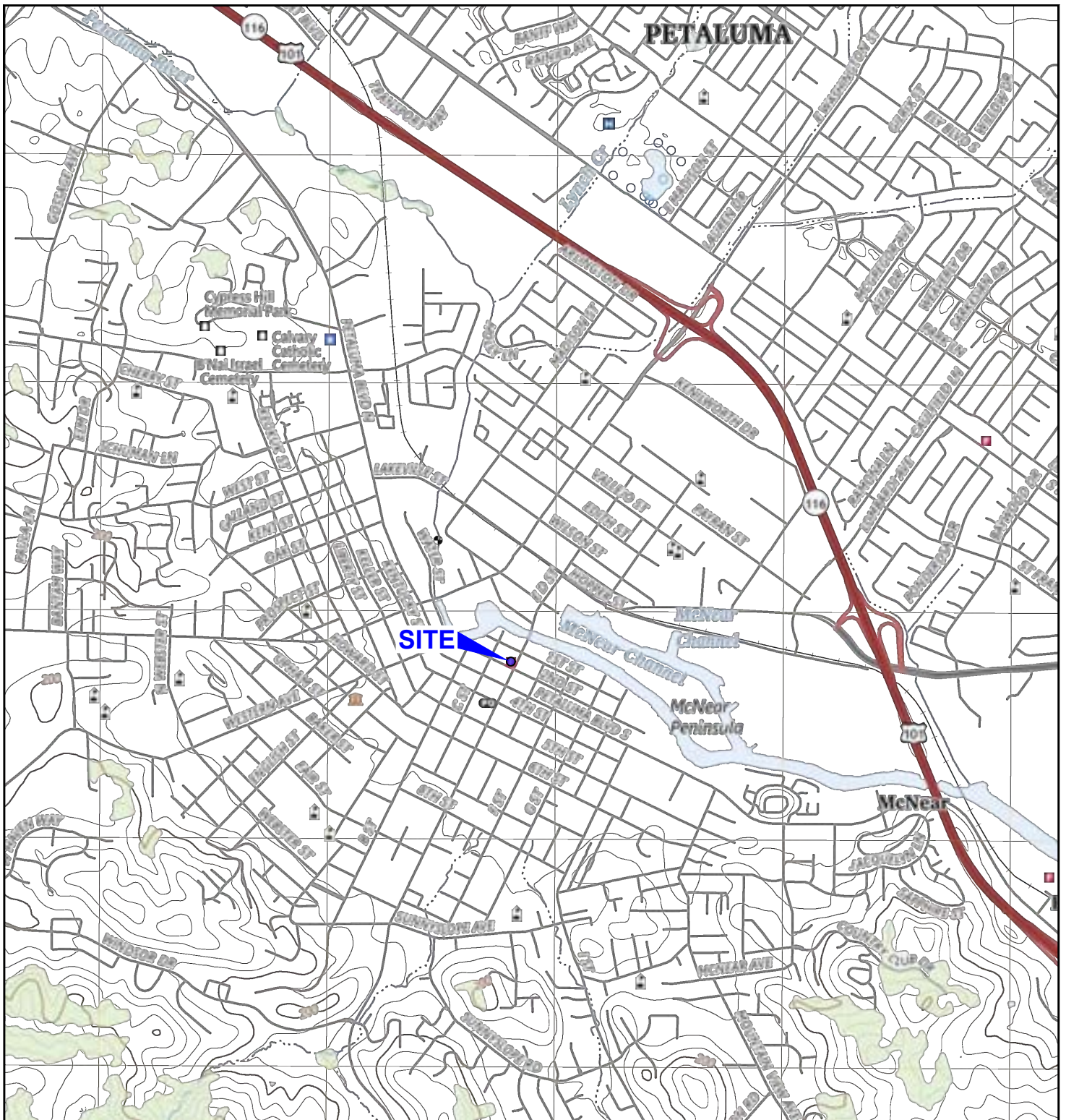
Table 4 - Miscellaneous Hazardous Building Materials Survey Results

Building/Room	Transformers	Light Ballasts	Mercury Thermostats	A/C-Heating Units	Fluorescent Light Tubes	Exit Signs	Fire Doors	Freon Systems/ Refrigerators
Main Building	0	95	0	3	190	0	1	1



FIGURES

404782001.dwg 03/07/2024 AEK



NOTE: DIMENSIONS, DIRECTIONS, AND LOCATIONS ARE APPROXIMATE | REFERENCE: USGS, 2024

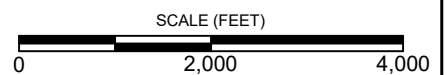


FIGURE 1

404782001.dwg 03/07/2024 AEK



NOTE: DIMENSIONS, DIRECTIONS, AND LOCATIONS ARE APPROXIMATE | REFERENCE: GOOGLE EARTH, 2024

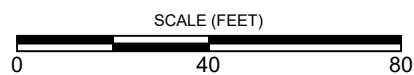


FIGURE 2

SITE VICINITY

PETALUMA FIRE DEPARTMENT STATION 1
198 D STREET
PETALUMA, CALIFORNIA
404782001 | 03/24

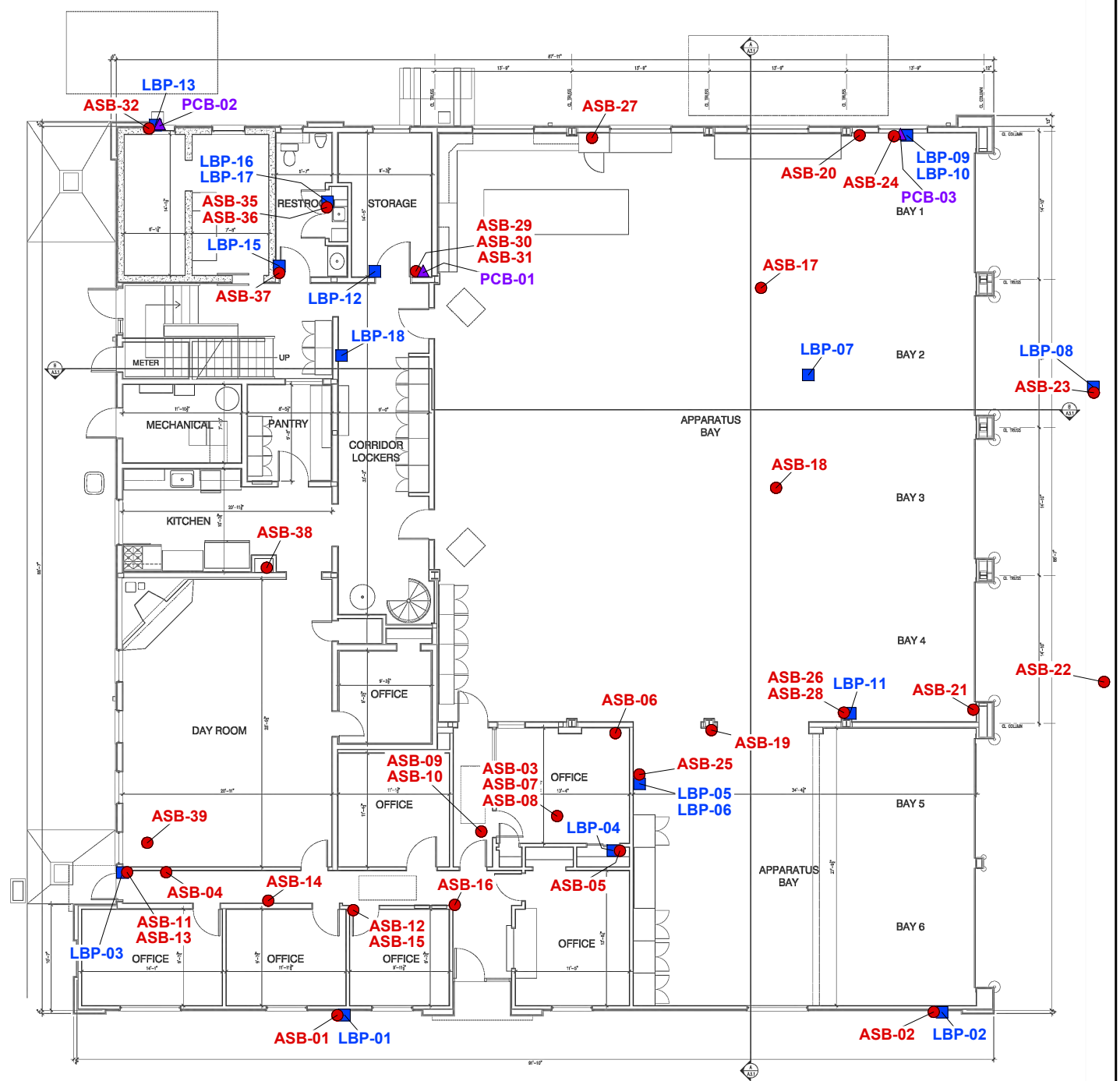
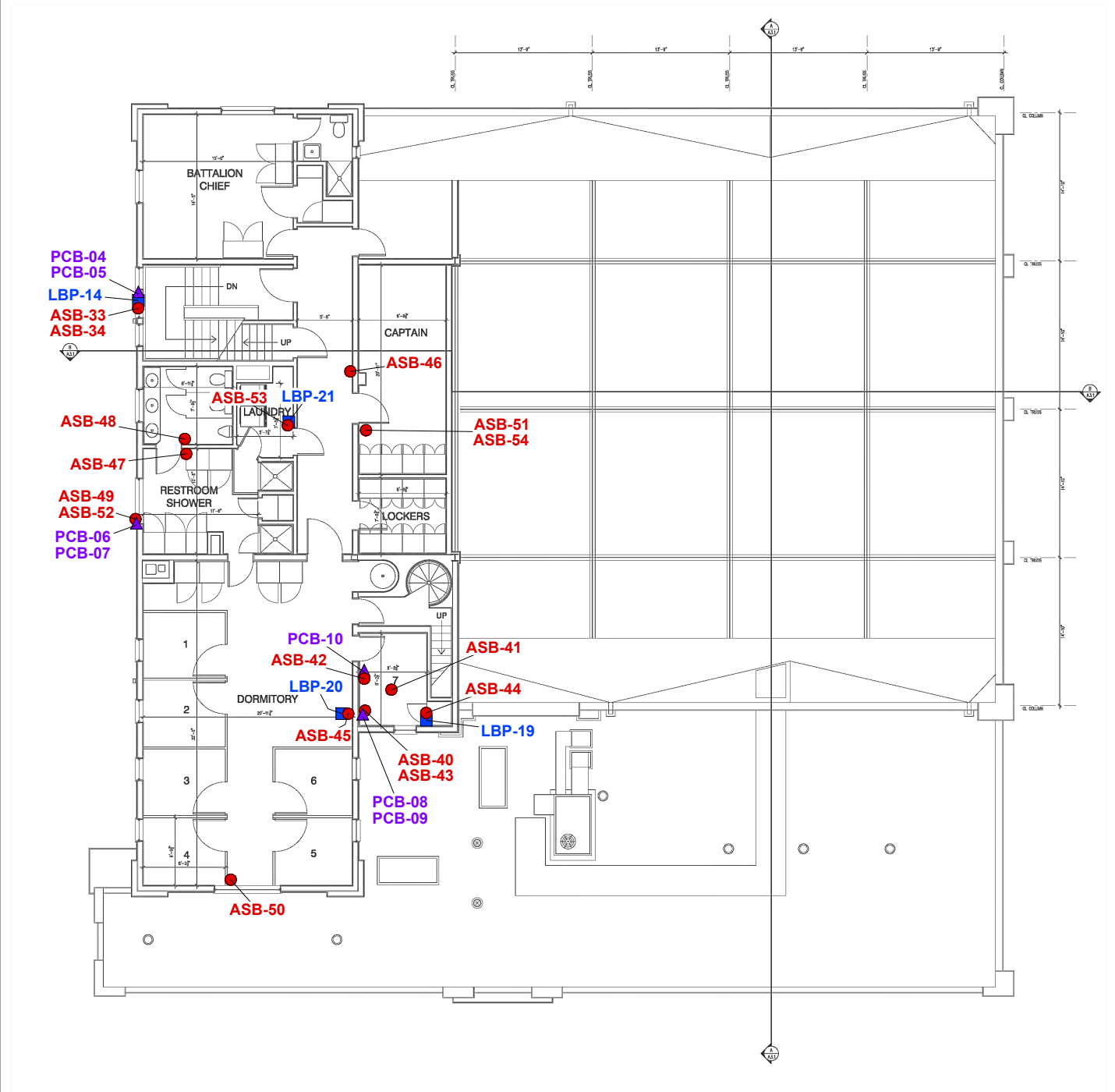


FIGURE 3

SAMPLE LOCATIONS: FIRST FLOOR

PETALUMA FIRE DEPARTMENT STATION 1
198 D STREET
PETALUMA, CALIFORNIA
404782001 | 03/24



LEGEND

ASB-33 ● SUSPECT ASBESTOS SAMPLE LBP-14 ■ SUSPECT LEAD SAMPLE PCB-04 ▲ SUSPECT PCB SAMPLE

NOTE: DIMENSIONS, DIRECTIONS, AND LOCATIONS ARE APPROXIMATE
REFERENCE: CITY OF PETALUMA, 2024



FIGURE 4

SAMPLE LOCATIONS: SECOND FLOOR

PETALUMA FIRE DEPARTMENT STATION 1
198 D STREET
PETALUMA, CALIFORNIA
404782001 | 03/24



APPENDIX A

Certifications

DEPARTMENT OF INDUSTRIAL RELATIONS

Division of Occupational Safety and Health-Asbestos Certification

1750 Howe Avenue, Suite 460

Sacramento, CA 95825

(916) 574-2993 Office <http://www.dir.ca.gov/dosh/asbestos.html> actu@dir.ca.gov

911222688C

193

October 25, 2023

William Patrick Larkin
4 Miramonte Road
Orinda CA 94563

Dear Certified Asbestos Consultant or Technician:

Enclosed is your certification card. To maintain your certification, you must abide by the rules printed on the back of the certification card.

Your certification is valid for a period of one year. If you wish to renew your certification, you must apply for renewal at least 60 days before the expiration date shown on your card. [8 CCR 341.15(h)(1)].

Please hold and do not send copies of your required AHERA refresher renewal certificates to our office until you apply for renewal of your certification.

Certificates must be kept current if you are actively working as a CAC or CSST. The grace period is only for those who are not actively working as an asbestos consultant or site surveillance technician.

Please contact our office at the above address or email w any changes in your contact/mailling information within 15 days of the change.

Sincerely,

Kevin Graulich
Principal Safety Engineer

Attachment: Certification Card

cc: File



LEAD-RELATED CONSTRUCTION CERTIFICATE

INDIVIDUAL:	CERTIFICATE TYPE:	NUMBER:	EXPIRATION DATE:
 William Larkin	Lead Inspector/Assessor	LRC-00001285	7/3/2024
	Lead Project Monitor	LRC-00001284	7/3/2024

Disclaimer: This document alone should not be relied upon to confirm certification status. Compare the individual's photo and name to another valid form of government issued photo identification. Verify the individual's certification status by searching for Lead-Related Construction Professionals at www.cdph.ca.gov/programs/clrph or calling (800) 597-LEAD

LEAD-RELATED CONSTRUCTION CERTIFICATE

INDIVIDUAL:



Nathan Eubanks

CERTIFICATE TYPE:

Lead Sampling Technician

NUMBER:

LRC-00010612

EXPIRATION DATE:

11/14/2024

Disclaimer: This document alone should not be relied upon to confirm certification status. Compare the individual's photo and name to another valid form of government issued photo identification. Verify the individual's certification status by searching for Lead-Related Construction Professionals at www.cdph.ca.gov/programs/clppb or calling (800) 597-LEAD



APPENDIX B

Asbestos Laboratory Analytical Report and Chain-of-Custody Records



EMSL Analytical, Inc.

464 McCormick Street San Leandro, CA 94577

Tel/Fax: (510) 895-3675 / (510) 895-3680

<http://www.EMSL.com> / sanleandrolab@emsl.com

EMSL Order: 092404331

Customer ID: NOMO22

Customer PO: 404782001

Project ID:

Attention: William Larkin
Ninyo & Moore
2020 Challenger Drive
Suite 103
Alameda, CA 94501

Project: FIRE-STATION1

Phone: (510) 343-3000

Fax: (510) 633-5646

Received Date: 02/29/2024 10:30 AM

Analysis Date: 03/04/2024

Collected Date: 02/29/2024

Test Report: Asbestos Analysis of Bulk Materials via AHERA Method 40CFR 763 Subpart E Appendix E supplemented with EPA 600/R-93/116 using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos % Type
			% Fibrous	% Non-Fibrous	
ASB-01-Texture 092404331-0001	WEST EXT WALL AREA- WALL TEXTURE W/ STUCCO	White Non-Fibrous Homogeneous		20% Quartz 60% Matrix 20% Non-fibrous (Other)	None Detected
ASB-01-Stucco 092404331-0001A	WEST EXT WALL AREA- WALL TEXTURE W/ STUCCO	Brown Non-Fibrous Homogeneous		20% Quartz 60% Matrix 20% Non-fibrous (Other)	None Detected
ASB-02-Texture 092404331-0002	SW EXT WALL AREA- WALL TEXTURE W/ STUCCO	White Non-Fibrous Homogeneous		80% Matrix 20% Non-fibrous (Other)	None Detected
ASB-02-Stucco 092404331-0002A	SW EXT WALL AREA- WALL TEXTURE W/ STUCCO	Tan Non-Fibrous Homogeneous		80% Matrix 20% Non-fibrous (Other)	None Detected
ASB-03 092404331-0003	CENTRAL OFFICE- CENTER CEILING AREA- 12"X12" ACT	Tan Fibrous Homogeneous	95% Cellulose	5% Non-fibrous (Other)	None Detected
ASB-04 092404331-0004	OFFICE HALLWAY- FOR NORTH CEILING AREA- 12"X12" ACT	Brown Fibrous Homogeneous	95% Cellulose	5% Non-fibrous (Other)	None Detected
ASB-05-Vinyl Floor Tile 092404331-0005	CENTRAL OFFICE- WEST FLOOR AREA- 9"X9" TAN VFT W/ MASTIC	Tan Non-Fibrous Homogeneous		80% Matrix 18% Non-fibrous (Other)	2% Chrysotile
ASB-05-Mastic 092404331-0005A	CENTRAL OFFICE- WEST FLOOR AREA- 9"X9" TAN VFT W/ MASTIC	Yellow Non-Fibrous Homogeneous		80% Matrix 20% Non-fibrous (Other)	None Detected
ASB-06-Vinyl Floor Tile 092404331-0006	CENTRAL OFFICE- EAST FLOOR AREA- 9"X9" TAN VFT W/ MASTIC	Tan Non-Fibrous Homogeneous		80% Matrix 18% Non-fibrous (Other)	2% Chrysotile
ASB-06-Mastic 092404331-0006A	CENTRAL OFFICE- EAST FLOOR AREA- 9"X9" TAN VFT W/ MASTIC	Yellow Non-Fibrous Homogeneous		80% Matrix 20% Non-fibrous (Other)	None Detected
ASB-07-Mastic 1 092404331-0007	CENTRAL OFFICE- CENTER CEILING AREA-BROWN "PUCK" MASTIC	Brown Non-Fibrous Homogeneous		80% Matrix 20% Non-fibrous (Other)	None Detected
ASB-07-Mastic 2 092404331-0007A	CENTRAL OFFICE- CENTER CEILING AREA-BROWN "PUCK" MASTIC	Beige Non-Fibrous Homogeneous		80% Matrix 20% Non-fibrous (Other)	None Detected

Initial report from: 03/04/2024 19:43:27



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EMSL Order: 092404331

Customer ID: NOMO22

Customer PO: 404782001

Project ID:

Test Report: Asbestos Analysis of Bulk Materials via AHERA Method 40CFR 763 Subpart E Appendix E supplemented with EPA 600/R-93/116 using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
ASB-08-Joint Compound 092404331-0008	CENTRAL OFFICE-CENTER CEILING AREA- JOINT COMPOUND				Layer Not Present
ASB-08-Wallboard 092404331-0008A	CENTRAL OFFICE-CENTER CEILING AREA- JOINT COMPOUND	White Non-Fibrous Homogeneous		80% Gypsum 20% Non-fibrous (Other)	None Detected
ASB-09-Vinyl Floor Tile 092404331-0009	HALLWAY OUTSIDE CENTRAL OFFICE-12"X12" - WHITE VFT W/ MASTIC	Tan/White Non-Fibrous Homogeneous		80% Matrix 20% Non-fibrous (Other)	None Detected
ASB-09-Mastic 092404331-0009A	HALLWAY OUTSIDE CENTRAL OFFICE-12"X12" - WHITE VFT W/ MASTIC	Yellow Non-Fibrous Homogeneous		80% Matrix 20% Non-fibrous (Other)	None Detected
ASB-10-Vinyl Floor Tile 092404331-0010	HALLWAY OUTSIDE CENTRAL OFFICE UNDER ASB-09-12"X12" YELLOW VFT W/ MASTIC	Tan Non-Fibrous Homogeneous		80% Matrix 18% Non-fibrous (Other)	2% Chrysotile
ASB-10-Mastic 092404331-0010A	HALLWAY OUTSIDE CENTRAL OFFICE UNDER ASB-09-12"X12" YELLOW VFT W/ MASTIC	Yellow Non-Fibrous Homogeneous		80% Matrix 20% Non-fibrous (Other)	None Detected
ASB-11-Wallboard 092404331-0011	OFFICE HALLWAY - FOR NORTH WALL CORNER- WB/JC	White Non-Fibrous Homogeneous		80% Gypsum 20% Non-fibrous (Other)	None Detected
ASB-11-Joint Compound 092404331-0011A	OFFICE HALLWAY - FOR NORTH WALL CORNER- WB/JC	White Non-Fibrous Homogeneous		80% Ca Carbonate 18% Non-fibrous (Other)	2% Chrysotile
ASB-12-Wallboard 092404331-0012	WEST OFFICE - NE WALL CORNER- WB/JC	White Non-Fibrous Homogeneous		80% Gypsum 20% Non-fibrous (Other)	None Detected
ASB-12-Joint Compound 092404331-0012A	WEST OFFICE - NE WALL CORNER- WB/JC	Beige Non-Fibrous Homogeneous		80% Matrix 18% Non-fibrous (Other)	2% Chrysotile
ASB-13-Texture 092404331-0013	OFFICE HALLWAY- FOR NORTH WALL AREA- WALL TEXTURE	White Non-Fibrous Homogeneous		80% Ca Carbonate 18% Non-fibrous (Other)	2% Chrysotile
ASB-13-Wallboard 092404331-0013A	OFFICE HALLWAY- FOR NORTH WALL AREA- WALL TEXTURE	White Non-Fibrous Homogeneous		80% Gypsum 20% Non-fibrous (Other)	None Detected
ASB-14 092404331-0014	OFFICE HALLWAY CENTRAL WALL AREA- WALL TEXTURE	White Non-Fibrous Homogeneous		80% Matrix 17% Non-fibrous (Other)	3% Chrysotile
ASB-15-Texture 092404331-0015	OFFICE WEST- NE WALL AREA- WALL- TEXTURE	Beige Non-Fibrous Homogeneous		80% Matrix 18% Non-fibrous (Other)	2% Chrysotile
ASB-15-Wallboard 092404331-0015A	OFFICE WEST- NE WALL AREA- WALL- TEXTURE	White Non-Fibrous Homogeneous		80% Gypsum 20% Non-fibrous (Other)	None Detected

Initial report from: 03/04/2024 19:43:27



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Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
ASB-16 092404331-0016	OFFICE HALLWAY- WEST WALL AREA- CARPETED" WALL TEXTURE	White Non-Fibrous Homogeneous		80% Matrix 15% Non-fibrous (Other)	5% Chrysotile
ASB-17-Concrete 1 092404331-0017	APPARATUS BAY- EAST CENTRAL FLOOR- CONCRETE	Gray Non-Fibrous Homogeneous		20% Quartz 60% Matrix 20% Non-fibrous (Other)	None Detected
ASB-17-Concrete 2 092404331-0017A	APPARATUS BAY- EAST CENTRAL FLOOR- CONCRETE	Red Non-Fibrous Homogeneous		20% Quartz 60% Matrix 20% Non-fibrous (Other)	None Detected
ASB-18 092404331-0018	APPARATUS BAY- WEST CENTRAL FLOOR- CONCRETE	Gray Non-Fibrous Homogeneous		80% Matrix 20% Non-fibrous (Other)	None Detected
ASB-19-Wallboard 092404331-0019	APPARATUS BAY- WEST PILAR- WALL BOARD				Layer Not Present
ASB-19-Joint Compound 092404331-0019A	APPARATUS BAY- WEST PILAR- WALL BOARD	White Non-Fibrous Homogeneous		80% Ca Carbonate 18% Non-fibrous (Other)	2% Chrysotile
ASB-20 092404331-0020	APPARATUS BAY- EAST WALL AREA- TRANSITE WALL PANEL	Red Fibrous Homogeneous		60% Matrix 20% Non-fibrous (Other)	20% Chrysotile
ASB-21 092404331-0021	APPARATUS BAY-WEST WALL AREA- TRANSITE WALL PANEL	Brown Fibrous Homogeneous		60% Matrix 5% Non-fibrous (Other)	35% Chrysotile
ASB-22 092404331-0022	APPARATUS BAY- EXT FLOOR - CONCRETE	Gray Non-Fibrous Homogeneous		20% Quartz 60% Matrix 20% Non-fibrous (Other)	None Detected
ASB-23 092404331-0023	APPARATUS BAY- EXT FLOOR- CONCRETE	Gray Non-Fibrous Homogeneous		80% Matrix 20% Non-fibrous (Other)	None Detected
ASB-24 092404331-0024	APPARATUS BAY- WEST WINDOW- WINDOW PUTTY	Gray Non-Fibrous Homogeneous		80% Matrix 20% Non-fibrous (Other)	None Detected
ASB-25 092404331-0025	APPARATUS BAY- WEST WALL AREA- WALLBOARD	White Non-Fibrous Homogeneous		80% Gypsum 20% Non-fibrous (Other)	None Detected
ASB-26-Stucco 1 092404331-0026	APP BAY- SW WALL AREA- STUCCO	White Non-Fibrous Homogeneous		20% Quartz 60% Matrix 20% Non-fibrous (Other)	None Detected
ASB-26-Stucco 2 092404331-0026A	APP BAY- SW WALL AREA- STUCCO	Tan Non-Fibrous Homogeneous		20% Quartz 60% Matrix 20% Non-fibrous (Other)	None Detected
ASB-27 092404331-0027	APP BAY- NE- WALL AREA- STUCCO	White Non-Fibrous Homogeneous		20% Quartz 60% Matrix 20% Non-fibrous (Other)	None Detected
ASB-28 092404331-0028	APP BAY- SW LOWER WALL AREA- CONCRETE	Gray Non-Fibrous Homogeneous		20% Quartz 60% Matrix 20% Non-fibrous (Other)	None Detected
ASB-29-Carpet 092404331-0029	STORAGE- SW FLOOR AREA- RED CARPET W/ MASTIC	Red/Orange Fibrous Homogeneous	95% Synthetic	5% Non-fibrous (Other)	None Detected
ASB-29-Mastic 092404331-0029A	STORAGE- SW FLOOR AREA- RED CARPET W/ MASTIC	Tan Non-Fibrous Homogeneous		80% Matrix 20% Non-fibrous (Other)	None Detected

Initial report from: 03/04/2024 19:43:27



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EMSL Order: 092404331

Customer ID: NOMO22

Customer PO: 404782001

Project ID:

Test Report: Asbestos Analysis of Bulk Materials via AHERA Method 40CFR 763 Subpart E Appendix E supplemented with EPA 600/R-93/116 using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
ASB-30-Vinyl Floor Tile 092404331-0030	STORAGE-UNDER ASB-29 9"X9" RED VFT W / BLACK MASTIC	Red Non-Fibrous Homogeneous		75% Matrix 20% Non-fibrous (Other)	5% Chrysotile
ASB-30-Mastic 092404331-0030A	STORAGE-UNDER ASB-29 9"X9" RED VFT W / BLACK MASTIC	Black Non-Fibrous Homogeneous		80% Matrix 20% Non-fibrous (Other)	None Detected
ASB-31 092404331-0031	STORAGE - SW WALL AREA- STUCCO	Tan Non-Fibrous Homogeneous		80% Matrix 20% Non-fibrous (Other)	None Detected
ASB-32 092404331-0032	TANK ROOM- NE WINDOW- WINDOW CAULKING	Clear Non-Fibrous Homogeneous		80% Matrix 20% Non-fibrous (Other)	None Detected
ASB-33 092404331-0033	STAIRS- WINDOW AREA- WINDOW CAULKING	White Non-Fibrous Homogeneous		80% Matrix 20% Non-fibrous (Other)	None Detected
ASB-34 092404331-0034	STAIRS- WINDOW AREA- WINDOW PUTTY	White Non-Fibrous Homogeneous		80% Matrix 20% Non-fibrous (Other)	None Detected
ASB-35-Ceramic Tile 092404331-0035	1ST FLOOR RR- FLOOR AREA- 1"x1" GREY CERAMIC FLOOR TIME W/ MORTAR & GROUT	Gray Non-Fibrous Homogeneous		80% Matrix 20% Non-fibrous (Other)	None Detected
ASB-35-Mortar 092404331-0035A	1ST FLOOR RR- FLOOR AREA- 1"x1" GREY CERAMIC FLOOR TIME W/ MORTAR & GROUT	Gray Non-Fibrous Homogeneous		80% Matrix 20% Non-fibrous (Other)	None Detected
ASB-35-Grout 092404331-0035B	1ST FLOOR RR- FLOOR AREA- 1"x1" GREY CERAMIC FLOOR TIME W/ MORTAR & GROUT				Layer Not Present
ASB-36-Ceramic Tile 092404331-0036	1ST FLOOR RR- WALL AREA- 4"X4" WHITE CERAMIC WALL TILE W/ MORTAR & GROUT	White Non-Fibrous Homogeneous		80% Matrix 20% Non-fibrous (Other)	None Detected
ASB-36-Mortar 092404331-0036A	1ST FLOOR RR- WALL AREA- 4"X4" WHITE CERAMIC WALL TILE W/ MORTAR & GROUT				Layer Not Present
ASB-36-Grout 092404331-0036B	1ST FLOOR RR- WALL AREA- 4"X4" WHITE CERAMIC WALL TILE W/ MORTAR & GROUT				Layer Not Present
ASB-37-Stucco 092404331-0037	1ST FLOOR RR-NW FLOOR AREA- STUCCO	White Non-Fibrous Homogeneous		80% Matrix 20% Non-fibrous (Other)	None Detected
ASB-37-Joint Compound 092404331-0037A	1ST FLOOR RR-NW FLOOR AREA- STUCCO	White Non-Fibrous Homogeneous		80% Matrix 18% Non-fibrous (Other)	2% Chrysotile

Initial report from: 03/04/2024 19:43:27



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Project ID:

Test Report: Asbestos Analysis of Bulk Materials via AHERA Method 40CFR 763 Subpart E Appendix E supplemented with EPA 600/R-93/116 using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
ASB-38-Vinyl Floor Tile 092404331-0038	KITCHEN - WEST FLOOR AREA- 12"X12" WHITE/ BLUE VFT W/ MASTIC	Blue Non-Fibrous Homogeneous		80% Matrix 20% Non-fibrous (Other)	None Detected
ASB-38-Mastic 092404331-0038A	KITCHEN - WEST FLOOR AREA- 12"X12" WHITE/ BLUE VFT W/ MASTIC	Yellow Non-Fibrous Homogeneous		80% Matrix 20% Non-fibrous (Other)	None Detected
ASB-39-Vinyl Floor Tile 1 092404331-0039	DAY ROOM - NW FLOOR AREA- 9"X9" RED/ BLACK VFT WITH MASTIC	Red Non-Fibrous Homogeneous		75% Matrix 20% Non-fibrous (Other)	5% Chrysotile
ASB-39-Vinyl Floor Tile 2 092404331-0039A	DAY ROOM - NW FLOOR AREA- 9"X9" RED/ BLACK VFT WITH MASTIC	Black Non-Fibrous Homogeneous		75% Matrix 20% Non-fibrous (Other)	5% Chrysotile
ASB-39-Mastic 092404331-0039B	DAY ROOM - NW FLOOR AREA- 9"X9" RED/ BLACK VFT WITH MASTIC	Black Non-Fibrous Homogeneous		75% Matrix 20% Non-fibrous (Other)	5% Chrysotile
ASB-40-Vapor Barrier 092404331-0040	TOWER- CRAWL SPACE- BLACK VAPOR BARRIER	Brown/Black Fibrous Homogeneous	95% Cellulose	5% Non-fibrous (Other)	None Detected
ASB-40-Insulation 092404331-0040A	TOWER- CRAWL SPACE- BLACK VAPOR BARRIER	Beige Fibrous Homogeneous	99% Glass	1% Non-fibrous (Other)	None Detected
ASB-41 092404331-0041	TOWER- CENTRAL CEILING - STUCCO	Tan Non-Fibrous Homogeneous		80% Matrix 20% Non-fibrous (Other)	None Detected
ASB-42 092404331-0042	TOWER- VENTILATION DUET- PINK BATT INS	Pink Fibrous Homogeneous	95% Glass	5% Non-fibrous (Other)	None Detected
ASB-43 092404331-0043	TOWER- CRAWL SPACE- WHITE-/YELLOW BATT IN	White Fibrous Homogeneous	99% Glass	1% Non-fibrous (Other)	None Detected
ASB-44 092404331-0044	TOWER- WEST WALL AREA- STUCCO	Tan Non-Fibrous Homogeneous		80% Matrix 20% Non-fibrous (Other)	None Detected
ASB-45 092404331-0045	DORM - SOUTH WALL AREA- WALL TEXTURE	White Non-Fibrous Homogeneous		80% Matrix 20% Non-fibrous (Other)	None Detected
ASB-46 092404331-0046	HALLWAY - SOUTH WALL AREA- STUCCO	White Non-Fibrous Homogeneous		80% Matrix 20% Non-fibrous (Other)	None Detected
ASB-47-Linoleum 092404331-0047	RR SHOWER- EAST FLOOR AREA- YELLOW LINO FLOORING W/ MASTIC	Brown Fibrous Homogeneous	20% Cellulose	80% Non-fibrous (Other)	None Detected
ASB-47-Mastic 092404331-0047A	RR SHOWER- EAST FLOOR AREA- YELLOW LINO FLOORING W/ MASTIC	Brown Non-Fibrous Homogeneous		80% Matrix 20% Non-fibrous (Other)	None Detected

Initial report from: 03/04/2024 19:43:27



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Customer PO: 404782001

Project ID:

Test Report: Asbestos Analysis of Bulk Materials via AHERA Method 40CFR 763 Subpart E Appendix E supplemented with EPA 600/R-93/116 using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
ASB-48-Linoleum 092404331-0048	RESTROOM- WEST FLOOR AREA- BROWN LINO FLOORING W/ MASTIC	Gray Fibrous Homogeneous		70% Matrix 20% Non-fibrous (Other)	10% Chrysotile
ASB-48-Mastic 092404331-0048A	RESTROOM- WEST FLOOR AREA- BROWN LINO FLOORING W/ MASTIC	Tan Non-Fibrous Homogeneous		80% Matrix 20% Non-fibrous (Other)	None Detected
ASB-49 092404331-0049	RR SHOWER- NW WINDOW AREA- WINDOW CAULKING	White Non-Fibrous Homogeneous		80% Matrix 20% Non-fibrous (Other)	None Detected
ASB-50 092404331-0050	DORM- WEST WALL AREA- WALL TEXTURE	Beige Non-Fibrous Homogeneous		20% Quartz 60% Matrix 20% Non-fibrous (Other)	None Detected
ASB-51-Texture 092404331-0051	CAPTAIN'S ROOM - NW WALL AREA- WALL TEXTURE	White Non-Fibrous Homogeneous		80% Matrix 20% Non-fibrous (Other)	None Detected
ASB-51-Wallboard 092404331-0051A	CAPTAIN'S ROOM - NW WALL AREA- WALL TEXTURE	White Non-Fibrous Homogeneous		80% Gypsum 20% Non-fibrous (Other)	None Detected
ASB-52 092404331-0052	RR SHOWER- NW WINDOW AREA- WINDOW PUTTY	Gray Non-Fibrous Homogeneous		80% Matrix 20% Non-fibrous (Other)	None Detected
ASB-53 092404331-0053	LAUNDRY ROOM- SOUTH WALL AREA- STUCCO	White Non-Fibrous Homogeneous		60% Matrix 40% Non-fibrous (Other)	None Detected
ASB-54-Wallboard 092404331-0054	CAPTIN'S ROOM - NW WALL AREA WB/JC	White Non-Fibrous Homogeneous		80% Gypsum 20% Non-fibrous (Other)	None Detected
ASB-54-Joint Compound 092404331-0054A	CAPTIN'S ROOM - NW WALL AREA WB/JC	White Non-Fibrous Homogeneous		80% Matrix 20% Non-fibrous (Other)	None Detected

Analyst(s)

Kimberly Chuc (14)

Christian Albayalde (25)

Aimee Hartwig (23)

Elena White (17)

Oscar Merino, Laboratory Manager
or Other Approved Signatory

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Samples analyzed by EMSL Analytical, Inc. Santa Clara, CA NVLAP Lab Code 600318-0

Initial report from: 03/04/2024 19:43:27



EMSL Analytical, Inc.

464 McCormick Street San Leandro, CA 94577

Phone/Fax: (510) 895-3675 / (510) 895-3680

<http://www.EMSL.com> / sanleandrolab@emsl.com

EMSL Order: 092404331

Customer ID: NOMO22

Customer PO: 404782001

Project ID:

Attention: William Larkin
Ninyo & Moore
2020 Challenger Drive
Suite 103
Alameda, CA 94501

Project: FIRE-STATION1

Phone: (510) 343-3000

Fax: (510) 633-5646

Received: 02/29/2024 10:30 AM

Analysis Date: 03/04/2024 - 03/07/2024

Collected: 02/29/2024

Test Report: Asbestos Analysis of Bulk Materials via AHERA Method 40CFR 763 Subpart E Appendix E supplemented with EPA 600/R-93/116 using Polarized Light Microscopy. Quantitation using 400 Point Count Procedure

Sample	Description	Appearance	Non-Asbestos		Asbestos
			% Fibrous	% Non-Fibrous	% Type
ASB-11-Joint Compound 092404331-0011A	OFFICE HALLWAY - FOR NORTH WALL CORNER- WB/JC	White Non-Fibrous Homogeneous		100.0% Non-fibrous (Other)	<0.25% Chrysotile
This is a composite result of the drywall and joint compound.					
ASB-13-Texture 092404331-0013	OFFICE HALLWAY- FOR NORTH WALL AREA- WALL TEXTURE				Insufficient Material
ASB-14 092404331-0014	OFFICE HALLWAY CENTRAL WALL AREA- WALL TEXTURE	White Non-Fibrous Homogeneous		99.75% Non-fibrous (Other)	0.25% Chrysotile
ASB-15-Texture 092404331-0015	OFFICE WEST- NE WALL AREA- WALL- TEXTURE				Insufficient Material
ASB-16 092404331-0016	OFFICE HALLWAY- WEST WALL AREA-" CARPETED" WALL TEXTURE	White Non-Fibrous Homogeneous		99.75% Non-fibrous (Other)	0.25% Chrysotile
ASB-19-Joint Compound 092404331-0019A	APPARATUS BAY- WEST PILAR- WALL BOARD	White Non-Fibrous Homogeneous		100.0% Non-fibrous (Other)	<0.25% Chrysotile
ASB-37-Joint Compound 092404331-0037A	1ST FLOOR RR-NW FLOOR AREA- STUCCO	White Non-Fibrous Homogeneous		100.0% Non-fibrous (Other)	<0.25% Chrysotile

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Samples analyzed by EMSL Analytical, Inc. Santa Clara, CA NVLAP Lab Code 600318-0

Initial report from: 03/04/2024 16:43:39



EMSL Analytical, Inc.

464 McCormick Street San Leandro, CA 94577

Phone/Fax: (510) 895-3675 / (510) 895-3680

<http://www.EMSL.com> / sanleandrolab@emsl.com

EMSL Order: 092404331

Customer ID: NOMO22

Customer PO: 404782001

Project ID:

Attention: William Larkin
Ninyo & Moore
2020 Challenger Drive
Suite 103
Alameda, CA 94501

Project: FIRE-STATION1

Phone: (510) 343-3000

Fax: (510) 633-5646

Received: 02/29/2024 10:30 AM

Analysis Date: 03/04/2024 - 03/07/2024

Collected: 02/29/2024

**Test Report: Asbestos Analysis of Bulk Materials via AHERA Method 40CFR 763 Subpart E
Appendix E supplemented with EPA 600/R-93/116 using Polarized Light Microscopy.
Quantitation using 400 Point Count Procedure**

Sample	Description	Appearance	% Fibrous	<u>Non-Asbestos</u>		<u>Asbestos</u>
				% Non-Fibrous		% Type

Analyst(s)

Aimee Hartwig (5)

Oscar Merino, Laboratory Manager
or other approved signatory

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted. The above analyses were performed in general compliance with Appendix E to Subpart E of 40 CFR (previously EPA 600/M4-82-020 "Interim Method") but augmented with procedures outlined in the 1993 ("final") version of the method. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the federal government. Non-friable organically bound materials present a problem matrix and therefore EMSL recommends gravimetric reduction prior to analysis. Unless requested by the client, building materials manufactured with multiple layers (i.e. linoleum, wallboard, etc.) are reported as a single sample. Estimation of uncertainty is available on request.

Samples analyzed by EMSL Analytical, Inc. Santa Clara, CA NVLAP Lab Code 600318-0

Initial report from: 03/04/2024 16:43:39

ASBESTOS BULK SAMPLE DATA SHEET

24TAT 092 404331

Sheet 1 of ____

Ninyo & Moore 1301 Marina Village Pkwy Suite 110 Alameda, CA 94501 Tel.: (510) 343-3000	Project Name: Fire Station 1 Project No.: 404782001 Project Manager: WPL Site Address:	Sampled By: WPL Sampled By: Sampled By: Date Sampled: 02/28	Laboratory: EMSL Analytical, Inc. 464 McCormick St San Leandro, CA 94577 Tel.: (510) 895-3675

CHAIN OF CUSTODY INFORMATION:

Relinquished By: (sign/print)	Company	Date	Time (24 hr.)	Received By: (sign/print)	Laboratory
<i>[Signature]</i> Nathan E. [Signature]	Ninyo & Moore	02/29	02292024	4-1030 <i>[Signature]</i>	

Sample ID	Building Number	Room Number	Sample Location	Sample Description	Quantity (SF/LF/EA)	Friable (Y/N)	Condition
ASB-01	9 th Flr		West Ext. Wall Area	Wall Texture w/stu		N	Good
ASB-02			SW Ext. Wall Area	"		N	
ASB-03			Central Office - center ceiling Area	12"x12" ACT		Y	
ASB-04			Office Hallway - Far North ceiling Area	"		Y	
ASB-05			Central Office - West Floor Area	9"x9" Tan VFT w/Mastic		N	
ASB-06			Central Office - East Floor Area	"		N	
ASB-07			Central Office - center ceiling Area	Brown "Puck" Mastic		N	
ASB-08			"	Joint Compound		Y	
ASB-09			Hallway outside central office	12"x12" white VFT w/Mastic		N	
ASB-10			" Under ASB-09 "	12"x12" Yellow VFT w/Mastic		N	
ASB-11			Office Hallway - Far North wall corner	WB/JC		Y	
ASB-12			West office - NE Wall corner	WB/JC			
ASB-13			Office Hallway - Far North wall Area	Wall texture			
ASB-14			Office Hallway - Central wall Area	Wall texture			
ASB-15			Office Hallway - West wall Area	Wall texture			

Page 1 of 5

OrderID: 092404331

ASBESTOS BULK SAMPLE DATA SHEET

24TAT

092404331

Sheet 1 of _____

Ninyo & Moore 1301 Marina Village Pkwy Suite 110 Alameda, CA 94501 Tel.: (510) 343-3000	Project Name: Fire Station 1 Project No.: 4104782001 Project Manager: WPL Site Address:	Sampled By: WPL Sampled By: Sampled By: Date Sampled: 02/28	Laboratory: EMSL Analytical, Inc. 464 McCormick St San Leandro, CA 94577 Tel.: (510) 895-3675

CHAIN OF CUSTODY INFORMATION:

Relinquished By: (sign/print)	Company	Date	Time (24 hr.)	Received By: (sign/print)	Laboratory
<i>[Signature]</i> Nathan Eubank	Ninyo & Moore	02/29	0229202	4-1030 <i>[Signature]</i>	

Sample ID	Building Number	Room Number	Sample Location	Sample Description	Quantity (SF/LF/EA)	Friable (Y/N)	Condition
ASB-16	1st Flr		Office Hallway - West Wall Area	"Carpeted" wall texture		Y	Good
ASB-17			Apparatus Bay - East Central Floor	Concrete		N	
ASB-18			Apparatus Bay - West Central Floor	Concrete		N	
ASB-19			Apparatus Bay - West Pillar	Wall board		Y	
ASB-20			Apparatus Bay - East wall Area	Transite wall panel		Y	
ASB-21			Apparatus Bay - West wall Area	"		Y	
ASB-22			Apparatus Bay - Ext Floor	Concrete		N	
ASB-23			Apparatus Bay - Ext Floor	"		N	
ASB-24			Apparatus Bay - West window	Window putty		N	
ASB-25			Apparatus Bay - West wall Area	Wallboard		X	
ASB-26			App Bay - ~~West~~ SW wall Area	Stucco		N	
ASB-27			App Bay - NE wall Area	"		N	
ASB-28			App Bay - SW lower wall Area	Concrete		N	
ASB-29			Storage - SW Floor Area	Red Carpet w/ Mastic		N	
ASB-30			Storage - Under ASB-29	9"x9" Red VFT w/ Black Mastic		N	

Page 2 of 5

OrderID: 092404331

ASBESTOS BULK SAMPLE DATA SHEET

092404331

Sheet 1 of

Ninjo & Moore
1301 Marina Village Pkwy
Suite 110
Alameda, CA 94501
Tel.: (510) 343-3000

Project Name: Fire Station 1
Project No.: 404782001
Project Manager: WPL
Site Address:

Sampled By: WPL
Sampled By:
Date Sampled: 02/28
Laboratory:
EMSL Analytical, Inc.
464 McCormick St
San Leandro, CA 94577
Tel.: (510) 895-3675

CHAIN OF CUSTODY INFORMATION:

Relinquished By: (sign/print)	Company	Date	Time (24 hr.)	Received By: (sign/print)	Laboratory		
<i>me</i>	<i>Northwestern Eubank</i>	<i>02/29</i>	<i>0229202</i>	<i>WPL</i>			
Sample ID	Building Number	Room Number	Sample Location	Sample Description	Quantity (SF/L/EA)	Friable (Y/N)	Condition
ASB-31	1st Flr		~~Storage~~ - SW wall Area	Stucco		N	Good
ASB-32			Take Room - NE window	Window Caulking		N	
ASB-33			Stairs - Window Area	Window Caulking		N	
ASB-34			Stairs - Window Area	Window Putty		N	Bad
ASB-35			1st Floor RR - ~~this wall~~ Floor Area	1"x1" Ceramic Floor tile w/ mortar		N	Good
ASB-36			1st Floor RR - wall Area	4"x4" white ceramic wall tile w/ mortar		N	
ASB-37			1st Floor RR - NW wall Area	Stucco		N	
ASB-38			Kitchen - West Floor Area	12"x12" white/blue VFT w/ Mastic		N	
ASB-39			Day Room - NW Floor Area	9"x9" Red/Black VFT w/ Mastic		N	
ASB-40	2nd flr		Tower - Crawl Space	Black vapor barrier		N	
ASB-41			Tower - Central Ceiling	Stucco		N	
ASB-42			Tower - Ventilation Duct	Pink Batt ins.		N	
ASB-43			Tower - Crawl Space	White/Yellow Batt ins.		N	
ASB-44			Tower - West wall Area	Stucco		N	
ASB-45			Dorm - South wall Area	~~Stucco~~ wall texture		N	

ASBESTOS BULK SAMPLE DATA SHEET

Ninyo & Moore 1301 Marina Village Pkwy Suite 110 Alameda, CA 94501 Tel.: (510) 343-3000	Project Name: Fire Station 1	Sampled By: WPL	Laboratory: EMSL Analytical, Inc. 464 McCormick St San Leandro, CA 94577 Tel.: (510) 895-3675
	Project No.: 104782001	Sampled By:	
	Project Manager: WPL	Sampled By:	
	Site Address:	Date Sampled: 02/28	

CHAIN OF CUSTODY INFORMATION:

Relinquished By: (sign/print)	Company	Date	Time (24 hr.)	Received By: (sign/print)	Laboratory
<i>[Signature]</i> Nathan Eubanks	Ninyo & Moore	02/29	0229202	4-1030 <i>[Signature]</i> WPL	
/				/	

Sample ID	Building Number	Room Number	Sample Location	Sample Description	Quantity (SF/LF/EA)	Friable (Y/N)	Condition
ASB-46	2nd Flr		Hallway - South Wall Area	Stucco		N	Good
ASB-47			RR Shower - ~~to~~ East Floor Area	Yellow lino Flooring w/ Mastic		N	Good
ASB-48			Restroom - West Floor Area	Brown lino Flooring w/ Mastic		N	Good
ASB-49			RR Shower - NW Window Area	Window Caulking		N	Good
ASB-50			Dorm - West Wall Area	Wall texture		X	
ASB-51			Captain's Room - NW Wall Area	Wall texture		X	
ASB-52			RR Shower - NW Window Area	Window Putty		N	
ASB-53			Laundry Room - South Wall Area	Stucco		N	
ASB-54			Captain's Room - NW Wall Area	WB/SL		X	

Orsetti, Kaitlyn

092404331

From: Orsetti, Kaitlyn
Sent: Thursday, February 29, 2024 7:26 PM
To: William Larkin; Nathan Eubanks
Cc: EMSL Lab - San Leandro
Subject: TAT Update - 404782001 "Fire Station 1" PLM Analysis
Attachments: NOMO22 (54 PLM).pdf

Categories: Katie Orsetti

Good Evening Bill and Nathan,

I apologize for the delayed outreach today. Due to ongoing capacity constraints in our PLM Department, the San Leandro lab unfortunately cannot accommodate your requested 24HR TAT for your Project 404782001 "Fire Station 1" received today (COC attached).

At this time, the fastest turnaround we can accommodate is a 96HR TAT for results due Tuesday 3/05 at 10:30AM. We are actively seeking assistance from our EMSL sister laboratories to find space for this project – if we can find space in one of our sister labs to return results sooner, we will transfer these samples and notify you accordingly.

We sincerely apologize for the delay and any inconvenience caused. If you have any questions or concerns regarding this project, please let us know and we will do our best to assist.

Thank you,



Kaitlyn Orsetti
Laboratory Administrative Coordinator
EMSL Analytical, Inc. 464 McCormick Street San Leandro, CA 94577
Phone: 510-895-3675 Toll Free: 888-455-3675

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APPENDIX C

Lead-Containing Material Laboratory Analytical Report and Chain-of-Custody Records



EMSL Analytical, Inc

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Phone/Fax: (510) 895-3675 / (510) 895-3680

<http://www.EMSL.com>

sanleandrolab@emsl.com

EMSL Order: 092404292

CustomerID: NOMO22

CustomerPO: 404782001

ProjectID:

Attn: **Bill Larkin**
Ninyo & Moore
2020 Challenger Drive
Suite 103
Alameda, CA 94501

Phone: (510) 343-3000
Fax: (510) 633-5646
Received: 2/29/2024 10:30 AM
Collected: 2/28/2024

Project: **FIRESTATION 1 / 404782001**

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

Client Sample Description	Lab ID	Collected	Analyzed	Weight	Lead Concentration
LBP-01	092404292-0001	2/28/2024	2/29/2024	0.2575 g	0.066 % wt
Site: WEST EXT WALL AREA - STUCCO - WHITE / 2 / STUCCO					
LBP-02	092404292-0002	2/28/2024	2/29/2024	0.2534 g	0.080 % wt
Site: SW EXT WALL AREA - STUCCO - WHITE / 2 / STUCCO					
LBP-03	092404292-0003	2/28/2024	2/29/2024	0.2067 g	0.17 % wt
Site: OFFICE HALLWAY - FAR NORTH WALL AREA - WOOD - CREAM / 2 / WOOD					
LBP-04	092404292-0004	2/28/2024	2/29/2024	0.2551 g	<0.0080 % wt
Site: CENTRAL OFFICE - SOUTHWEST WALL - WOOD - BLUE / 2 / WOOD					
LBP-05	092404292-0005	2/28/2024	2/29/2024	0.2595 g	0.076 % wt
Site: APPARATUS BAY - WEST WALL AREA - WOOD - GREEN / 2 / WOOD					
LBP-06	092404292-0006	2/28/2024	2/29/2024	0.2535 g	0.042 % wt
Site: APPARATUS BAY - WEST WALL AREA - WOOD - WHITE / 2 / STUCCO					
LBP-07	092404292-0007	2/28/2024	2/29/2024	0.2597 g	<0.0080 % wt
Site: APPARATUS BAY - CENTRAL FLOOR - CONCRETE - RED / 1 / CONCRETE					
LBP-08	092404292-0008	2/28/2024	2/29/2024	0.2514 g	<0.0080 % wt
Site: APPARATUS BAY - EXT FLOOR 0 CONCRETE - RED / 1 / CONCRETE					
LBP-09	092404292-0009	2/28/2024	2/29/2024	0.1612 g	2.3 % wt
Site: APPARATUS BAY - WEST WINDOW - METAL - GREEN / 1 / METAL					
LBP-10	092404292-0010	2/28/2024	2/29/2024	0.251 g	0.33 % wt
Site: APPARATUS BAY - WEST WINDOW SILL - WOOD - GREY / 2 / WOOD					
LBP-11	092404292-0011	2/28/2024	2/29/2024	0.2569 g	0.70 % wt
Site: APP BAY - SW LOWER WALL AREA - CONCRETE - BLUE / 1 / CONCRETE					


Oscar Merino, Laboratory Manager
or other approved signatory

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* Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.008% wt based on the minimum sample weight per our SOP. "<" (less than) result signifies the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. Definitions of modifications are available upon request.

Samples analyzed by EMSL Analytical, Inc San Leandro, CA AIHA LAP, LLC-ELLAP Accredited #101748

Initial report from 02/29/2024 16:06:54



EMSL Analytical, Inc

464 McCormick Street, San Leandro, CA 94577

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<http://www.EMSL.com>

sanleandrolab@emsl.com

EMSL Order: 092404292

CustomerID: NOMO22

CustomerPO: 404782001

ProjectID:

Attn: **Bill Larkin**
Ninyo & Moore
2020 Challenger Drive
Suite 103
Alameda, CA 94501

Phone: (510) 343-3000
Fax: (510) 633-5646
Received: 2/29/2024 10:30 AM
Collected: 2/28/2024

Project: **FIRESTATION 1 / 404782001**

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B/7000B)*

Client Sample Description	Lab ID	Collected	Analyzed	Weight	Lead Concentration
LBP-12	092404292-0012	2/28/2024	2/29/2024	0.2515 g	0.015 % wt
Site: STORAGE - WEST WALL AREA - STUCCO - WHITE / 2 / STUCCO					
LBP-13	092404292-0013	2/28/2024	2/29/2024	0.1603 g	0.44 % wt
Site: TANK ROOM - NEW WINDOW METAL - GREY / 1 / METAL					
LBP-14	092404292-0014	2/28/2024	2/29/2024	0.2557 g	0.27 % wt
Site: STAIRS - WINDOW AREA - STUCCO - WHITE / 2 / STUCCO					
LBP-15	092404292-0015	2/28/2024	2/29/2024	0.2574 g	1.3 % wt
Site: 1ST FLOOR RR - NW WALL AREA - STUCCO - WHITE / 2 / STUCCO					
LBP-16	092404292-0016	2/28/2024	2/29/2024	0.252 g	<0.0080 % wt
Site: 1ST FLOOR RR - FLOOR AREA - CERAMIC - 1"X1"X GREY CERAMIC FLOOR TILE Traditional lead methods are not recommended for determination of lead content in ceramic tile					
LBP-17	092404292-0017	2/28/2024	2/29/2024	0.2529 g	<0.0080 % wt
Site: 1ST FLOOR RR - FLOOR AREA - CERAMIC - 4"X4"X WHITE CERAMIC WALL TILE Traditional lead methods are not recommended for determination of lead content in ceramic tile					
LBP-18	092404292-0018	2/28/2024	2/29/2024	0.253 g	<0.0080 % wt
Site: CORRIDOR LOCKER - WOOD - BLUE / 2 / WOOD					
LBP-19	092404292-0019	2/28/2024	2/29/2024	0.2581 g	<0.0080 % wt
Site: LOWER - WEST WALL AREA - STUCCO - WHITE / 1 / STUCCO					
LBP-20	092404292-0020	2/28/2024	2/29/2024	0.2542 g	<0.0080 % wt
Site: DORM - SOUTH WALL AREA - STUCCO - WHITE / 2 / STUCCO					
LBP-21	092404292-0021	2/28/2024	2/29/2024	0.2548 g	0.23 % wt
Site: LAUNDRY ROOM - SOUTH WALL AREA - STUCCO - WHITE / 2 / STUCCO					


Oscar Merino, Laboratory Manager
or other approved signatory

EMSL maintains liability limited to cost of analysis. Interpretation and use of test results are the responsibility of the client. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. The report reflects the samples as received. Results are generated from the field sampling data (sampling volumes and areas, locations, etc.) provided by the client on the Chain of Custody. Samples are within quality control criteria and met method specifications unless otherwise noted.

* Analysis following Lead in Paint by EMSL SOP/Determination of Environmental Lead by FLAA. Reporting limit is 0.008% wt based on the minimum sample weight per our SOP. "<" (less than) result signifies the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request. Definitions of modifications are available upon request.

Samples analyzed by EMSL Analytical, Inc San Leandro, CA AIHA LAP, LLC-ELLAP Accredited #101748

Initial report from 02/29/2024 16:06:54

LEAD BASED PAINT BULK SAMPLE DATA SHEET

24TAT

092404292

Sheet 1 of ____

Ninyo & Moore 1301 Marina Village Pkwy Suite 110 Alameda, CA 94501 Tel.: (510) 343-3000	Project Name: Fire Station 1 Project No.: 401782001 Project Manager: WPL Site Address:	Sampled By: WPL Sampled By: Sampled By: Date Sampled: 02/29	Laboratory: EMSL Analytical, Inc. 464 McCormick St San Leandro, CA 94577 Tel.: (510) 895-3675

CHAIN OF CUSTODY INFORMATION:

Relinquished By: (sign/print)	Company	Date	Time(24 hr.)	Received By: (sign/print)	Laboratory
<i>Nathan Eubank</i>	Ninyo & Moore	02/29	022920	24-1030 '10 W/I	

Sample ID	Building Number	Room Number	Sample Location	Building Component	Sample Description (Color /# Layers /Substrate)	Estimated Surface Area	Condition
LBP-01	1st Flr		West Ext. Wall Area	Stucco	White/2/stucco		Intact
LBP-02			SW Ext. Wall Area	" "	White/2/stucco		
LBP-03			Office Hallway - Far North wall	Wood	Cream/2/wood		
LBP-04			Central Office - Southwest wall	Wood	Blue/2/wood		
LBP-05			Apparatus Bay - West Wall	Stucco	Green/2/stucco		
LBP-06			" "	"	White/2/stucco		
LBP-07			Apparatus Bay - Central Floor	Concrete	Red/1/concrete		
LBP-08			Apparatus Bay - East Floor	Concrete	Red/1/concrete		
LBP-09			Apparatus Bay - West window	Metal	Green/1/Metal		
LBP-10			Apparatus Bay - West window sill	Wood	Grey/2/wood		
LBP-11			App Bay - SW lower wall Area	Concrete	Blue/1/concrete		
LBP-12			Storage - West wall Area	Stucco	White/2/stucco		
LBP-13			Tank Room - NE Window	Metal	Grey/2/Metal		
LBP-14			Stairs - Window Area	Stucco	White/2/stucco		
LBP-15			1st Floor RR - NW Wall Area	Stucco	White/2/stucco		

Page 1 of 2

Sheet 1 of _____

Ninyo & Moore 1301 Marina Village Pkwy Suite 110 Alameda, CA 94501 Tel.: (510) 343-3000	Project Name : <i>Fire Station 1</i> Project No.: <i>404782001</i> Project Manager: <i>WPL</i> Site Address:	Sampled By: <i>WPL</i> Sampled By: Sampled By: Date Sampled: <i>02/28</i>	Laboratory: EMSL Analytical, Inc. 464 McCormick St San Leandro, CA 94577 Tel.: (510) 895-3675

Relinquished By: (sign/print)	Company	Date	Time(24 hr.)	Received By: (sign/print)	Laboratory
Nathan Eubank	Niryo&Moore	02/29	02292	024-1030	110 w/I

Page 2 of 2

APPENDIX D

Polychlorinated Biphenyl Laboratory Analytical Report and Chain-of-Custody Records





Enthalpy Analytical
931 West Barkley Ave
Orange, CA 92868
(714) 771-6900

enthalpy.com

Lab Job Number : 503422
Report Level : II
Report Date : 03/07/2024

Analytical Report *prepared for:*

Bill Larkin
Ninyo & Moore
1301 Marina Village Parkway
Suite 110
Alameda, CA 94501

Project: 404782001 - Fire Station 1

Authorized for release by:

Miguel Gamboa, Project Coordinator
miguel.gamboa@enthalpy.com

This data package has been reviewed for technical correctness and completeness. Release of this data has been authorized by the Laboratory Manager or the Manager's designee, as verified by the above signature which applies to this PDF file as well as any associated electronic data deliverable files. The results contained in this report meet all requirements of NELAP and pertain only to those samples which were submitted for analysis. This report may be reproduced only in its entirety.

CA ELAP# 1338, NELAP# 4038, SCAQMD LAP# 18LA0518, LACSD ID# 10105



Sample Summary

Bill Larkin
Ninyo & Moore
1301 Marina Village
Parkway
Suite 110
Alameda, CA 94501

Lab Job #: 503422
Project No: 404782001
Location: Fire Station 1
Date Received: 02/29/24

Sample ID	Lab ID	Collected	Matrix
PCB-01	503422-001	02/28/24 00:00	Miscell.
PCB-02	503422-002	02/28/24 00:00	Miscell.
PCB-03	503422-003	02/28/24 00:00	Miscell.
PCB-04	503422-004	02/28/24 00:00	Miscell.
PCB-05	503422-005	02/28/24 00:00	Miscell.
PCB-06	503422-006	02/28/24 00:00	Miscell.
PCB-07	503422-007	02/28/24 00:00	Miscell.
PCB-08	503422-008	02/28/24 00:00	Miscell.
PCB-09	503422-009	02/28/24 00:00	Miscell.
PCB-10	503422-010	02/28/24 00:00	Miscell.

Case Narrative

Ninyo & Moore
1301 Marina Village Parkway
Suite 110
Alameda, CA 94501
Bill Larkin

Lab Job 503422
Number:
Project No: 404782001
Location: Fire Station 1
Date Received: 02/29/24

This data package contains sample and QC results for ten miscell. samples, requested for the above referenced project on 02/29/24. The samples were received intact.

PCBs (EPA 8082):

- Many samples were diluted due to the color of the sample extracts.
- No other analytical problems were encountered.

 ENTHALPY ANALYTICAL		Chain of Custody Record Lab No: 503422 Page:		Turn Around Time (rush by advanced notice only) Standard: ☒ 5 Day: ☐ 3 Day: ☐ 2 Day: ☐ 1 Day: ☐ Custom TAT: ☐		
Enthalpy Analytical - Berkeley 2323 5th Street, Berkeley, CA 94710 Phone 510-486-0900		Matrix: A = Air S = Soil/Solid W = Water DW = Drinking Water SD = Sediment PP = Pure Product SEA = Sea Water SW = Swab T = Tissue WP = Wipe O = Other		Preservatives: 1 = Na ₂ S ₂ O ₃ 2 = HCl 3 = HNO ₃ 4 = H ₂ SO ₄ 5 = NaOH 6 = Other		
CUSTOMER INFORMATION Company: Ningbo & Moore Report To: William Larkin Email: William.Larkin@ningboandmoore.com Address: Phone: 510-388-5094 Fax:		PROJECT INFORMATION Name: Fire Station 1 Number: 404782001 P.O. #: Address: Global ID: Sampled By: WPL		Analysis Request PCB		
Sample ID		Sampling Date	Sampling Time	Matrix	Container No. / Size	Pres.
1	PCB-01	02/98				X
2	PCB-02					X
3	PCB-03					X
4	PCB-04					X
5	PCB-05					X
6	PCB-06					X
7	PCB-07					X
8	PCB-08					X
9	PCB-09					X
10	PCB-10					X
Test Instructions / Comments Red Carpet w/ Mastic Window Caulking Window Putty Window Caulking Window Putty Window Caulking Window Putty Window Putty Black Vapor barrier w/ 2x4 Yellow Batt insulation Pink Batt insulation w/ Silver Barrier						
Signature		Print Name		Company / Title		
Relinquished By: 		Nathan Eubank		Ningbo & Moore / Staff Scientist		
Received By: 		William Larkin		2/29/98		
Relinquished By: 		David Swafford		2/29/98		
Received By: 		David Swafford		3/16/98		
Relinquished By:		Received By:		Received By:		
Received By:		Received By:		Received By:		

SAMPLE RECEIPT CHECKLIST



Section 1: General Info

Date Received: 2/29/24 Login # 503422 Client: Umyo & Moore

Section 2: Shipping / Custody

Shipping Info: _____

Are custody seals present? ☒ No ☐ Yes If yes, where? ☐ on cooler, ☐ on samples, ☐ on package

Custody seals intact on arrival? ☐ Yes ☐ No ☒ N/A Date: _____ # of seals _____ ☐ Signature ☐ Initials

Section 3: Condition / Packaging

Important: Notify PM if temperature exceeds 6°C or arrive frozen

Date Opened 2/29/24 By (print) am (sign) [Signature]

☐ Samples received on ice directly from the field. Cooling process had begun. (if checked, skip temperatures)

If no cooler: Sample Temp (°C): 23.4

How many coolers? _____ Temp (°C): #1: _____ #2: _____ #3: _____ #4: _____ #5: _____ #6: _____

Temperature measured using ☐ Thermometer ID: _____, or IR Gun # ☐ B ☐ C

Type of ice used: ☐ Wet, ☐ Blue/Gel, ☒ None Temperature blank(s) included? ☐ Yes, ☐ No

Section 4: Containers / Labels / Samples

Were custody papers dry, filled out properly, and the project identifiable?

Were Method 5035 sampling containers present? Transferred to freezer @:

Did all containers arrive unbroken/unopened?

Are there any missing / extra samples?

Are samples in the appropriate containers for indicated tests?

Are sample labels present, in good condition and complete?

Does the container count match the COC?

Do the sample labels agree with custody papers?

Was sufficient amount of sample sent for tests requested?

Did you change the hold time in LIMS for unpreserved VOAs?

Did you change the hold time in LIMS for preserved terracores?

Are bubbles > 6mm present in VOA samples?

Was the client contacted about this delivery? Contacted: _____ By: _____ Date: _____

Section 5: Preservatives

Are the samples appropriately preserved? (If yes, skip the rest of section 5)

Did any samples / containers require preservation upon receipt?

Did you document your preservative check in the bench book?

Preservative added:

☐ H2SO4 lot# _____ added to samples _____ Date/Time _____

☐ HCL lot# _____ added to samples _____ Date/Time _____

☐ HNO3 lot# _____ added to samples _____ Date/Time _____

☐ CrVI Buffer lot# _____ added to samples _____ Date/Time _____

Section 6: Explanations / Comments

No sample date rec time on containers

Date Logged 2/29/24 By (print) am (sign) [Signature]

Date Labeled 2/29/24 By (print) am (sign) [Signature]



ENTHALPY ANALYTICAL

SAMPLE ACCEPTANCE CHECKLIST

Section 1

Client: Win 10 & Moore

Project: Fire Station 1

Date Received: 3/1/24

Sampler's Name Present: ☒ Yes ☐ No

Section 2

Sample(s) received in a cooler? ☒ Yes, How many? 1 ☐ No [skip section 2]

Sample Temp (°C)
(No Cooler) : _____

Sample Temp (°C), One from each cooler: #1: 5.7 #2: _____ #3: _____ #4: _____

(Acceptance range is < 6°C but not frozen (for Microbiology samples, acceptance range is < 10°C but not frozen). It is acceptable for samples collected the same day as sample receipt to have a higher temperature as long as there is evidence that cooling has begun.)

Shipping Information: _____

Section 3

Was the cooler packed with: ☒ Ice ☒ Ice Packs ☒ Bubble Wrap ☐ Styrofoam
☐ Paper ☐ None ☐ Other _____

Cooler Temp (°C): #1: 3.6 #2: _____ #3: _____ #4: _____

Section 4

	YES	NO	N/A
Was a COC received?	☒		
Are sample IDs present?	☒		
Are sampling dates & times present?		☒	
Is a relinquished signature present?	☒		
Are the tests required clearly indicated on the COC?	☒		
Are custody seals present?	☒		
If custody seals are present, were they intact?	☒		
Are all samples sealed in plastic bags? (Recommended for Microbiology samples)			☒
Did all samples arrive intact? If no, indicate in Section 4 below.	☒		
Did all bottle labels agree with COC? (ID, dates and times)	☒		
Were the samples collected in the correct containers for the required tests?	☒		
Are the containers labeled with the correct preservatives?			☒
Is there headspace in the VOA vials greater than 5-6 mm in diameter?			☒
Was a sufficient amount of sample submitted for the requested tests?	☒		

Section 5 Explanations/Comments

Section 6

For discrepancies, how was the Project Manager notified? ☐ Verbal PM Initials: _____ Date/Time: _____
☐ Email (email sent to/on): _____ / _____

Project Manager's response: _____

Completed By: Dan Smith Date: 3/1/24

Enthalpy Analytical, a subsidiary of Montrose Environmental Group, Inc.
931 W. Barkley Ave, Orange, CA 92868 • T: (714) 771-6900 • F: (714) 538-1209
www.enthalpy.com/socal

Sample Acceptance Checklist -- Rev 4, 8/8/2017

#5

5.7/3.6

Southwest Airlines

Printed on:
29 FEB 19:16

526 OAK 9990 2681



SNA

PC#
3 OF

DG
6 G

LOT WT
60 LB
(11.9 KG)

OAK WN 2652-01 MAR 07:30

STN FLT DATE ETD LOT 01



PC ID: 0003
PC WT: 43LB

526 99902681 0003

S

Polychlorinated Biphenyls (PCBs)

Lab #: 503422

Project#: 404782001

Client: Ninyo & Moore

Location: Fire Station 1

Field ID: PCB-01

Diln Fac: 2.000

Analyzed: 03/06/24

Type: SAMPLE

Batch#: 334609

Prep: EPA 3546

Lab ID: 503422-001

Sampled: 02/28/24

Analysis: EPA 8082

Matrix: Miscell.

Received: 02/29/24

Analyst: MES

Basis: as received

Prepared: 03/05/24

503422-001 Analyte	Result	RL	Units
Aroclor-1016	ND	1.0	mg/Kg
Aroclor-1221	ND	1.0	mg/Kg
Aroclor-1232	ND	1.0	mg/Kg
Aroclor-1242	ND	1.0	mg/Kg
Aroclor-1248	ND	1.0	mg/Kg
Aroclor-1254	ND	1.0	mg/Kg
Aroclor-1260	ND	1.0	mg/Kg
Aroclor-1262	ND	1.0	mg/Kg
Aroclor-1268	ND	1.0	mg/Kg
503422-001 Surrogate	%REC	Limits	
Decachlorobiphenyl (PCB)	87	19-121	

Field ID: PCB-02

Diln Fac: 2.000

Analyzed: 03/07/24

Type: SAMPLE

Batch#: 334609

Prep: EPA 3546

Lab ID: 503422-002

Sampled: 02/28/24

Analysis: EPA 8082

Matrix: Miscell.

Received: 02/29/24

Analyst: MES

Basis: as received

Prepared: 03/05/24

503422-002 Analyte	Result	RL	Units
Aroclor-1016	ND	1.0	mg/Kg
Aroclor-1221	ND	1.0	mg/Kg
Aroclor-1232	ND	1.0	mg/Kg
Aroclor-1242	ND	1.0	mg/Kg
Aroclor-1248	ND	1.0	mg/Kg
Aroclor-1254	ND	1.0	mg/Kg
Aroclor-1260	ND	1.0	mg/Kg
Aroclor-1262	ND	1.0	mg/Kg
Aroclor-1268	ND	1.0	mg/Kg
503422-002 Surrogate	%REC	Limits	
Decachlorobiphenyl (PCB)	86	19-121	

Polychlorinated Biphenyls (PCBs)

Lab #: 503422

Project#: 404782001

Client: Ninyo & Moore

Location: Fire Station 1

Field ID: PCB-03

Diln Fac: 2.000

Analyzed: 03/07/24

Type: SAMPLE

Batch#: 334609

Prep: EPA 3546

Lab ID: 503422-003

Sampled: 02/28/24

Analysis: EPA 8082

Matrix: Miscell.

Received: 02/29/24

Analyst: MES

Basis: as received

Prepared: 03/05/24

503422-003 Analyte

	Result	RL	Units
Aroclor-1016	ND	1.0	mg/Kg
Aroclor-1221	ND	1.0	mg/Kg
Aroclor-1232	ND	1.0	mg/Kg
Aroclor-1242	ND	1.0	mg/Kg
Aroclor-1248	ND	1.0	mg/Kg
Aroclor-1254	ND	1.0	mg/Kg
Aroclor-1260	ND	1.0	mg/Kg
Aroclor-1262	ND	1.0	mg/Kg
Aroclor-1268	ND	1.0	mg/Kg

503422-003 Surrogate

	%REC	Limits
Decachlorobiphenyl (PCB)	86	19-121

Field ID: PCB-04

Diln Fac: 2.000

Analyzed: 03/07/24

Type: SAMPLE

Batch#: 334609

Prep: EPA 3546

Lab ID: 503422-004

Sampled: 02/28/24

Analysis: EPA 8082

Matrix: Miscell.

Received: 02/29/24

Analyst: MES

Basis: as received

Prepared: 03/05/24

503422-004 Analyte

	Result	RL	Units
Aroclor-1016	ND	0.83	mg/Kg
Aroclor-1221	ND	0.83	mg/Kg
Aroclor-1232	ND	0.83	mg/Kg
Aroclor-1242	ND	0.83	mg/Kg
Aroclor-1248	ND	0.83	mg/Kg
Aroclor-1254	ND	0.83	mg/Kg
Aroclor-1260	ND	0.83	mg/Kg
Aroclor-1262	ND	0.83	mg/Kg
Aroclor-1268	ND	0.83	mg/Kg

503422-004 Surrogate

	%REC	Limits
Decachlorobiphenyl (PCB)	82	19-121

Polychlorinated Biphenyls (PCBs)

Lab #: 503422

Project#: 404782001

Client: Ninyo & Moore

Location: Fire Station 1

Field ID: PCB-05

Diln Fac: 2.000

Analyzed: 03/07/24

Type: SAMPLE

Batch#: 334609

Prep: EPA 3546

Lab ID: 503422-005

Sampled: 02/28/24

Analysis: EPA 8082

Matrix: Miscell.

Received: 02/29/24

Analyst: MES

Basis: as received

Prepared: 03/05/24

503422-005 Analyte	Result	RL	Units
Aroclor-1016	ND	0.91	mg/Kg
Aroclor-1221	ND	0.91	mg/Kg
Aroclor-1232	ND	0.91	mg/Kg
Aroclor-1242	ND	0.91	mg/Kg
Aroclor-1248	ND	0.91	mg/Kg
Aroclor-1254	ND	0.91	mg/Kg
Aroclor-1260	ND	0.91	mg/Kg
Aroclor-1262	ND	0.91	mg/Kg
Aroclor-1268	ND	0.91	mg/Kg
503422-005 Surrogate	%REC		Limits
Decachlorobiphenyl (PCB)	91		19-121

Field ID: PCB-06

Diln Fac: 10.00

Analyzed: 03/07/24

Type: SAMPLE

Batch#: 334609

Prep: EPA 3546

Lab ID: 503422-006

Sampled: 02/28/24

Analysis: EPA 8082

Matrix: Miscell.

Received: 02/29/24

Analyst: MES

Basis: as received

Prepared: 03/05/24

503422-006 Analyte	Result	RL	Units
Aroclor-1016	ND	4.2	mg/Kg
Aroclor-1221	ND	4.2	mg/Kg
Aroclor-1232	ND	4.2	mg/Kg
Aroclor-1242	ND	4.2	mg/Kg
Aroclor-1248	ND	4.2	mg/Kg
Aroclor-1254	ND	4.2	mg/Kg
Aroclor-1260	ND	4.2	mg/Kg
Aroclor-1262	ND	4.2	mg/Kg
Aroclor-1268	ND	4.2	mg/Kg
503422-006 Surrogate	%REC		Limits
Decachlorobiphenyl (PCB)	90		19-121

Polychlorinated Biphenyls (PCBs)

Lab #: 503422

Project#: 404782001

Client: Ninyo & Moore

Location: Fire Station 1

Field ID: PCB-07

Diln Fac: 2.000

Analyzed: 03/07/24

Type: SAMPLE

Batch#: 334609

Prep: EPA 3546

Lab ID: 503422-007

Sampled: 02/28/24

Analysis: EPA 8082

Matrix: Miscell.

Received: 02/29/24

Analyst: MES

Basis: as received

Prepared: 03/05/24

503422-007 Analyte	Result	RL	Units
Aroclor-1016	ND	1.0	mg/Kg
Aroclor-1221	ND	1.0	mg/Kg
Aroclor-1232	ND	1.0	mg/Kg
Aroclor-1242	ND	1.0	mg/Kg
Aroclor-1248	ND	1.0	mg/Kg
Aroclor-1254	ND	1.0	mg/Kg
Aroclor-1260	ND	1.0	mg/Kg
Aroclor-1262	ND	1.0	mg/Kg
Aroclor-1268	ND	1.0	mg/Kg
503422-007 Surrogate	%REC	Limits	
Decachlorobiphenyl (PCB)	87	19-121	

Field ID: PCB-08

Diln Fac: 2.000

Analyzed: 03/07/24

Type: SAMPLE

Batch#: 334609

Prep: EPA 3546

Lab ID: 503422-008

Sampled: 02/28/24

Analysis: EPA 8082

Matrix: Miscell.

Received: 02/29/24

Analyst: MES

Basis: as received

Prepared: 03/05/24

503422-008 Analyte	Result	RL	Units
Aroclor-1016	ND	1.0	mg/Kg
Aroclor-1221	ND	1.0	mg/Kg
Aroclor-1232	ND	1.0	mg/Kg
Aroclor-1242	ND	1.0	mg/Kg
Aroclor-1248	ND	1.0	mg/Kg
Aroclor-1254	ND	1.0	mg/Kg
Aroclor-1260	ND	1.0	mg/Kg
Aroclor-1262	ND	1.0	mg/Kg
Aroclor-1268	ND	1.0	mg/Kg
503422-008 Surrogate	%REC	Limits	
Decachlorobiphenyl (PCB)	70	19-121	

Polychlorinated Biphenyls (PCBs)

Lab #: 503422

Project#: 404782001

Client: Ninyo & Moore

Location: Fire Station 1

Field ID: PCB-09

Diln Fac: 2.000

Analyzed: 03/07/24

Type: SAMPLE

Batch#: 334609

Prep: EPA 3546

Lab ID: 503422-009

Sampled: 02/28/24

Analysis: EPA 8082

Matrix: Miscell.

Received: 02/29/24

Analyst: MES

Basis: as received

Prepared: 03/05/24

503422-009 Analyte	Result	RL	Units
Aroclor-1016	ND	1.0	mg/Kg
Aroclor-1221	ND	1.0	mg/Kg
Aroclor-1232	ND	1.0	mg/Kg
Aroclor-1242	ND	1.0	mg/Kg
Aroclor-1248	ND	1.0	mg/Kg
Aroclor-1254	ND	1.0	mg/Kg
Aroclor-1260	ND	1.0	mg/Kg
Aroclor-1262	ND	1.0	mg/Kg
Aroclor-1268	ND	1.0	mg/Kg
503422-009 Surrogate	%REC	Limits	
Decachlorobiphenyl (PCB)	81	19-121	

Field ID: PCB-10

Diln Fac: 2.000

Analyzed: 03/07/24

Type: SAMPLE

Batch#: 334609

Prep: EPA 3546

Lab ID: 503422-010

Sampled: 02/28/24

Analysis: EPA 8082

Matrix: Miscell.

Received: 02/29/24

Analyst: MES

Basis: as received

Prepared: 03/05/24

503422-010 Analyte	Result	RL	Units
Aroclor-1016	ND	1.0	mg/Kg
Aroclor-1221	ND	1.0	mg/Kg
Aroclor-1232	ND	1.0	mg/Kg
Aroclor-1242	ND	1.0	mg/Kg
Aroclor-1248	ND	1.0	mg/Kg
Aroclor-1254	ND	1.0	mg/Kg
Aroclor-1260	ND	1.0	mg/Kg
Aroclor-1262	ND	1.0	mg/Kg
Aroclor-1268	ND	1.0	mg/Kg
503422-010 Surrogate	%REC	Limits	
Decachlorobiphenyl (PCB)	77	19-121	



Polychlorinated Biphenyls (PCBs)

Lab #: 503422

Project#: 404782001

Client: Ninyo & Moore

Location: Fire Station 1

Type: BLANK

Batch#: 334609

Analysis: EPA 8082

Lab ID: QC1133918

Prepared: 03/05/24

Analyst: MES

Matrix: Soil

Analyzed: 03/06/24

Diln Fac: 1.000

Prep: EPA 3546

QC1133918 Analyte	Result	RL	Units
Aroclor-1016	ND	0.051	mg/Kg
Aroclor-1221	ND	0.051	mg/Kg
Aroclor-1232	ND	0.051	mg/Kg
Aroclor-1242	ND	0.051	mg/Kg
Aroclor-1248	ND	0.051	mg/Kg
Aroclor-1254	ND	0.051	mg/Kg
Aroclor-1260	ND	0.051	mg/Kg
Aroclor-1262	ND	0.051	mg/Kg
Aroclor-1268	ND	0.051	mg/Kg
QC1133918 Surrogate		%REC	Limits
Decachlorobiphenyl (PCB)		79	19-121

Legend

ND: Not Detected

RL: Reporting Limit



Polychlorinated Biphenyls (PCBs): Batch QC

Lab #: 503422

Project#: 404782001

Client: Ninyo & Moore

Location: Fire Station 1

Type: LCS

Batch#: 334609

Analysis: EPA 8082

Lab ID: QC1133919

Prepared: 03/05/24

Analyst: MES

Matrix: Soil

Analyzed: 03/06/24

Diln Fac: 1.000

Prep: EPA 3546

QC1133919 Analyte	Spiked	Result	%REC	Limits	Units
Aroclor-1016	0.5051	0.4955	98	14-150	mg/Kg
Aroclor-1260	0.5051	0.4465	88	10-150	mg/Kg
QC1133919 Surrogate			%REC	Limits	
Decachlorobiphenyl (PCB)			84	19-121	

Polychlorinated Biphenyls (PCBs): Batch QC

Lab #: 503422

Project#: 404782001

Client: Ninyo & Moore

Location: Fire Station 1

Field ID: ZZZZZZZZZZ

Basis: as received

Prepared: 03/05/24

Type: MS

Diln Fac: 2.000

Analyzed: 03/06/24

MSS Lab ID: 503426-001

Batch#: 334609

Prep: EPA 3546

Lab ID: QC1133920

Sampled: 02/28/24

Analysis: EPA 8082

Matrix: Soil

Received: 02/29/24

Analyst: MES

QC1133920 Analyte	MSS Result	Spiked	Result	%REC	Limits	Units
Aroclor-1016	<0.02891	0.5051	0.5191	103	42-127	mg/Kg
Aroclor-1260	<0.04893	0.5051	0.4652	92	38-130	mg/Kg

QC1133920 Surrogate	%REC	Limits
Decachlorobiphenyl (PCB)	86	19-121

Field ID: ZZZZZZZZZZ

Basis: as received

Prepared: 03/05/24

Type: MSD

Diln Fac: 2.000

Analyzed: 03/06/24

MSS Lab ID: 503426-001

Batch#: 334609

Prep: EPA 3546

Lab ID: QC1133921

Sampled: 02/28/24

Analysis: EPA 8082

Matrix: Soil

Received: 02/29/24

Analyst: MES

QC1133921 Analyte	Spiked	Result	%REC	Limits	Units	RPD	Lim
Aroclor-1016	0.5051	0.5594	111	42-127	mg/Kg	7	30
Aroclor-1260	0.5051	0.5060	100	38-130	mg/Kg	8	30

QC1133921 Surrogate	%REC	Limits
Decachlorobiphenyl (PCB)	95	19-121

Legend

RPD: Relative Percent
Difference

APPENDIX E

CDPH Form 8552 – Lead Hazard Evaluation Report



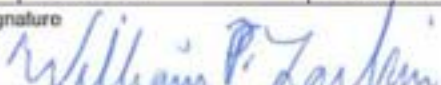
LEAD HAZARD EVALUATION REPORT**Section 1 — Date of Lead Hazard Evaluation** 2/28/2024**Section 2 — Type of Lead Hazard Evaluation (Check one box only)**☐ Lead inspection ☐ Risk assessment ☐ Clearance inspection ☒ Other (specify) Chip Sampling**Section 3 — Structure Where Lead Hazard Evaluation Was Conducted**

Address [number, street, apartment (if applicable)]		City	County	Zip Code
198 D Street		Petaluma	Sonoma	94546
Construction date (year) of structure	Type of structure		Children living in structure?	
1930s	☐ Multi-unit building ☐ School or daycare ☐ Single family dwelling ☒ Other Fire Station Bldg		☐ Yes ☒ No ☐ Don't Know	

Section 4 — Owner of Structure (if business/agency, list contact person)

Name		Telephone number	
Petaluma Fire Department/Jeff Schach		707/778-4390	
Address [number, street, apartment (if applicable)]		City	State
198 D Street		Petaluma	California
			Zip Code
			94546

Section 5 — Results of Lead Hazard Evaluation (check all that apply)☐ No lead-based paint detected ☒ Intact lead-based paint detected ☐ Deteriorated lead-based paint detected
☐ No lead hazards detected ☐ Lead-contaminated dust found ☐ Lead-contaminated soil found ☐ Other**Section 6 — Individual Conducting Lead Hazard Evaluation**

Name		Telephone number	
William P. Larkin		510/343-3000	
Address [number, street, apartment (if applicable)]		City	State
1301 Marina Village Parkway, Suite 110		Alameda	California
			Zip Code
			94501
CDPH certification number	Signature		Date
1284/1285			3/1/2024

Name and CDPH certification number of any other individuals conducting sampling or testing (if applicable)

N/A

Section 7 — Attachments

- A. A foundation diagram or sketch of the structure indicating the specific locations of each lead hazard or presence of lead-based paint;
- B. Each testing method, device, and sampling procedure used;
- C. All data collected, including quality control data, laboratory results, including laboratory name, address, and phone number.

First copy and attachments retained by inspector

Second copy and attachments retained by owner

Third copy only (no attachments) mailed or faxed to:

California Department of Public Health
Childhood Lead Poisoning Prevention Branch Reports
850 Marina Bay Parkway, Building P, Third Floor
Richmond, CA 94804-6403
Fax: (510) 620-5656

1301 Marina Village Parkway, Suite 110 | Alameda, California 94501 | p. 510.343.3000

SAN DIEGO | IRVINE | LOS ANGELES | FONTANA | OAKLAND | SAN FRANCISCO | SACRAMENTO

SAN JOSE | PHOENIX | TUCSON | PRESCOTT | LAS VEGAS | DENVER | BROOMFIELD | HOUSTON

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SECTION 02 83 19

LEAD-BASED/LEAD-CONTAINING PAINT ABATEMENT

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. The scope of work under this section consists of furnishing all labor, materials, facilities, equipment, services, employee training and testing, permits and agreements necessary to perform the abatement/stabilization and legal disposal of damaged lead-based paint (LBP) and/or lead-containing paint (LCP) identified in the ***Limited Hazardous Building Materials Survey, City of Petaluma Fire Station 1, 198 D Street, Petaluma, California (Ninyo & Moore, March 13, 2024)***, and associated sample location maps/plans in accordance with the latest applicable federal, state, and local government regulations and these specifications.
- B. Abatement/stabilization of all damaged LBP and/or LCP shall include the removal and disposal of loose, flaky, chipping and peeling LBP/LCP, including paint chips, debris, dust and scrapings. LBP/LCP that is securely adhered to the underlying substrate (i.e., non-flaking or non-peeling) shall be disposed of as part of renovation debris as non-hazardous waste with intact paint. The accepting landfill may require a Toxicity Characteristic Leaching Procedure (TCLP) analysis and/or Total Threshold Limit Concentration (TTLC) analysis of the lead waste.
- C. Cleaning with HEPA-filtered vacuums and damp wiping or mopping is required. If vacuuming is not effective, material may be removed by hand and plastic dust pans, then by wiping with damp cloths. Waste material shall be contained, transported, and disposed of in accordance with federal and state regulations. Contractor shall provide a Lead Compliance Plan that describes the methods and tools used in the planned scope of work.
- D. Refer to the sample location maps associated with the ***Limited Hazardous Building Materials Survey, City of Petaluma Fire Station 1, 198 D Street, Petaluma, California (Ninyo & Moore, March 13, 2024)***, and these specifications indicating the presence and the general locations of LBP/LCP within the buildings that will undergo required abatement/stabilization.

1.02 REFERENCES

- A. U.S. and State of California Environmental Protection Agency (EPA and Cal/EPA) regulations.
- B. Bay Area Air Quality Management District (BAAQMD) regulations.
- C. California Department of Health Services - Division of Occupational Safety and Health Administration (Cal-OSHA).
- D. Federal Government standards of Occupational Safety and Health Administration (OSHA).

- E. State of California Department of Public Health (CDPH) regulations.
- F. U.S. Department of Transportation 49 CFR, parts 173, 178, and 179.
- G. National Institute for Occupational Safety and Health (NIOSH) standards.
- H. Applicable federal, state, and local government regulations.

Whenever there is a conflict or overlap of the above references, the most stringent provision is applicable.

1.03 SUBMITTALS AND NOTICES

- A. Training: Submit within three (3) days of start date of contract, three (3) copies of the training documentation for each supervisor and worker who will be on-site for this project. This training shall be in accordance with 8 CCR 1532.1 (Cal-OSHA Lead in Construction Standard).
- B. Medical Monitoring: Submit within three (3) days of start date of contract, three (3) copies of the medical documentation for each supervisor and worker who will be on-site for this project. Contractor shall submit documentation that all employees engaged in removal activities have had the appropriate medical examinations within the prescribed time periods immediately preceding project start-up. Contractor shall submit a project-specific Respiratory Protection Plan. Documentation shall include, but is not limited to, baseline blood lead levels performed in accordance with 8 CCR 1532.1 (Cal-OSHA Lead in Construction Standard).
- C. Respiratory Protection: Submit within three (3) days of start date of contract, three (3) copies of Respiratory Protection Program which is in compliance with ANSI Z88.2-1980, OSHA 29 CFR 1910 and 1926, Cal-OSHA Title 8 Section 1532.1. Contractor shall submit statement from examining physician that each employee is fit to wear a respirator in accordance with 8 CCR 5144 within the last twelve months. Contractor shall also provide documentation showing that all employees have passed respiratory fit tests within the past six months. Contractor shall use only workers medically qualified, trained CA-DHS, and Cal-OSHA certified for lead work and respirator usage.
- D. OSHA Lead Compliance Plan: Submit within three (3) days of start date of contract, three (3) copies of detailed plans of the procedures proposed in order to comply with the requirements of 29 CFR 1926.62 and Cal-OSHA Title 8 Section 1532.1. Include in the plan all components required under the standard.
- E. Hazardous Waste Management Plan: Submit within three (3) days of start date of contract, three (3) copies of Hazardous Waste Management Plan which is in compliance with federal, state, and local hazardous waste regulations and addresses:
 - 1. Identification of hazardous wastes associated with the work.
 - 2. Estimated quantities of wastes to be generated and disposed of.
 - 3. Names and qualifications of each contractor that will be transporting, storing, treating, and/or disposing of the lead wastes. Include the facility location and a 24-hour

point of contact. Furnish copies of EPA, state, and local permit applications and permits. The Client will supply the EPA Generator Identification number.

4. Names and qualifications (experience and training) of personnel who will be abating on-site hazardous wastes.
5. List of waste handling equipment to be used in performing the work, to include cleaning, volume reduction, and transport equipment.
6. Spill prevention, containment, and cleanup contingency measures to be implemented.
7. The contractor shall submit name, address, and telephone number of landfill or landfills and transporter to Client's representative for approval, prior to disposal. This includes those landfills used for waste categories determined to be non-hazardous.

F. Waste Disposal Records:

1. The Contractor shall provide a Hazardous Materials Report that, at a minimum, provides:
 - a site background and brief history of events to date regarding lead (and asbestos if present) removal.
 - a description of activities section including (but not limited to):
 - a site description,
 - copies of pictures taken of field activities (with location notes) including mobilization, emplaced equipment, sample locations (if additional samples are taken during the course of construction), equipment operations and locations of abated area(s) and locations of hazardous materials remaining following project completion,
 - location on a diagram (or similar) for locations of abated area(s) and locations of hazardous materials remaining following project completion,
 - a written log of site activities,
 - a description of any site spills or releases and corrective measures taken, and
 - copies of disposal records, bills of lading and manifests.

PART 2 – PRODUCTS

2.01 TOOLS AND EQUIPMENT

- A. Provide all necessary tools and materials for removal of lead contamination, including but not limited to required ladders, scaffolding, HEPA vacuums, GFI protected extension cords, hand tools, personal protection equipment (PPE) etc.
- B. Provide HEPA-filtered vacuum cleaners to pick up loose dust and debris.

- C. Transportation Equipment: Transportation equipment, as required, shall be suitable for loading, temporary storage, and unloading of contaminated waste without exposure to persons or property, and shall be in compliance with federal and state regulations.
- D. Provide portable shower unit, hot water heater, water filtration system, and appropriate materials for a temporary shower (if required). Project workers are not expected to be exposed above the Permissible Exposure Limit (PEL) of 50 µg/m³.

PART 3 – EXECUTION

3.01 BUILDING ISOLATION AND SIGNAGE

- A. Furnish, install, and maintain temporary barricade with continuous lead caution tape demarcating a lead abatement regulated area around the work area during periods of LBP/LCP abatement/stabilization. Only the contractor and the consultant shall be allowed in the area. Anyone entering the work area shall wear appropriate respiratory protection, disposable coveralls and other necessary PPE. People entering the work area shall show their respirator fit test documentation.
- B. Project signage must comply with Proposition 65 requirements and be located such that it is readily available to the public, yet still facilitate (and not hamper) the planned work activities.

3.02 DECONTAMINATION FACILITIES

- A. The contractor shall construct a personnel and equipment decontamination facility as required under Cal-OSHA regulations. Project workers are not expected to be exposed above the Permissible Exposure Limit (PEL) of 50 µg/m³.
- B. If waste water is generated by project activities, it shall be filtered through a 3.0-micron pore size filter prior to disposal into the sanitary sewer.

3.03 REMOVAL OF LOOSE AND PEELING LEAD-BASED PAINT AND LEAD-CONTAINING PAINT

- A. The contractor is required to remove all damaged, loose, flaking, chipping, debris, dust and peeling LBP/LCP from interior and exterior surfaces of the work areas within the site facilities (as needed). The contractor shall submit a scope of work that includes, at a minimum, the following:
 - 6-mil poly must be placed on the ground and sealed to the wall with duct tape. Extend 10 feet of poly from the wall of the building to be abated. Extend the work area farther if needed to collect dust and debris.
 - All windows and doors within 20 feet of the working surfaces must be closed, including windows on adjacent structures.

- Limit access to the work area by placing warning signs and around a 20-foot perimeter of the work area (or less if distance to next building or sidewalk is less than 20 feet).
 - A disposable tarp may be laid loosely over plants, put weights around the edge of the tarp to keep it down.
 - Do not perform outside abatement work if average winds are more than 10 miles per hour (20 mph per HUD Guidelines).
- B. The contractor shall request an inspection from the Client's representative following the completion of the work described in Item A above. The Client's representative will inspect the surfaces for any signs of loose, blistered, peeling paint, dust and/or debris and if found, the contractor shall perform additional work to the satisfaction of the Client's representative. The Client's representative will implement a 1 square foot (or 144 square inches) final dust wipe clearance/inspection of each particular work area, and they must pass at least the Client's (and EPA's and CPDH's) dust hazard standard per area tested ($<10 \mu\text{g}/\text{ft}^2$ for floors and $<100 \mu\text{g}/\text{ft}^2$ for sills) as needed.
- C. All perimeter exterior work areas where abatement will occur shall be lined with two layers of polyethylene/plastic sheeting (6 mil) in order to collect all falling LBP/LCP debris. Clear and grade work area as required. HEPA vacuum all LBP/LCP debris from polyethylene surface. Contractor shall submit a scope of work as describes in Section 303 A, above.

3.04 HANDLING AND DISPOSAL OF LEAD-CONTAMINATED WASTE

- A. Contractor shall collect and dispose of all loose LBP/LCP as hazardous waste. Miscellaneous debris resulting from the abatement may, at the contractor's option, be disposed of as hazardous waste or undergo testing to determine if the material is hazardous waste. Should the Contractor elect for testing, the testing shall be in accordance with California Code of Regulations, Title 22, Section 6669 (National Lead Laboratory Accreditation Program (NLLAP [lead lab accreditation])). The testing procedures shall be subject to the Engineer's approval. The costs of all such testing shall be at the Contractor's expense. Contractor shall provide evidence that the chosen landfill has accepted the sampling to date as sufficient for non-hazardous waste.
- B. The contractor shall follow all federal and state regulations for waste handling, containerizing, transporting, and disposing of hazardous waste.
- C. The contractor shall remove waste from the structures following specification requirements. Waste shall be deposited directly into double polyethylene waste bags (6 mil), goose-necked, then deposited into fiber or metal drums or other approved waste receptacles that will be used to transport the waste. Containers up to a drum in size can only have one TCLP test prior to its disposal. Containers with lead waste (including used PPE) must be labeled "LEAD CONTAMINATED WASTE".
- D. The contractor is responsible for providing all waste receptacles required for disposal. All waste temporarily stored on site shall be secured to prevent against vandalism and/or loss of property. The waste storage area should be blocked off and not accessible to

children or animals. Labels/warning signs must be placed outside of stored lead waste area and should say "DANGER: LEAD WASTE".

- E. The contractor shall establish a manifest system that meets federal and state regulations and accounts for all hazardous waste.
- F. The transporter must possess an approved EPA identification number for the site. The appropriate hazardous waste manifest must be completed by the contractor, and signed by a representative of the client, other than a Ninyo & Moore employee.

3.05 PROJECT CLOSEOUT

- A. Prior to final payment, the contractor shall comply with the following:
 - 1. Finalize disposal receipts for all waste.
 - 2. At the completion of lead abatement, all waste and storage dumpsters shall be removed from the site.

3.06 SUBSTITUTION OF MATERIALS AND/OR METHODS

- A. Any substitution in materials or methods to those specified shall be approved by the Client prior to use. Requests for substitution shall be provided in writing to the Client's representative.

END OF SECTION

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1. SCOPE OF WORK

The scope of work for the abatement project will involve the removal, transport, and disposal of any items and/or materials falling under the State of California Department of Toxic Substance Control (DTSC) Universal Hazardous Waste Rule (UWR), materials potentially containing polychlorinated biphenyls (PCBs), and other potential hazardous building materials (**including coolants, gases, and/or oils associated with elevator and/or HVAC systems**) within the planned abatement/work areas. These items and/or materials are to be removed prior to renovation activities that could disturb these materials at Fire Station 1 located at 198 D Street in Petaluma, California, as outlined in the construction contract documents.

1.1. Overview

- All work shall be supervised by experienced persons trained, knowledgeable, and qualified in the techniques of UWR/PCB abatement, handling of UWR/PCB waste and UWR/PCB-contaminated materials, and cleaning of UWR/PCB-contaminated areas.
- The Contractor shall provide and maintain environmental and occupational safety protective measures, equipment, and procedures at the work site.
- With respect to available utilities, the Contractor shall coordinate access and use of all utilities as needed for the duration of the project with the Owner. If utilities are unavailable, the Contractor will be required to provide the utilities at the Contractor's own cost.
- The Contractor shall furnish all labor, materials, services, insurance, equipment, decontamination facilities, and waste characterization of all potential UWR/PCB materials in order to carry out the complete removal, transport, and disposal of all UWR/PCB identified in these specifications that are part of the demolition project.
- The Contractor shall furnish all labor, materials, services, insurance, equipment, decontamination facilities, and waste characterization of all potentially hazardous PCB-containing materials in order to carry out the complete removal, transport, and disposal of all potentially PCB-containing materials identified in these specifications that are part of the demolition project
- Work shall be performed in accordance with all applicable regulations, codes, ordinances, and standards of governing authorities having jurisdiction and the requirements specified herein. Where applicable state or local standards are more stringent than federal standards, the Contractor shall adhere to the most stringent standards.

1.2. UWR Scope of Work

The Contractor's Scope of Work for UWR includes, but is not limited to, the following:

- Removal and disposal/recycling of potentially mercury-containing fluorescent light tubes from light fixtures and other non-incandescent light bulbs;
- Removal and disposal/recycling of potentially mercury-containing switches from thermostats;

- Removal and disposal/recycling of potentially tritium-containing exit signs;
- Removal and disposal/recycling of potentially Freon™-containing air conditioning units and refrigeration systems;
- Removal and disposal/recycling of any building material falling under the Universal Waste Rule or other potential hazardous building materials as described in Ninyo & Moore's **Limited Hazardous Building Materials Survey, City of Petaluma Fire Station 1, 198 D Street, Petaluma, California, 94541 (Ninyo & Moore, March 13, 2024)**,
- Placement of all contaminated items generated as a result of work activities and clean up in approved storage containers;
- Marking and labeling of all UWR materials and items for storage and disposal/recycling purposes;
- Transport of all UWR, items, and containers to a disposal facility and/or to an approved and off-site processing site for recycling;
- Preparing manifests, bills of lading, and all other required documentation for transportation, processing, and disposal of UWR for signature by the Owner.

1.3. PCB Waste Scope of Work

The Contractor's Scope of Work for PCBs includes, but is not limited to, the following:

- Removal of all potentially PCB-containing ballasts from light fixtures. All light fixtures are to be visually inspected, prior to removal or retrofitting, to determine if they contain PCBs. Those ballasts marked as "No PCBs" or "PCB Free" shall be considered as such. Those ballasts that are unmarked shall be considered PCB-containing and properly handled.
- Proper cleanup and disposal of light fixtures if ballast oils have breached its container;
- Placement and proper packaging of all PCB or PCB-contaminated items generated as a result of work activities and clean up in approved storage containers;
- Proper packaging includes the use of an approved absorbent to contain any leaks that may occur during transportation to the disposal facility;
- Marking and labeling of all PCB materials and/or PCB-contaminated items for storage and disposal purposes;
- Transportation of all PCB materials, PCB-contaminated items, and disposal containers to an on-site storage facility, a disposal facility, and to an approved and permitted off-site processing site for draining and/or flushing prior to disposal and recycling;
- Labeling and record keeping in accordance with all applicable local, state, and federal regulations;

- Incineration or recycling of PCB and PCB-contaminated fluids (and solids, if preferred by the Contractor) and land filling of contaminated solids only as authorized by 40 Code of Regulations (CFR) 761 and facilities approved by the United States Environmental Protection Agency (USEPA) and all other applicable regulatory agencies for such purposes;
- Prepare manifests and all other documentation for transportation, processing, and disposal of PCB wastes for signature by the Owner.

1.4. Quality Assurance

Since the work described herein includes the handling and disposal of highly toxic substances and materials requiring special expertise, the Contractor shall meet the following specific qualifications:

- **Single Party Responsibility:** The Contractor performing the work shall be responsible for, and accomplish, all UWR and PCB-related work activities.
- **License Requirements:** The Contractor or agent performing work for the Contractor must be currently licensed by the State of California Department of Public Health for the transporting, handling, and hauling of extremely hazardous wastes, including UWRs and PCB-related wastes.
- **Qualifications Statement:** The Contractor shall provide a Statement of Qualifications for review by the Owner or the Owner's Representative. The statement will provide sufficient data and information to prove to the satisfaction of the Owner that the Contractor performing the work described herein is fully experienced in the handling, storage, and transport of UWR, UWR-contaminated articles, and PCB-related wastes.

1.5. Submittals

- The Contractor performing the work described herein will develop, together with applicable subcontractors, a site-specific work plan. This work plan, at a minimum, will specify procedures, products and materials for the containment of the regulated work area (where appropriate), removal of UWR and PCB-containing/contaminated liquids and solids, decontamination of equipment and disposal of equipment that contained UWR and PCBs, waste storage containers, spill clean up, personnel decontamination, emergency contact numbers and procedures, first aid treatment, and temporary on-site storage procedures. This work plan will include the names and day-time phone numbers of all key personnel, the location of all required on-site documentation and emergency equipment, and delineation of the work area. A generalized, "boiler-plate" type of plan will not be accepted.
- Prior to the start of work, the Contractor will submit a complete list of all the materials and equipment proposed for use in the work. The list shall include such items as protective clothing, respiratory protection, absorbents, solvents, waste storage containers, item containers, and all appurtenances. A current Safety Data Sheet (SDS) will be submitted for each item for which a SDS is available. For items which a SDS is not available, the Contractor will submit the name of the manufacturer, brand name, and catalog/serial number for each item.
- Prior to the start of work, the Contractor will submit the Work Plan, Hazardous Waste Permits (where applicable), Qualifications Statement, Hazardous Waste Haulers License Number,

USEPA Identification Number, Certification of Disposal (where applicable), Accidental Spills Contingency Plan, and Routing of Equipment to be removed.

1.6. Regulatory Compliance

All work shall be performed in compliance with pertinent laws, rules, and regulations existing at the time of the work, including but not limited to:

- Standards for Universal Waste Management, 40 CFR Part 273.
- California Code of Regulations, Title 8, Division 1, Chapter 4.
- California Code of Regulations, Title 22, Division 4.5.
- California Health and Safety Code, Division 20.
- The Occupational Safety and Health Administration (OSHA) Standards, for respiratory protection, 29 CFR Part 1910.134.
- The Transportation Safety Act, Hazardous Material Transportation Act, Title 49 CFR Parts 106, 107, 171-179.
- All applicable state, local regulations, and ordinances, including any regulations regarding State and/or local licenses or certificates.
- Where applicable state or local regulations are more stringent than OSHA requirements or the requirements referenced herein, the Contractor shall adhere to the more stringent regulations.
- The Contractor warrants that he is familiar with the codes and requirements applicable to UWR and PCB work and shall give all notices and comply with all laws, ordinances, rules, and regulations applicable to the work. If the Contractor observes that the Specifications or plans at variance therewith, he shall give written notice to the Owner and/or Consultant describing such variances. If the Contractor performs any work knowing it to be contrary to such laws, ordinances, rules, and regulations, and without written notice to the Owner and/or Consultant, the Contractor shall bear all costs arising there from. Failure or omission on the part of the Contractor, or any of its representatives, either to discover or to bring to the attention of the Owner and/or Consultant any deviation from, omission from, or noncompliance with the requirements for asbestos abatement shall not be used by the Contractor as defense for failure on its part to fulfill such requirements.

2. PRODUCTS

2.1. Storage Containers

- All UWR/PCB fluids and UWR/PCB-contaminated fluids, including flush and cleaning solvents and mixtures, shall be stored in sealed Department of Transportation (DOT) 17E closed top drums or other waste container approved for the storage of these materials.

- For the purposes of these specifications, PCB-contaminated fluids are defined as containing more than 5 but less than 500 parts per million (ppm). PCB fluids are defined as containing PCBs in concentration of 500 ppm or greater. Flush solvents shall be assumed to contain more than 500 ppm PCBs.
- All UWR/PCB soil wastes and items used in the course of work, such as rags, absorbents, and protective clothing, shall be stored in sealed DOT 17C open type drums or other waster container approved for the storage of these materials.
- Any UWR/PCB article container, other than approved DOT drums described above, that is intended for the storage, shall be submitted to the Owner or Owner's Representative for approval.

2.2. Solvents, Cleaning Agents, and Absorbents

- An appropriate solvent in which UWR are shown to be soluble in will be selected. An appropriate solvent, in which PCBs are shown to be at least 5% soluble, by weight, will be selected. Solvents specified by the USEPA include: kerosene, diesel fuel, terpene hydrocarbons, and a mixture of terpene hydrocarbons and terpene alcohols. Care should be taken to limit the complexity of the waste stream. In all cases where solvents are used in the course of work, proper ventilation shall be provided by the Contractor to insure that the resulting fumes/vapors are not dispersed to occupied building areas either as a result of natural convection or via air intakes for building ventilation systems. The manufacturer's recommendations for applications and requirements for California Occupational Safety and Health Administration (Cal-OSHA) shall be strictly observed.
- An appropriate cleaning agent in which UWR are shown to be soluble in will be selected. An appropriate cleaning agent in which PCBs are shown to be at least 5% soluble, by weight, will be selected. Care should be taken to limit the complexity of the waste stream. Numerous non-toxic cleaning agents, shown to meet or exceed the solubility standard, are commercially available. In all cases where cleaning agents are used in the course of work, proper ventilation shall be provided by the Contractor to ensure that the resulting fumes/vapors are not dispersed to occupied building areas either as a result of natural convection or via air intakes for building ventilation systems. The manufacturer's recommendations for applications and requirements for Cal-OSHA shall be strictly observed.
- Safestep, as manufactured by Andesite of California, Inc. or functional equivalent, approved by the Owner's Representative, will be used as an absorbent.

3. SAFETY PROCEDURES AND WORKER PROTECTION

3.1. General Precautions

- The Contractor shall take all precautions and measures required to protect employees, inspection personnel, the Owner's Representative, and the general public from exposure to UWR/PCB solids, liquids, and vapors.
- All personnel authorized for entry into the work areas shall be instructed in the proper procedures for working with or around electrical hazards and UWR/PCB-containing/contaminated materials.

- All electrical equipment, upon which UWR/PCB-related activities are to be performed, shall be de-energized, locked out/tagged out, and permanently disconnected from any power source prior to the commencement of work.
- Consumption of food or tobacco products shall not be permitted in any of the work areas where UWR/PCB materials, volatile solvents, or other hazardous materials are present. In addition, no open flames shall be permitted in these areas. Signage to this effect will be posted at each entry and exit from the work areas.

3.2. Work Area Protection and Demarcation

- Prior to commencing any UWR/PCB-related work activities, the Contractor will provide barricades, roping, and warning signs to clearly identify and effectively guard against unauthorized entry into the work area.
 - At a minimum, barricades may consist of yellow sawhorses, set end-to-end.
 - Ropes are to be yellow in color and supported by the use of weighted bottom pipe type supports.
 - Warning signs shall be suspended from the rope and placed at intervals of approximately 10 feet. Warning signs for the work area shall be approximately 18 inches square, with a yellow background and black lettering. Signs shall read "DANGER - KEEP OUT - TOXIC CHEMICAL WORK AREA".
- The Contractor will place barricades in order to maintain a minimum of 25 feet from all perimeters of the work being conducted to the barricades, where feasible.
- All equipment, such as tools and containers, shall be confined to the work area until the work is complete, containers are sealed, and equipment has been properly decontaminated and safely stored for transport.

3.3. Personal Protective Clothing, Equipment, and Personal Protective Procedures

- At all times when UWR/PCB fluids or mixtures in any volume are not sealed in drums, containers, or electrical equipment, workers shall wear the following:
 - Gloves impermeable to both UWR/PCB and the clean up agent in use.
 - Disposable coverall, impermeable to both UWR/PCB and the clean up agent in use.
 - Appropriate eye protection to ensure that eyes are protected from liquid splatter or exposure to concentrated vapors or fumes.
 - If appropriate, respiratory protection appropriate for the concentration of the hazardous material(s) present and atmosphere present. If utilized, supplied air must meet the requirements for Grade D air, at a minimum.

- The Contractor shall provide protective clothing, eye protection, and breathing apparatus, as required for authorized inspection personnel, the Owner, and/or the Owner's Representative upon request.
- The UWR/PCB work area shall not be left unattended from the start of work activities until all UWR/PCB and incidentals have been sealed in approved containers. If immediate transportation to a UWR/PCB storage facility or disposal facility is not feasible, the work area must be secured in a manner approved by the Owner or Owner's Representative.
- During work procedures and at all times when UWR/PCB-containing/contaminated fluids in any volume are not sealed in drums, containers, or electrical equipment, all personnel entering the work area must don protective clothing and equipment. Upon exiting the work area, all disposable protective clothing shall be stored in appropriate waste storage drums and sealed, for subsequent transportation to the on-site storage facility or disposal facility.
- Workers with cuts or scratches shall cover these wounds sufficiently to prevent accidental contact with hazardous materials with the regulated work area, prior to entering the regulated work area. Similarly, workers who incur accidental minor cuts or scratches in the course of work activities will immediately leave the work area, cleanse the wound with a medical grade soap, and seal the wound before returning to the work area.

4. EXECUTION

4.1. Spill Clean-up, Containerization, and Marking

4.1.1. Clean-up of Work Area, UWR/PCB, and Spills

- After the last UWR/PCB-containing light ballast has been removed and all fluids and solids have been cleaned from the fixture, all tools and equipment used in the work shall be decontaminated and properly stored for future use.
- All tools that have come into contact with UWR/PCBs at any concentration will be thoroughly double washed/rinsed with an appropriate cleaning agent, wiped cleaned, and properly stored.
- At a minimum, all exterior surfaces of equipment that may have come into contact with UWR/PCBs or contaminated solids or fluids either during the course of work activities or due to past leaks will be double washed/rinsed with an appropriate cleaning agent and wiped clean.
- All metal surfaces and surfaces with impermeable liners which have come into contact with UWR/PCBs or UWR/PCB mixtures in the course of work or as a result of past leaks shall be thoroughly cleaned using a combination of absorbents and solvents or cleaning agents. Minimum cleaning requirements for these surfaces will include the removal of bulk material and two rinses with the cleaning agent for the affected surfaces. The work area shall be effectively ventilated during operations such that vapors used during decontamination and cleaning are not vented to occupied building areas. Upon completion of UWR/PCB-related activities, if fumes or vapors are still present in levels that could impede breathing or be considered toxic under state and/or National Institute of Occupational Safety and Health (NIOSH) standards, the Contractor will provide additional ventilation to accelerate drying. If

needed, auxiliary breathing apparatus may only be used by personnel trained in the use of this equipment and experienced in conducting UWR/PCB-related work while wearing such apparatus, which can impede safe work practices.

- The USEPA, Region IX, regards soil, asphalt, wood, cement, and concrete as porous materials that absorb UWR/PCBs. Where practical, these materials must be removed when they are within the spill or contamination boundary.
- Completion of decontamination activities shall be inspected by the Contractor's Environmental Monitor, by collecting an appropriate number and type of samples for the specific UWR and/or PCBs and surfaces. The Contractor is responsible for all cost associated with spill clean up and oversight.

4.1.2. Containerization and Marking

- All liquids generated as a result of work activities and clean up operation shall be placed in appropriate work containers and the containers sealed.
- All solids, such as absorbents, rags, disposable clothing, soil, and other incidentals, shall be placed in appropriate work containers and the containers sealed.
- All drums and items containers utilized shall be permanently marked as to the specific contents and dated. In addition, each drum and container shall be marked with the standard Environmental Protection Agency (EPA), UWR ML or PCB ML label, as appropriate (40 CFR 273) and Hazardous Waste label (40 CFR 262).

4.2. Handling and Transportation to Storage Facilities

- All closed and open top drums must be permanently sealed and marked prior to loading on the transport vehicle. Filled drums shall be loaded onto the transport vehicle by the following methods:
 - By a hoist or lift truck capable of utilizing a two-point drum lifter,
 - By a hoist or lift truck provided with a band-around type drum lifter, or
 - By a lift truck lifting the drums from underneath by a pallet attached to the drum by a banding arrangement.
- The drums shall not be lifted by:
 - Any rope, chain, or cloth slings tied about the drum,
 - Placement of drums on bare fork lift trucks,
 - Forcing drums between the forks of a lift truck, or
 - Any commercial drum lifter exerting force on the sides of the drums.

- All drums and containers shall be secured to the transport vehicle to prevent movement while in transit.

4.3. Transportation to the Storage Facility

4.3.1. General

- All UWR/PCB items and all drums containing liquids, solids, and incidentals shall be transported to an off-site UWR/PCB-approved and permitted recycling/disposal facility.
- The Contractor performing this section of the work shall be licensed for the transport and hauling of extremely hazardous waste. The Contractor shall provide a route plan, which clearly identifies the routes that he proposes to follow while transporting UWR/PCB items from the various work sites to off-site facilities.
- A minimum of two operators shall be in attendance at all times with UWR/PCB items are being transported, loaded, and unloaded.

4.3.2. General Provisions

- The specifications in the following sections apply to each motor carrier engaged in the transportation of hazardous materials by a motor vehicle that must be marked or placarded in accordance with DOT 177.
- These specifications include each officer or employee of the carrier who performs supervisory duties related to the transportation of UWR, PCBs, or hazardous materials and each person who operates and who is in charge of motor vehicle(s) transporting UWR, PCBs, or hazardous materials.

4.3.3. Compliance with Federal Motor Carrier Safety Rules

A motor carrier driver or other person must comply with the rules when he/she is transporting UWR, PCBs, or other hazardous materials by a motor vehicle, which must be marked or placarded in accordance with DOT 177.

4.3.4. State and Local Laws, Ordinances, and Regulations

Every motor vehicle transporting or storing items containing UWR, PCBs, or other hazardous materials must be operated and parked in compliance with the law, ordinances, and regulations of the state jurisdiction of which it is being operated in, unless they are at variance with specific regulations of the DOT, which are applicable to the operation of that vehicle and impose a more stringent obligation or restraint.

4.3.5. Binding and Tie-down

- If a motor vehicle transports UWR, PCBs, or other hazardous materials, all containers must be properly secured in place to ensure that no equipment items or containers can come loose or unsafely placed into the transport vehicle. This may include chaining, roping, strapping, or winching. The driver of the vehicle must stop the vehicle in a safe location at least once during each two hours or 100 miles traveled, whichever is less, and inspect the contents of the shipment. At the time of inspection, if any form of binding is found to be loose, the driver shall immediately take action to remedy the situation for safe transportation.
- Any equipment, drums, or other items carried in an open, flatbed, or stake type truck shall be covered with a tarp to protect it from the elements.

4.3.6. Hazardous Waste Instruction and Documentation

A motor carrier that transports "Hazardous Waste" must furnish the driver of each motor vehicle the following documents:

- A copy of these specifications.
- A document containing instructions on procedures to followed in the case of an accident or delay. The documents must include the names and telephone numbers of the people to be contacted, the types of hazardous wastes being transported, and the precautions taken in emergencies, such as fires, accidents, or leakages.
- Manifest and permit documents described in these specifications and required for waste transport.

4.3.7. Marking of Vehicles

A motor vehicle being operated must be marked if that vehicle is:

- Transporting UWR, PCBs, or hazardous materials of a kind that require the vehicle be marked or placarded in accordance with DOT 177 and;
- Commercial vehicles must display the name or trade name of the carrier operating the vehicle. These vehicles must display markings that designate the carrier as being a commercial vehicle "for hire".

4.4. UWR/PCB Disposal

The contractor shall treat and dispose of all collected UWR/PCB wastes collected and generated during the execution of the scope of work described in Section 1 of these specifications.

- Except as may be otherwise specifically directed by the Owner or Owner's Representative, the Contractor shall treat and dispose of all waste UWR/PCB materials as governed by 40 CFR 273, California State Regulations, local regulations, and subsequent amendments

- All UWR fluids, flushing fluids, and other UWR contaminants (**including coolants, gases and/or oils associated with elevator and/or HVAC systems**) shall be disposed of by incineration or recycling at a facility approved for such use by the USEPA, and all other controlling regulatory agencies and bodies of the state, county, and municipality of that's facility's location. If the Contractor so elects, solid UWR wastes may also be incinerated, as suitable and allowed for this type of disposal.
- All PCB fluids, flushing fluids, waste oils, and other fluid contaminants whose total PCB content is equal to or greater than 5 ppm (and are therefore restricted to this mode of thermal destruction) shall be disposed of by incineration or recycling at a facility approved for such use by the USEPA, and all other controlling regulatory agencies and bodies of the state, county, and municipality of that's facility's location. If the Contractor so elects, solid PCB wastes may also be incinerated, as suitable and allowed for this type of disposal.
- All UWR/PCB wastes generated as part of these operations will likewise be disposed of by the Contractor in a legal manner and the disposal will be included as part of the Contractor's bid.
- The Contractor shall not sell, transfer, or recover any material from the wastes received from the Owner with their prior written consent.

4.5. Manifests and Records

- The Contractor shall provide the Owner with a compliance certificate verifying that all wastes received by it have been properly treated and disposed.
- The Contractor shall provide the Owner with copies of all manifests, permits, or other documents currently in effect relating to the specific UWR/PCB wastes to be transported, treated, and disposed of herein, except as otherwise stated in this section. The Contractor shall also promptly furnish the Owner copies of all new or renewal permits or other documents applicable to this project as soon as the Contractor receives them.
- As the waste generator, the Owner will sign the complete waste manifests, upon approval, for all UWR/PCB items/wastes generated during the course of this project. These manifests will accompany the waste loads to disposal and be properly completed by the hauler and disposal agent, as required under federal and state hazardous waste management statutes. The final manifest shall be returned to the Owner by registered mail within the designated time period under federal statutes.
- The project shall not be considered complete nor will the Owner issue final payment until the Owner receives certifications of incineration (for fluids) and/or recycling.

4.6. Placement in Storage and Records

4.6.1. Unloading and Placement in Storage

- Transport vehicles will be unloaded utilizing the same equipment and methods as for loading (Section 4.2).
- Drums and other storage containers will be placed in storage facilities in locations designated by the Owner or Owner's Representative.

- Drums shall be placed on pallets of sufficient strength to withstand double stacking. Drums shall not be stacked at the time at the time of storage, unless space is limited as determined by the Owner or Owner's Representative. Where stacking of drums is necessary, pallets shall be placed between the drum layers.
- Ample clearance space will be provided around other storage containers in order to facilitate future inspections.
- Immediately following the unloading of the UWR/PCB transport vehicle, the cargo area shall be inspected to check for any fluid leaks. If any fluids are found, the source of the leaking drum or other storage container shall be identified and sealed.
- The contaminated cargo area shall be thoroughly washed/rinsed clean with absorbents, solvents, and liquid cleaners. Cleaning agents, solvents, and solids shall be place in proper drums for disposal.

4.6.2. Records

Upon completion of all UWR/PCB-related work activities, the Contractor shall provide a complete record of all activities and storage data to the Owner or Owner's Representative for the UWR/PCBs removed during the course of the project. The record shall include the following:

- Name of the firm performing the work of this section and technician in charge.
- Number and size of drums and other storage containers.
- Weight in kilograms or gallons of content for each drum or other storage container.
- Date placed in storage.

SECTION 03 10 00**CONCRETE FORMING AND ACCESSORIES**

PART 1 – GENERAL**1.1 SUMMARY**

- A. Section Includes: All labor, materials and equipment and all operations required to complete all formwork as indicated on the drawings; to produce shapes and configurations as shown, as required; and as specified herein, including:
 - 1. Forms, shores, bracing, removal and other operations as necessary for all cast-in-place concrete and masonry placed.
 - 2. Setting and securing anchor bolts and other metal items embedded in concrete into formwork, using materials and layouts furnished and delivered to jobsite as specified under other sections.
- B. Related Sections:
 - 1. Pertinent Sections of Division 03 specifying concrete construction.
 - 2. Pertinent Sections of other Divisions specifying work to be embedded in concrete or work penetrating concrete foundations and formwork.

1.2 REFERENCES

- A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC): Chapter 19 Concrete.
- B. American Concrete Institute (ACI) PRC-347 "Guide to Formwork for Concrete".
- C. American Plywood Association (APA) "Concrete Forming Guide".
- D. West Coast Lumberman Inspection Bureau (WCLIB) "Standard Grading Rules for West Coast Lumber".
- E. ACI MNL-066 "ACI Detailing Manual".
- F. ACI SPEC-301 "Specifications for Concrete Construction".
- G. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice".

1.3 DESIGN REQUIREMENTS

- A. Design, engineer, and construct formwork, shoring and bracing to conform to design and code requirements, resist imposed loads; resultant concrete to conform to required shape, line and dimension.

1.4 SUBMITTALS

- A. Limitation of review: Structural Engineer's review will be required only where specifically requested for general architectural applications and features only. Contractor is responsible for structural stability, load-resisting characteristics and sufficiency of form work design.

1.5 QUALITY ASSURANCE

- A. General: All form materials shall be new at start of work. Produce high quality concrete construction. Minimize defects due to joints, deflection of forms, roughness of forms, nonconforming materials, concrete or workmanship.
- B. Reuse of Forms: Plywood forms may be reused, if thoroughly cleaned of all dirt, mortar, and foreign materials, and undamaged at edges and contact face. Reuse shall be subject to permission from the Architect without exception, and issued in writing. Reuse of any panel which will produce a blemish on exposed concrete, will not be permitted.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Form Materials:
 - 1. Non-Exposed Surface Formwork Facing: Forms for concrete which is not exposed to view, may be of plywood as specified for exposed surfaces, or square edge 1x nominal Douglas Fir, Construction Grade, S4S.
 - 2. Exposed Surface Formwork Facing:
 - a. Forms for all exterior and interior concrete flat surfaces unless otherwise specified as board formed shall be new Douglas Fir Plywood (APA) ply, 5/8-inch, B-B Plyform, Class 1, Exterior Type, oiled and edged and edge-sealed conforming to U.S. Product Standard PS 1 in large sheet sizes to achieve joint patterns shown.
 - b. All exposed concrete edges shall be chamfered 3/4" minimum or as noted on the drawings.
 - 3. Exposed Surface Formwork - Special Pattern Form Liner:
 - a. Forms for all exterior and interior concrete flat surfaces indicated shall be as designated by Architect.
- B. Earth Forms: Allowed, subject to soil standing in excavations without ravel or caving.
- C. Form Release Agent: Spray-on compound, not affecting color, bond or subsequent treatment of concrete surfaces. Maximum VOC content shall comply with local requirements and California Green Building Code.

- D. Accessories: Types recommended by manufacturers or referenced standards to suit conditions indicated;
1. Anchors, spacers, void in-fill materials: sized to resist imposed loads.
 2. Form Ties: Prefabricated rod, flat band, or wire snap ties with 1" break-back or threaded internal disconnecting type with external holding devices of adequate bearing area. Ties shall permit tightening and spreading of forms and leave no metal closer than 1" to surface.
- E. Corner Chamfers and Rustications: Filleted, wood strip or foam type; sizes and shapes as detailed, or 3/4 x 3/4 inch size minimum if not detailed; maximum possible lengths.
- F. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.
- G. Foam Block Formwork: For use only where specified on drawings to create void space under or within concrete. ASTM D6817.

Use Case	InsulFoam Geofoam (or equivalent)	Maximum Density (pcf)	Compressiv e Resistance at 1% Deformation (psi)	Compressiv e Resistance at 5% Deformation (psi)	Compressiv e Resistance at 10% Deformation (psi)
1) Void formwork	EPS-15	0.90	3.6	8.0	10.2
2) Planters	EPS-19	1.14	5.8	13.1	16.0
3) Pedestrian Loads (≤100psf)	EPS-22	1.35	7.3	16.7	19.6
4) Vehicular Loads and Sidewalks (≤ 250psf)	EPS-39	2.40	15.0	35.0	40.0

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Inspect the substrate and the conditions under which concrete formwork is to be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected. Commencement of work indicates acceptance of substrates and conditions.
- B. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.2 EARTH FORMS

- A. If natural soil or compacted fill can be accurately cut and maintained, foundations and grade beams may be poured against earth without forming. Provide positive protection of trench top corners.
- B. Maintain earth forms free of water and foreign materials.

3.3 ERECTION – FORMWORK

- A. General: Construct formwork in accordance with calculations, and recommendations of ACI PRC-347. Construct forms to the sizes, shapes, lines and dimensions shown, and as required to obtain accurate alignment, location, grades, level and plumb work in finished structure. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required. Use selected materials to obtain required finishes.
 - 1. Construct cambers specified in concrete members and slabs in the formwork.
 - 2. Schedule the work and notify other trades in ample time so that provisions for their work in the formwork can be made without delaying progress of the project. Install all sleeves, pipes, etc. for building services systems, or other work. Secure information about and provide for all openings, offsets, recessed nailing blocks, channel chases, anchors, ties, inserts, etc. in the formwork before concrete placement.
 - 3. Deflection: Formwork and concrete with excessive deflection after concrete placement will be rejected. Excessive deflection is that which will produce visible and noticeable waves in the finished concrete.
 - 4. Measure formwork for elevated structural slabs, columns, wall elevations points of maximum camber and submit in writing to the Architect/Engineer prior to placing concrete.
- B. Formwork Construction: Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI SPEC-301. Uniform, substantial and sufficiently tight to prevent leakage of concrete paste, readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials. Tie, brace, shore, and support to insure stability against pressures from any source, without failure of any component part and without excessive deflection. Solidly butt joints and provide backup material at joints as required to prevent leakage and fins.
- C. Provide all openings, offsets, inserts, anchorages, blocking, and other features of the work as shown or required. See INSERTS, EMBEDDED PARTS, AND OPENINGS for detailed requirements.
- D. Warped, checked, or scuffed forms will be rejected.

- E. Maintain membranes, reinforcing and other work free of damage; protect with plywood runway boards or other positive, durable means.
- F. Align joints and make watertight. Keep form joints to a minimum.
- G. Provide fillet and chamfer strips on external corners of exposed locations and as indicated to form patterns in finished work. Extend patterns around corners and into alcoves, on backs of columns and similar locations not otherwise shown.
 - 1. Produce beveled, smooth, solid, unbroken lines, except as otherwise indicated to conform to patterns.
 - 2. Form corners and chamfers with 3/4 inch x 3/4 inch strips, unless otherwise indicated, accurately formed and surfaced to produce uniformly straight lines and tight edge joints. Extend terminal edges to required limit and miter chamfer at changes in direction.
- H. Unexposed corners may be formed either square or chamfered.
- I. Ties and Spreaders: Arrange in a pattern acceptable to the Architect when exposed. Snap-ties may be used except at joints between pours where threaded internal disconnecting type shall be used.
- J. Coordinate this section with other sections of work that require attachment of components to formwork.
- K. Reglets and Rebates: Accurately locate, size, and form all reglets and rebates required to receive work of other trades, including flashing, frames, and equipment.

3.4 APPLICATION - FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
- C. Do not allow excess form coating material to accumulate in the forms or to come into contact with reinforcement or surfaces which will be bonded to fresh concrete.
- D. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork will be rejected.
- E. Leave no residue or stain on the face of the concrete, nor affect bonding of subsequent finishes or work specified in other sections.

3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Provide formed openings where required for items to be embedded in passing through concrete work.

1. Provide openings in concrete formwork to accommodate work of other sections including those under separate contracts (if any). Size and location of openings, recesses and chases shall be in accordance with the section requiring such items. Accurately place and securely support items to be built into forms.
- B. Construction Joints: Construct and locate generally as indicated on Drawings and only at locations approved by Structural Engineer, so as not to impair the strength of the structure. Form keys in all cold joints shown or required.
- C. Locate and set in place items that will be cast directly into concrete.
- D. Rough Hardware and Miscellaneous Metal: Set inserts, sleeves, bolts, anchors, angles, and other items to be embedded in concrete. Set embedded bolts and sleeves for equipment to template and approved shop drawings prepared by trades supplying equipment.
- E. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.
- F. Wood Inserts and Nailers: Provide approved preservative-treated lumber. Set all required nailing blocks, grounds, and other inserts as required to produce results shown. Wood plugs shall not be used.
- G. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- H. Piping: Do not embed piping in structural concrete unless locations specifically approved by Structural Engineer.
- I. Conduit: Place conduit below slabs-on-grade and only as specifically detailed on structural drawings. Minimum clear distance between conduits shall be 3 diameters. Location shall be subject to Engineer's written approval and shall not impair the strength of the structure.
- J. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
 1. Provide openings for the introduction of vibrators at intervals necessary for proper placement.
 2. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.
- K. Install Form Liner inserts in accordance with manufacturer's recommendations, to produce patterns and textures indicated.

- L. Install waterstops in accordance with manufacturer's recommendations to provide continuous waterproof barrier.

3.6 FORM CLEANING

- A. Clean forms as erection proceeds, remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.
 - 1. Remove all dirt, chips, sawdust, rubbish, water and foreign materials detrimental to concrete.
 - 2. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

3.7 FOOTINGS

- A. Verify elevations and provide final excavation required for footings prior to placing of concrete.

3.8 EQUIPMENT BASES

- A. Form concrete bases for all mechanical and electrical equipment in accordance with approved shop details furnished by other sections.
- B. Sizes and locations as indicated and as required to produce results shown.
- C. Provide coved base for all equipment bases placed on concrete slabs.

3.9 FORMWORK TOLERANCES

- A. Construct formwork to maintain tolerances required by ACI SPEC-301.

3.10 FOAM BLOCK FORMWORK

- A. Blocks shall be placed on prepared leveling course for level bearing. Place adjacent blocks in tight contact together. Where placed in multiple layers, orient long axis of upper layer at 90° to lower layer, and so forth for subsequent layers. Anchor blocks as required to prevent movement prior to and during concrete placement. Do not expose to hydrocarbons, solvents, or coal tar.

3.11 FIELD QUALITY CONTROL

- A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.
- B. Do not reuse wood formwork more than 2 times for concrete surfaces to be exposed to view. Do not patch formwork.

- C. Clean and repair surfaces to be re-used in the work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact surfaces as specified for new formwork.
- D. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets.

3.12 FORM REMOVAL

- A. Do not loosen or remove forms before minimum curing period has elapsed without employment of appropriate alternate curing methods, approved by the Architect in writing.
- B. Remove forms without damage to the concrete using means to ensure complete safety of the structure and without damage to exposed beams, columns, wall edges, chamfers and inserts. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- C. Do not remove forms until the concrete has hardened sufficiently to permit safe removal and the concrete has attained sufficient strength to safely support imposed loads. The minimum elapsed time for removal of forms after concrete has been placed shall be as follows:
 - 1. Columns and Walls: 7 days, provided members are not subjected to overhead loads.
 - 2. Retaining Walls: 21 days minimum.
 - 3. Footings: 7 days minimum. If backfilled immediately, side forms may be removed 24 hours after concrete is placed.
 - 4. Beams, elevated slab, and similar overhead conditions: 28 days unless adequate shoring is provided.
- D. Durations listed above are minimums and are subject to extension at the sole judgment of the Architect/Engineer.
- E. Reshoring: Reshore members where and if required by Formwork Design Engineer.
- F. Do not subject concrete to superimposed loads (structure or construction) until it has attained full specified design strength, nor for a period of at least 14 days after placing.
- G. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

3.13 CLEANING

- A. Remove excess material and debris associated with this work from the job site.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCING

PART 1 – GENERAL**1.1 SUMMARY****A. Section Includes:**

1. Reinforcing steel work for all concrete and masonry work as indicated on the drawings and specified herein.
2. Coordinate this work with other work affected by these operations, such as forms, electrical work, mechanical work, structural steel, masonry and concrete.

B. Related Sections:

1. Pertinent Sections of Division 01 specifying Quality Control and Testing Laboratory services.
2. Pertinent Sections of Divisions 03 specifying concrete construction.
3. Pertinent Sections of Divisions 04 specifying masonry construction.
4. Pertinent Sections of other Divisions specifying work to be embedded in concrete or work penetrating concrete work.

1.2 REFERENCE STANDARDS

- A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC) Chapter 19 Concrete.
- B. American Concrete Institute (ACI) SPEC-301 "Specifications for Concrete Construction".
- C. ACI CODE-318 "Building Code Requirements for Structural Concrete and Commentary".
- D. ACI MNL-066 "ACI Detailing Manual".
- E. ASTM International (ASTM) A1064 "Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete".
- F. ASTM A615 "Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement".
- G. ASTM A706 "Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement".

- H. American Welding Society (AWS) D1.4 – “Structural Welding Code - Steel Reinforcing Bars”.
- I. Concrete Reinforcing Steel Institute (CRSI) - “Manual of Standard Practice”.
- J. CRSI - “Placing Reinforcing Bars”.

1.3 SUBMITTALS

- A. Submit in accordance with pertinent sections of Division 01 specifying submittal procedures. Submit for review prior to fabrication.
- B. Limitation of Review: Structural Engineer's review will be for general conformance with design intent as indicated in the Contract Documents and does not relieve Contractor of full responsibility for conformance with the Contract Documents. The General Contractor shall review and approve shop drawings prior to submittal to the Architect/Engineer.
- C. Shop Drawings: Show complete fabrication and placing details of all reinforcing steel. Comply with requirements of ACI MNL-66. Include:
 - 1. Bar sizes and schedules;
 - 2. Shapes of bent bars, layout and spacing of bars, location of splices.
 - 3. Stirrup spacing, arrangements and assemblies,
 - 4. References to Contract Document detail numbers and designations.
 - 5. Wall elevations corresponding to elevations shown in Contract Documents.
- D. Product Data: Submit manufacturer's product data, specifications, location and installation instructions for proprietary materials and reinforcement accessories. Provide samples of these items upon request.
- E. Certificates: Submit all certifications of physical and chemical properties of steel for each heat number as manufactured, including location of material in structure as specified below in Article titled QUALITY ASSURANCE. All materials supplied shall be tagged with heat numbers matching submitted Mill Test Report analyses.
- F. Samples: Provide to the Owner's Testing laboratory as specified in Article SOURCE QUALITY CONTROL.

1.4 QUALITY ASSURANCE

- A. Perform work of this Section in accordance with the CRSI “Manual of Standard Practice”, CRSI “Placing Reinforcing Bars”, ACI SPEC-301, and ACI CODE-318.
- B. Requirements of Regulatory Agencies, refer to pertinent Sections of Division 01 and CBC.

- C. Certification and Identification of Materials and Uses: Provide Owner's Testing Agency with access to fabrication plant to facilitate inspection of reinforcement. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection and all material identification/test information listed below.
 - 1. Provide manufacturer's Mill Test Reports for all materials. Include chemical and physical properties of the material for each heat number manufactured. Tag all fabricated materials with heat number.
 - 2. Provide letter certifying all materials supplied are from heat numbers covered by supplied mill certificates. Include in letter the physical location of each grade of reinforcing and/or heat number in the project (i.e. foundations, walls, etc.).
 - 3. Unidentified Material Tests: Where identification of materials by heat number to mill tests cannot be made, Owner's Testing Agency shall test unidentified materials as described below.
- D. Testing and Inspection: Tests and Inspections required by Independent Testing Agency are specified below in Articles SOURCE QUALITY CONTROL and FIELD QUALITY CONTROL. Duties and limitations of Independent Testing Agency, test costs and test reports in conformance with pertinent Sections of Division 01.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Comply with pertinent requirements of Division 01.
- B. Deliver reinforcement to project site in bundles marked with durable tags indicating heat number, mill, bar size and length, proposed location in the structure and other information corresponding with markings shown on placement diagrams.
- C. Handle and store materials above ground to prevent damage, contamination or accumulation of dirt or rust.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Reinforcing Steel: Deformed billet steel bars, ASTM A706 Grade 60 or ASTM A615 Grade 60.
 - 1. Welded reinforcement shall be ASTM A706, or A615 meeting carbon requirements of AWS D1.4. Welding shall conform with AWS D1.4.
 - 2. All reinforcement to be unfinished.
 - 3. ASTM A615 reinforcement at special structural concrete walls, concrete coupling beams, and special concrete moment frames shall have maximum yield stress of 78,000 psi and the tensile strength shall be

greater than 125% of the actual yield strength. Test ASTM A615 reinforcement for conformance to these criteria prior to fabrication and/or installation.

- B. Welded Wire Reinforcement: ASTM A1064.
- C. Tie Wire: No. 16 AWG or heavier, black annealed.
- D. Concrete Blocks: On-grade conditions only, as required to support reinforcing bars in position.
- E. Reinforcing Supports: Plastic or galvanized steel chairs, bolsters, bar supports, or spacers sized and shaped for adequate support of reinforcement and construction loads imposed during concrete placement, meeting ACI and CRSI standards.
 - 1. For use over formwork: Galvanized wire bar type supports complying with CRSI recommendations. Provide plastic tips where exposed to view or weather after removal of formwork. Do not use wood, brick, or other unacceptable materials.
- F. Reinforcement Splice Couplers: For use only where specified on drawings. Submit other locations proposed for use to Engineer for review. "L-Series Bar Lock" Coupler Systems for Splicing Reinforcement Bars, UES ER-0319, by Dayton-Superior Corporation.

2.2 FABRICATION

- A. Fabricate concrete reinforcing in accordance with CRSI (DA4), unless specifically shown otherwise. Details not specifically shown or indicated shall conform to SP-066 and specified codes and standards.
 - 1. Accurately shop-fabricate to shapes, bends, sizes, gauges and lengths indicated or otherwise required.
 - 2. Bend bars once only. Discard bars improperly bent due to fabricating or other errors and provide new material; do not re-bend or straighten unless specifically indicated. Rebending of reinforcement in the field is not allowed.
 - 3. Do not bend reinforcement in a manner that will injure or weaken the material or the embedding concrete.
 - 4. Do not heat reinforcement for bending. Heat-bent materials will be rejected.
- B. Unacceptable materials: Reinforcement with any of the following defects will not be permitted in the work.
 - 1. Bar lengths, depths and bends exceeding specified fabrication tolerances.
 - 2. Bends or kinks not indicated on Drawings or final shop drawings.

3. Bars with reduced cross-section due to rusting or other cause.
- C. Tag reinforcement with durable identification to facilitate sorting and placing.
- D. Shop Fusion Welded Stirrup/Tie/Spiral Cages
 1. Shop fusion welding of stirrup/tie/spiral cages is permitted to aid in fabrication and handling. The following requirements shall be met.
 2. All reinforcing bars receiving weld shall be ASTM A706.
 3. Longitudinal holding wires shall be ASTM A1064.
 4. Shop welding shall be performed by machines under a continuous, controlled process.
 5. Quality control tests shall be performed on shop-welded specimens and the test results shall be available, upon request, to the Architect/Engineer.
 6. Tack welding of reinforcing steel is not permitted.
 7. Welding of any type shall not occur at 90°, 135°, or 180° bends. Circular ties and spirals may be shop fusion welded outside of areas with 90°, 135°, or 180° hook bends.
 8. Longitudinal bars shall not be welded to stirrups/ties/spirals.

2.3 SOURCE QUALITY CONTROL

- A. The Testing Agency, as specified in the Article QUALITY ASSURANCE, will perform the following:
 1. Material Testing:
 - a. Identified Steel: When samples are taken from bundled steel identified by heat number, matched with accompanying mill analyses as delivered from the mill, supplemental testing of reinforcing steel is not required.
 - b. Unidentified Steel: When identification of materials by heat number matched to accompanying mill analyses cannot be made, perform one tensile test and one bend test per each two and one-half tons or fraction thereof for each required size of reinforcing steel. Tests of unidentified steel shall be performed by the Owner's Testing Agency and costs for these tests shall be paid by the Contractor by deductive change order.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Inspect the conditions under which concrete reinforcement is to be placed. Do not proceed with the work until unsatisfactory conditions have been corrected.

- B. Coordinate with work of other sections to avoid conflicts or interference. Bring conflicts between reinforcement and other elements to Architect's attention. Resolve conflicts before concrete is placed.
- C. Notify Architect, Structural Engineer, and Authority Having Jurisdiction for review of steel placement not less than 48 hours before placing concrete.

3.2 PLACEMENT

- A. General: Comply with the specified codes and standards, and Concrete Reinforcing Steel Institute recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.
- B. Clean bars free of substances which are detrimental to bonding. Maintain reinforcement clean until embedded in concrete.
- C. Place reinforcement to obtain the minimum coverages for concrete protection. Do not deviate from required position. Maintain required distance, spacing and clearance between bars, forms, and ground.
- D. Location and Support: Provide metal chairs, runners, bolsters, spacers and hangers, as required.
- E. Provide additional steel reinforcement as necessary or as directed, to act as spreaders or separators to maintain proper positioning.
- F. Tying and Attachment: Securely tie at all intersections and supports with wire. Prevent dislocation or movement during placement of concrete. Direct twisted ends of wire ties away from exposed concrete surfaces.
- G. Separate reinforcing from pipes or conduits with approved non-metallic separators. Do not use wood or steel form stakes or reinforcement used as stakes as support for reinforcement.
- H. Accommodate placement of formed openings required by other sections.
- I. Obstructions:
 - 1. Where obstructions, block-outs, or penetrations (conduits, raceways, ductwork) prevent continuous placement of reinforcement as indicated, provide additional reinforcing as detailed and as directed by the Structural Engineer to supplement the indicated reinforcement around the obstruction.
 - 2. Place additional trim bars, ties, stirrups, or other elements as detailed and as directed at all opening, sleeves, pipes or other penetrations through structural elements.
- J. Welded Wire Reinforcement: Reinforce slabs with 6"x 6"-W1.4 x W1.4 welded wire reinforcement reinforcing, unless otherwise noted on drawings.

1. Provide flat sheets only, no rolls. Straighten, cut to required size, and lay out flat in place.
2. Securely wire-tie reinforcement to other reinforcement at frequent intervals.
3. Extend reinforcement over supporting beams and walls, and to within 1 inch of edge of slabs, construction joints, and expansion joints.
4. Support reinforcement in mid-depth of slab.
5. Lift reinforcement at intervals as slab concrete is placed, ensure proper embedment.

3.3 REINFORCING SPACING AND COVERAGE

- A. Spacing: Do not space bars closer than four (4) diameters of the largest of two adjacent bars, except at bar laps, which shall be placed such that a minimum of 2 bar diameters is clear between bars.
- B. Where reinforcing in members is placed in two layers, the distance between layers shall not be less than four bar diameters of the largest bar and the bars in the upper layers shall be placed directly above those in the bottom layer, unless otherwise detailed or dimensioned.
- C. Coverage of bars (including stirrups and columns ties) shall be as follows, unless otherwise shown:
 1. Concrete cast against earth or grade: 3 inches.
 2. Concrete exposed to weather or formed and exposed to earth:
 - a. #5 & smaller: 1-1/2 inches.
 - b. #6 & larger: 2 inches.
 3. Concrete not exposed to earth or weather:
 - a. #5 & smaller: 1 inch.
 - b. #6 & larger: 1-1/2 inches.

3.4 DOWELS, SPLICES, OFFSETS AND BENDS

- A. Provide standard reinforcement splices at splices, corners, and intersections by lapping ends, placing bars in contact, and tightly tying with wire at each end. Comply with details shown on structural drawings and requirements of ACI CODE-318.
- B. Provide minimum 1-1/2 inch clearance between sets of splices. Stagger splices in horizontal bars so that adjacent splices will be 4 feet apart.

- C. Laps of welded wire reinforcement shall be at least two times the spacing of the members in the direction lapped but not less than twelve inches.
- D. Splices of reinforcement shall not be made at points of maximum stress. Provide splice lengths as noted on the structural drawings, with sufficient lap to transfer the stress between bars by bond and shear.
- E. Spacing:
 - 1. Space bars minimum distance specified and all lapped bars 2 bar diameters (minimum) clear of the next bar.
 - 2. Stagger splices of adjacent bars where possible and where required to maintain bar clearance.
 - 3. Beam or slab top bars shall be spliced mid-span of column support and bottom bars spliced at column supports.
 - 4. Request Architect/Engineer review prior to placement for all splices not shown on the drawings.
- F. Reinforcement Couplers: Install at all locations indicated. Install couplers in accordance with manufacturer's recommendations.

3.5 WELDING

- A. No reinforcing shall be welded unless specifically indicated. No reinforcing shall be welded without prior approval of the Structural Engineer and the Authority Having Jurisdiction.
- B. Only when so approved for use as noted above, all welding shall conform to AWS D1.4, ACI CODE-318, and the following;
 - 1. All welding performed by certified welders.
 - 2. All reinforcement requires preheat prior to welding. All preheat and welding shall be continuously inspected by the Testing Agency.

3.6 MISPLACED REINFORCEMENT

- A. Notify Architect/Engineer immediately if reinforcing bars are known to be misplaced after concrete has been placed.
- B. Perform no correction or cutting without specific direction. Do not bend or kink misplaced bars.
- C. Correct misplaced reinforcing only as directed in writing by the Architect/Engineer. Bear all costs of redesign, new, or additional reinforcing required because of misplaced bars at Contractor's expense.

3.7 FIELD QUALITY CONTROL

- A. The Testing Agency as specified in the Article QUALITY ASSURANCE, will inspect the work for conformance to contract documents before concrete placement.
 - 1. Inspection: Provide inspection and verification of installed reinforcement. Confirm that the surface of the rebar is free of form release oil or other coatings.
 - 2. Inspect all preheat and welding activities for steel reinforcement, when these occur.
 - 3. Exception: Shallow foundations & non-structural slabs-on-grade supporting buildings of no greater than three stories and either of concrete design strength 2500psi (or greater) or supporting light-frame construction do not require special inspection. Non-structural patios, driveways, and sidewalks do not require special inspection.

3.8 CLEANING

- A. Remove excess material and debris associated with this work from the job site.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 – GENERAL**1.1 SUMMARY**

- A. Section Includes: Provide all labor, materials, equipment and services to complete all concrete work required, including, but not limited to, the following:
1. Foundations, beams, columns, elevated slabs, slabs-on-ground, walls, and retaining walls.
 2. Installation of all bolts, inserts, sleeves, connections, etc. in the concrete.
 3. Joint devices associated with concrete work.
 4. Miscellaneous concrete elements, including, but not limited to: equipment pads, light pole bases, flagpole bases, thrust blocks, and manholes.
 5. Concrete curing.
 6. Coordination with other sections:
 - a. Make all preparations and do all work necessary to receive or adjoin other work. Install all bolts and anchors, including those furnished by other sections, into formwork and provide all required blocking.
 - b. Install all accessories embedded in the concrete and provide all holes, blockouts and similar provisions necessary for the work of other sections. Provide all patching or cutting made necessary by failure or delay in complying with this requirement at the Contractor's expense.
 - c. Coordinate with other sections for the accurate location of embedded accessories.
- B. Related Sections:
1. Pertinent Sections of Division 01 specifying Quality Control and Testing Laboratory services.
 2. Pertinent Sections of Division 03 specifying concrete construction.
 3. Pertinent Sections of other Divisions specifying work to be embedded in concrete or work penetrating concrete.
 4. Pertinent sections of other Divisions specifying floor finishes and sealants applied to concrete substrates.

1.2 REFERENCES

- A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC) Chapter 19 Concrete.
- B. American Concrete Institute (ACI) PRC-211.1 "Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete"

- C. ACI PRC-213 "Guide for Structural Lightweight-Aggregate Concrete".
- D. ACI SPEC-301 "Specifications for Concrete Construction".
- E. ACI PRC-302.1 "Guide for Concrete Floor and Slab Construction".
- F. ACI PRC-304 "Guide for Measuring, Mixing, Transporting, and Placing Concrete".
- G. ACI SPEC-305.1 "Specification for Hot Weather Concreting".
- H. ACI SPEC-306.1 "Standard Specification for Cold Weather Concreting".
- I. ACI SPEC-308.1 "Specification for Curing Concrete".
- J. ACI CODE-318 "Building Code Requirements for Structural Concrete and Commentary".

1.3 SUBMITTALS

- A. Submit in accordance with pertinent sections of Division 01 specifying submittal procedures. The General Contractor shall review and approve shop drawings prior to submittal to the Architect/Engineer. Submittals that do not meet these requirements will be returned for correction without review. Submit for review prior to fabrication.
- B. Limitation of Review: Structural Engineer's review will be for general conformance with design intent as indicated in the Contract Documents and does not relieve Contractor of full responsibility for conformance with the Contract Documents.
- C. Product Data: Submit manufacturers' data on manufactured products and other concrete related materials such as bond breakers, cure/sealer, admixtures, etc. Demonstrate compliance with specified characteristics. Provide samples of items upon request.
- D. Mix Designs: Submit Mix Designs for each structural concrete type required for work per requirements of articles CONCRETE MIXES and QUALITY ASSURANCE. Resubmit revised designs for review if original designs are adjusted or changed for any reason. Non-Structural mixes need not be submitted for review by Structural Engineer.
- E. Shop Drawings: Proposed location of construction and cold joints. Proposed location of all slab construction/dowel joints, control joints, and blockouts.
- F. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent construction for concrete accessories.
- G. Batch Plant Ticket: Include with delivery of each load of concrete. Provide ticket to the Testing Agency and the Architect/Engineer as separate submittals. Concrete delivered to the site without such ticket shall be rejected and returned

to the plant. Each ticket shall include all information specified in Article SOURCE QUALITY CONTROL below.

- H. Engineering Analysis: Prepared by a California-licensed Civil or Structural Engineer, justifying construction-imposed loads on slabs, beams, and walls which exceed those allowed by CBC for the specified use.
 - 1. 2000 lbs maximum allowable construction load without analysis.
 - 2. 10,000 lbs maximum allowable construction load with analysis.
- I. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

1.4 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI SPEC-301 and ACI CODE-318.
- B. Concrete construction verification and inspection to conform to CBC 1705.3.
- C. Common Sourcing: Provide each of the following materials from consistent sources for entire project.
 - 1. Cement.
 - 2. Fly ash.
 - 3. Aggregate.
 - 4. Slag Cement.
- D. Follow requirements of ACI SPEC-305.1 when concreting during hot weather. Follow requirements of ACI SPEC-306.1 when concreting during cold weather.
- E. Services by the Independent Testing Agency (includes "Special" Inspections) as specified in this Section and as follows:
 - 1. Perform tests and inspections specified below in articles SOURCE QUALITY CONTROL and FIELD QUALITY CONTROL. Duties and limitations of Independent Testing Agency, test costs and reports to be in conformance with pertinent Sections of Division 01.
- F. Contractor shall bear the entire cost of remediation, removal, and/or replacement of concrete determined defective or non-conforming, including Architect/Engineer fees for redesign.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Materials specified by brand name shall be delivered in unbroken packages bearing manufacturer's label and shall be brand specified or an approved equal.

- B. Delivery, Handling and Storage of other materials shall conform to the applicable sections of the current editions of the various reference standards listed in this Section.
- C. Protect materials from weather or other damage. Sort to prevent inclusion of foreign materials.
- D. Specific Requirements:
 - 1. Cement: Protect against dampness, contamination, and warehouse set. Store in weather tight enclosures.
 - 2. Aggregates: Prevent excessive segregation, or contamination with other materials or other sizes of aggregates. Use only one supply source for each aggregate stock pile.
 - 3. Admixtures:
 - a. Store to prevent contamination, evaporation, or damage.
 - b. Protect liquid admixtures from freezing and extreme temperature ranges.
 - c. Agitate emulsions prior to use.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Cold Weather (Freezing or near-freezing temperatures) per ACI SPEC-306.1:
 - 1. Heat concrete materials before mixing, as necessary to deposit concrete at a temperature of at least 50°F but not more than 90°F.
 - 2. Do not place concrete during freezing, near-freezing weather, snow, rain or sleet unless protection from moisture and/or cold is provided.
 - 3. Protect from freezing and maintain at a temperature of at least 50°F for not less than seven days after placing. Take special precautions to protect transit-mixed concrete.
 - 4. No salts, chemical protection or admixture are permitted without written approval of Architect/Engineer.
 - 5. Contractor shall maintain an air temperature log for the first 7 days after placement with entry intervals not to exceed 8 hours.
- B. Hot Weather per ACI SPEC-305.1:
 - 1. Cool concrete materials before mixing, or add ice in lieu of mix water as necessary to deposit concrete at a temperature below 85°F.
 - 2. Do not place concrete in hot/windy weather without Architect/ Engineer review of procedures.
 - 3. Provide sunshades and/or wind breakers to protect concrete during finishing and immediate curing operations. Do not place slab concrete at air temperature exceeding 90°F.
 - 4. Provide modified mix designs, adding retarders to improve initial set times and applying evaporation reducers during hot/windy weather for review by Independent Testing Agency prior to use.

1.7 MOCK-UP

- A. Construct and erect mock-up panel for architectural concrete surfaces indicated to receive special treatment or finish, as result of formwork.
 - 1. Panel Size: Sufficient to illustrate full range of treatment.
 - 2. Number of Panels: 2.
 - 3. Locate as indicated on drawings.
- B. If requested by Architect / Engineer, cast concrete against mock-up panel. Obtain acceptance of resulting surface finish prior to erecting formwork.
- C. Accepted mock-up panel is considered basis of quality for the finished work. Keep mock-up exposed to view for duration of concrete work.
- D. Mock-up may remain as part of the Work.

1.8 SCHEDULING AND SEQUENCING

- A. Organize the work and employ shop and field crew(s) of sufficient size to minimize inspections by the Testing Agency.
- B. Provide schedule and sequence information to Testing Agency in writing upon request. Update information as work progresses.

PART 2 – PRODUCTS

2.1 FORMWORK

- A. Comply with requirements of Section 03 1000.

2.2 REINFORCEMENT

- A. Comply with requirements of Section 03 2000.

2.3 MATERIALS

- A. General Requirements: All materials shall be new and best of their class or kind. All materials found defective, unsuitable, or not as specified, will be condemned and promptly removed from the premises.
- B. Cementitious Materials:
 - 1. Portland Cement: ASTM C150, Type II, low alkali conforming to CBC 1903.1.
 - 2. Fly Ash (Pozzolan): ASTM C618, Class F.
 - 3. Slag Cement: ASTM C989, Grade 100 or 120.
- C. Concrete Aggregates:
 - 1. Coarse and Fine Aggregates: ASTM C33; Stone aggregate and sand. Specific source aggregate and/or sand or shrinkage characteristics as required for class of concrete specified.

2. Lightweight aggregate: ASTM C330 and C332.
 3. Source shall remain constant throughout the duration of the job. The exact portions of the fine aggregates and coarse aggregates to be used in the mix shall be determined by the mix design.
 4. Recycled concrete products: Returned plastic concrete may not be used in a mix. Recycled Concrete Aggregate (RCA) is not permitted. Reclaimed coarse aggregate is permitted and shall comply with ASTM C33. Reclaimed fine aggregate is not permitted.
- D. Water: ASTM C1602. Potable, clean, from domestic source.
- E. Admixtures: All admixtures shall be used in strict accordance with the manufacturer's recommendations. Admixtures containing calcium chlorides or other accelerators shall not be used without the approval of the Architect/Engineer and the Owner's Testing Laboratory.
1. Normal or Mid Range Water Reducing Admixtures: ASTM C494 Type A, "MasterPozzolith" series or "MasterPolyheed" series by Master Builders Solutions, "WRDA" series by W.R. Grace, or equal.
 2. Water Reducing Admixture and Retarder: ASTM C494 Type B or D, "MasterSet R" series or "MasterSet DELVO" series by Master Builders Solutions, "Plastiflow-R" by Nox-crete, or equal.
 3. High Range Water-Reducing Admixtures: ASTM C494 Type F, "MasterRheoBuild 1000" or "MasterGlenium" series by Master Builders Solutions or equal.
 4. Air Entraining Admixtures: ASTM C260, "MasterAir" series by Master Builders Solutions or equal.
 5. Viscosity Modifiers: ASTM C494 Type S, "MasterMatrix VMA" series by Master Builders Solutions or equal..
- F. Slurry: Same proportion of cement to fine aggregates used in the regular concrete mix (i.e. only coarse aggregate omitted); well mixed with water to produce a thick consistency.
- G. High Strength Grout: See section 05 1200 or 05 1100 for requirements.
- H. Dry Pack: Dry pack (used only for cosmetic concrete repairs) shall consist of:
1. One part cement to 2-1/2 parts fine aggregate (screen out all materials retained on No.4 sieve), mixed with a minimum amount of water, added in small amounts.
 2. Mix to consistency such that a ball of the mixture compressed in the hand will retain its shape, showing finger marks, but without showing any surface water.

2.4 ACCESSORIES

- A. Bonding Agent: ASTM C881, Type II Grade 2 Class B or C. Do not allow epoxy to set before placing fresh concrete.
1. "MasterEmaco ADH 326" by Master Builders Solutions;

2. "Rezi-Weld 1000" by W.R. Meadows.
- B. Chemical Hardener: Fluorosilicate solution designed for densification of cured concrete slabs. "MasterKure HD 300 WB" by Master Builders Solutions, "LIQUI-HARD" W.R. Meadows Co, or equal.
- C. Moisture-Retaining Cover: ASTM C171, type 1, one of the following;
1. Regular Curing Paper, Type I, reinforced waterproof: Fortifiber Corporation "Orange Label Sisalkraft", "Pabcotite" paper, or equal.
 2. Polyethylene Film: ASTM D 2103, 4 mil thick, clear or white color.
 3. White-burlap-polyethylene sheet, weighing not less than 10 oz/per linear yd.
- D. Liquid Curing Compound: ASTM C 309, Type 1, Class B, clear or translucent, 25% minimum solids, water base acrylic cure/sealer which will not discolor concrete and compatible with bonding of finishes specified in related sections. W.R. Meadows Co. "Vocomp 25" or equal. Maximum VOC content shall comply with local requirements and California Green Building Code.
- E. Under Slab Water Vapor Retarder: Vapor retarder sheet to be ASTM E1745 Class A; 15 mil, single ply extruded polyolefin; permeance no greater than 0.01 U.S. Perms per ASTM E154, ASTM E96 procedure B or ASTM F1249.
1. "Stego Wrap Vapor Barrier (15mil)" by Stego Industries LLC.
 2. "Vaporguard" by Reef Industries.
 3. Approved Equal.
- F. Evaporation Reducer: "MasterKure ER 50", by Master Builders Solutions.
- G. Permeability Reducer: Use only where specifically referred to.
1. ASTM C494 Type S.
 2. Admixture Type: Xypex Chemical Corporation "XYPEX Admix C-500", Master Builders Solutions "MasterLife 300" series. Dosage: per manufacturer.
 3. Surface-Applied Type: Xypex Chemical Corporation "XYPEX Concentrate. Brush application: 1.25-1.50lb/sq. yd., 5 parts powder to 2 parts water. Master Builders Solutions "MasterSeal 500". Slurry coat: one part water to 2.25-2.5 parts powder by volume.
 4. Approved equal.

2.5 JOINT DEVICES AND MATERIALS

- A. Waterstops: Resilient type, meeting Corps of Engineers CRD-C 572. Consult manufacturer for appropriate product for specific use. Submit for review. Install per manufacturers recommendation. Provide W. R. Meadows "Seal Tight" PVC waterstop, Sika "Greenstreak" PVC waterstop, or approved equal.

- B. Expansion Joint Filler: ASTM D1751, Nonextruding, resilient asphalt impregnated fiberboard or felt, 3/8 inch thick and 4 inches deep; tongue and groove profile.
 - 1. Products: "Serviced Products", W.R. Meadows, Inc., "National Expansion Joint Company", "Celotex Corporation", or equal.
- C. Joint Filler: ASTM D944, Compressible asphalt mastic with felt facers, 1/4 inch thick and 4 inches deep.
- D. Sealant and Primer: As specified in Section 07 9000.
- E. Slab Joint Sealant: Compatible with floor finishes specified in related sections.

2.6 CONCRETE MIXES

- A. General requirements for mix design and submittal of structural class concrete:
 - 1. Provide Contractor submittals to Architect/Engineer not less than 15 days before placing concrete.
 - 2. Contractor shall review mix designs and proposed placing requirements prior to submittal for compatibility to ensure that the concrete as designed can be placed in accordance with the drawings and specifications.
 - 3. Changes or revisions require re-submittal: All variations to approved mix designs, including changing type and/or quantity of admixtures shall be resubmitted to the Architect/Engineer for review prior to use.
 - 4. Mix design(s) for all structural classes of concrete to be prepared by qualified person experienced in mix design. Allow for time necessary to do trial batch testing when required.
 - 5. Preparer to provide backup data and certify in writing that mix design meets:
 - a. Requirements of the specifications for concrete durability and quality;
 - b. Requirements of the California Building Code and ACI CODE-318, including break histories, trial batching test results, and/or a mix designed by a California Registered Civil Engineer per ACI CODE-318 and bearing the Engineer's seal & signature.
 - 6. Clearly note on mix designs with specified maximum W/CM if design permits addition of water on site, or clearly identify in the mix design that no water is to be added on site.
 - 7. Deviations: Clearly indicate proposed deviations, and provide written explanation explaining how the deviating mix design(s) will provide equivalent or better concrete product(s) than those specified.
 - 8. Include adjustments to reviewed mix designs to account for weather conditions and similar factors.
- B. Proportioning - General: The following provisions apply to all mix designs:

1. Proportion concrete mixes to produce concrete of required average strength (as defined by ACI CODE-318). Select slump, aggregate sizes, shrinkage, and consistency that will allow thorough compaction without excessive puddling, spading, or vibration, and without permitting the materials to segregate, or allow free water to collect on the surface.
 2. Select aggregate size and type to produce dense, uniform concrete with low to moderate shrinkage, free from rock pockets, honeycomb and other irregularities.
 3. Mix designs may include water reducing and retarding admixtures to meet or exceed minimum set times (time required to place and finish) and to minimize Water-Cementitious Materials (W/CM). Minimum and maximum criteria presented in this section are guidelines and do not represent a specific mix design.
 4. Cement Content: Minimum cement content indicates minimum sacks of cementitious material. Increasing cement content to increase early strengths or to achieve specified W/CM while maintaining water content is discouraged in order to minimize effects of shrinkage.
 - a. Substitution of fly ash for Portland cement on an equivalent weight basis up to 25% replacement is permitted, except at high early strength concrete. Replacement in excess of 25% is not permitted unless part of a specified mix design that has been submitted for review.
 - b. Substitution of slag cement for Portland cement on an equivalent weight basis up to 45% replacement is permitted, except at high early strength concrete. Replacement in excess of 45% is not permitted unless part of a specified mix design that has been submitted for review.
 - c. Such substitution requests may be denied by the Engineer.
 5. Water Content: Mix designs with a specified maximum W/CM may be designed with a lower WCR than specified in order to allow addition of water at the site.
 6. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI SPEC-301 and this section.
 - a. For trial mixtures method, employ independent testing agency acceptable to Architect/Engineer for preparing and reporting proposed mix designs.
 7. Placement Options: Mix designs may, at the Contractor's option, be designed for either pump or conventional placement with aggregate size, slumps, etc. to be maintained as specified in this section.
- C. Proportioning Normal Weight Concrete: Comply with ACI PRC-211.1 recommendations and this section.
- D. Special mix design requirements for interior concrete floor slabs-on-ground:
1. Proportion concrete mixes per this specification, ACI PRC-211.1, and the requirements below:

2. Fly Ash, shall be substituted for cement on a 1 lb. per 1 lb. basis, with a minimum replacement of 25% and a maximum of 35%. Alternatively, slag cement, shall be substituted for cement on a 1 lb. per 1 lb. basis, with a minimum replacement of 30% and a maximum of 45%.
3. 200 lbs. of 3/8(-) aggregate shall be added to reduce total sand.
4. Reduce total sand to minimum practical.
5. Admixture dosage shall be per manufacturer's recommendations. Dosage may be increased for workability as long as set times are not excessive for placement and finishing.

E. Mix Design Minimum Requirements:

Concrete Class	Coarse Aggregate Size (Inches) & Fine Aggregate ³	Maximum W/CM or Maximum Nominal Slump & Tolerance (Inches) ^{1,2}	Minimum 28-Day Design Strength	Minimum Cement Sacks/per yd ⁴
NON-STRUCTURAL				
1) Lean Concrete (use only where specified)	---	---	---	3.0
2) Exterior Slab on Ground (Walkways & Patios)	1" x #4	W/CM = .55	2,500	4.5
STRUCTURAL				
3) Interior Slab on Ground ⁵	1" x #4	W/CM = .45	3,000	6.1
4) Foundation (including continuous footings, pad footings, grade beams, stem walls)	1" x #4	W/CM = .53	3,000	5.0

1. The tolerance is the maximum deviation allowable without rejection. The mix design shall be based on the nominal value specified and is without water reducing mixtures. Slump to be measured at the end of the hose.
2. The maximum W/CM is limited at time of placement as noted. No water is to be added on site such that the specified W/CM or maximum slump is exceeded without approval of the testing laboratory and the Architect/Engineer. Workability is to be achieved utilizing an acceptable mid range to high range water reducing admixture.
3. Gradation of aggregate is per ACI CODE-318 and ASTM C33.
4. Minimum cement content includes all cementitious materials.
5. See Article 2.6E for additional requirements at interior slabs on ground.

2.7 MIXING CONCRETE

- A. Batch final proportions in accordance with approved mix designs. All adjustments to approved proportions, for whatever reason, shall be reviewed by the Architect/Engineer prior to use.
- B. Batch and mix concrete in accordance with ASTM C94, at an established plant. Site mixed concrete will be rejected.
- C. Provide batch and transit equipment adequate for the work. Operate as necessary to provide concrete complying with specified requirements.
- D. Place mixed concrete in forms within 1-1/2 hours from the time of introduction of cement and water into mixer or 300 revolutions of the drum whichever comes first. Use of, re-mixing, and/or tempering mixed concrete older than 1 hour will not be permitted.

- E. Do not add water at the site to concrete mixes with a maximum specified W/CM unless the water content at batch time provides for a W/CM less than specified and this provision, including the quantity of water which may be added at the site, is specifically noted on the mix design and certification by the mix preparer. See ASTM C94 for additional requirements.

2.8 SOURCE QUALITY CONTROL

- A. Services by independent Testing Agency:
 - 1. Batch Plant Certificates: Obtain the weighmaster's Batch Plant Certificate at arrival of truck at the site. If no batch plant certificate is provided, recommend to the General Contractor that the truckload of concrete be rejected. So note in daily log, along with the location of the load of concrete in the structure if the load is not rejected.
 - a. Laboratory's inspector shall obtain for each transit mixer Batch Plant Certificates to verify mix design quantities and condition upon delivery to the site.
 - b. Certificates to include: Date, time, ingredient quantities, water added at plant and on job, total mixer revolutions at time of placement, and time of departure.
 - c. Concrete with specified water cement ratio: Add no water on site unless mix design and batch records each show additional water may be added. See ASTM C94 for additional requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify lines, levels, and dimensions before proceeding with work of this section.
- B. Verify work of other sections is complete and tested as required before proceeding.

3.2 PREPARATION

- A. Observation, Inspection and Testing:
 - 1. Architect/Engineer: Notify not less than 2 working days before each concrete placement, for observation and review of reinforcing, forms, and other work prior to placement of concrete.
 - 2. Testing Agency: Notify not less than 24 hours before each placement for inspection and testing.
- B. Placement Records: Contractor shall maintain records of time, temperature and date of concrete placement including mix design and location in the structure. Retain records until completion of the contract. Make available for review by Testing Agency and Architect/Engineer.
- C. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

- D. Verify location, position and inclusion of all embedded and concealed items.
- E. Verify installation of vapor retarder under interior slabs on ground, as specified in related section, is complete.
- F. Cleaning and Preparation:
 - 1. Remove loose dirt, mud, standing water, and foreign matter from excavations and cavities.
 - 2. Close cleanout and inspection ports securely.
 - 3. Thoroughly clean reinforcement and other embedded items free from loose rust and foreign matter. Maintain reinforcing securely in place. Do not place concrete on hot reinforcing.
 - 4. At cold joints, remove laitance from previously placed concrete surface.
 - 5. Dampen form materials and substrates on which concrete is to be placed at least 1 hour in advance of placing concrete; repeat wetting as necessary to keep surfaces damp. Do not saturate. Do not place concrete on saturated material.
 - a. Thoroughly wet wood forms (except coated plywood), bottom and sides of trenches, adjacent concrete or masonry and reinforcement.
 - b. Concrete slabs on base rock, dampen rock.
 - c. Concrete slabs on vapor retarder, do not wet vapor retarder.
 - 6. Verify that metal forms are clean and free of rust before applying release agent.
 - 7. Thoroughly clean metal decking. Do not place concrete on wet deck surface.
 - 8. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.
- G. Drill holes in existing concrete at locations where new concrete is doweled to existing work. Insert steel dowels and prepare connections as detailed.
- H. Do not overcut at existing concrete work to remain. Contractor is responsible for repair/replacement of overcut concrete to the Owner's satisfaction.

3.3 PIPES AND CONDUITS IN CONCRETE

- A. Slabs-on-Ground:
 - 1. No pipe or conduit exceeding 1 inch outside diameter shall be embedded within the specified slab thickness except as specifically detailed.
 - 2. Do not stack or abut pipes, maintain 3 inches minimum clearance.
- B. Sleeving and Wrapping:
 - 1. Foundations: Sleeve or wrap all individual pipe penetrations, minimum 1-1/2 inches clear to reinforcing all around.
 - a. Sleeves: PVC. Provide 1 inch minimum clear all around O.D. pipe to I.D sleeve, UNO at ends, fill void space with mastic or plastic bituminous cement.

- b. Wrapped Vertical Pipes: Provide 1/8 inch nominal sheet foam with three wraps minimum, UNO.
 - c. Wrapped Horizontal Pipes: Provide 1/8 inch nominal sheet foam with eight wraps minimum, UNO.
 - d. Underground Fire Lines 4" and Larger: At sleeves provide 2 inch minimum clear all around O.D. pipe to I.D. sleeve. At wrapped pipes, provide 1/8 inch nominal sheet foam with sixteen wraps minimum.
- 2. Slabs or Curbs: Wrap pipes as described above.
- C. Space groups of pipes/conduits at least 3 sleeve diameters apart, do not interrupt specified concrete and reinforcement.
 - 1. Provide block-outs as detailed when grouping of pipes/conduits in foundation or other structural member prevents spacing as described. Notify Architect/Engineer for review of any conditions not conforming to details.
 - 2. Center pipe/conduit penetrations in the depth and/or thickness of foundations.
 - 3. Maximum size of pipe/conduit penetrations shall not exceed the least dimension of concrete divided by 3.
- D. Do not embed pipes/conduits in concrete slabs on metal deck.
- E. Provide the following at pipes/conduits detailed to be embedded in a concrete beam, wall or column:
 - 1. Place as near as possible to center of member with reinforcing as specified on each side.
 - 2. Where reinforcing is located near or at center of member, place pipe or conduit 1 inch minimum clear from reinforcing and provide #3 at 12 inches on center perpendicular to the pipe/conduit. Reinforcing to extend 12 inches minimum past pipe/conduit each side.
 - 3. Maintain $\frac{3}{4}$ inch clear minimum from added reinforcing to face of concrete where not exposed to weather and 1-1/2 inches clear where exposed to weather.
 - 4. Space embedded items (groups of pipe/conduit, junction boxes or other elements) minimum 3 inches apart.
 - 5. Provide reinforcing in walls, beams, columns as detailed for groups of pipe/conduit. Provide minimum replacement reinforcement of same size and number for interrupted or displaced reinforcement for the full height, length, width of the wall, beam, and/or column on each side of the "effective opening."

3.4 CONCRETE PLACEMENT

- A. Transporting:
 - 1. Provide clean, well-maintained equipment of sufficient quantity and capacity to execute the work and produce concrete of quality specified.

2. Handle and transport concrete from mixer to final deposit location as rapidly as practicable. Prevent separation or loss of ingredients.
- B. Perform concrete placement by methods which will not puncture, damage or disturb vapor retarder membrane. Repair all damage to vapor retarder membrane before covering.
- C. Placement - General: Placement, once started, shall be carried on as a continuous operation until section of approved size and shape is completed. Provide construction joints as detailed on the drawings. Engineer's written approval required for all deviations.
1. Deposition:
 - a. Deposit concrete to maintain an approximately horizontal plastic surface until the completion of the unit placement.
 - b. Deposit as neatly as practicable in final position, minimize re-handling or flow.
 - c. Do not drop concrete freely where reinforcing bars, embeds, or obstructions occur that may cause segregation. Provide spouts, elephant trunks, or other means to prevent segregation during placement.
 2. Depth: Layered placement in columns and walls shall not exceed ten feet vertical depth.
 - a. Place concrete in minimum 32 inch horizontal lifts.
 - b. Schedule placement to ensure that concrete will not take initial set before placement of next lift.
 - c. No horizontal cold joints are allowed in columns or walls.
 3. Progress Cleaning: Remove all concrete spilled on forms or reinforcing steel in portions of structure not immediately concreted. Remove completely before concrete sets.
 4. Interruptions: Shut down placement operations and dispose of all remaining mixed concrete and concrete in hoppers or mixers following all interruption in placement longer than 60 minutes.
 - a. If such interruption occurs, provide new or relocate existing construction joints as directed by Engineer.
 - b. Cut concrete back to the designated line, cleaning forms and reinforcing as herein specified.
 - c. Prepare for resumption of placement as for new unit when reason for interruption is resolved.
- D. Consolidation:
1. Consolidate all concrete thoroughly during placement with high-speed mechanical vibrators and other suitable tools. Perform manual spading and tamping to work around reinforcement, embedded fixtures, and into corners of formwork as required to obtain thorough compaction.
 - a. Provide vibrators with sufficient amplitude for adequate consolidation.
 - b. Use mechanical vibrators at each point of concrete placement.
 - c. Keep additional spare vibrators, in addition to those required for use, at the site for standby service in case of equipment failure.

2. Consolidate each layer of concrete as placed.
 - a. Insert vibrators vertically at points 18 to 30 inches apart; work into top area of previously placed layer to reconsolidate, slowly withdraw vibrator to surface.
 - b. Avoid contact of vibrator heads with formwork surfaces.
 - c. Systematically double back and reconsolidate wherever possible. Consolidate as required to provide concrete of maximum density with minimized honeycomb.
- E. Unacceptable Materials:
 1. Do not place concrete that has started to set or stiffen. Dispose of these materials.
 2. Do not add water on site to concrete except as specified in the approved mix design, see PART 2 above.
- F. Protection of installed work:
 1. Do not introduce any foreign material into any specified drainage, piping or duct systems.
 2. Contractor shall bear all costs of work required to repair or clean affected work as a result of failure to comply with this requirement.

3.5 CONCRETE JOINTS

- A. Structural Joints (Construction/Cold Joints):
 1. Locate joints only where shown, or as approved.
 2. Review Required: Joints not indicated on the plans shall be located to meet the minimum requirements below, shall not impair the strength of the structure and shall be submitted to Architect/Engineer for review prior to placement of concrete.
 - a. Indicate proposed location(s) of construction/cold/expansion joints on shop drawing submittals for review prior to placing concrete.
 3. Clean and roughen all surfaces of previously placed concrete at construction joints by washing and sandblasting to expose aggregate to 1/4 inch amplitude.
 4. Slabs-On-Ground: Maximum Length of continuous placement shall not exceed 60 feet without special review by the Architect/Engineer. Alternate or stagger placement sections.
 5. Foundations: Maximum Length of continuous placement shall not exceed 200 foot increments. Provide "keyed" shut-off locations made up with form boards. Extend reinforcing one lap length or more through shut-off.
 - a. All reinforcement shall be continuous through construction/cold joint, lapping to adjacent reinforcing in future placement.
 6. Retaining and Basement Walls: Maximum Length of continuous placement shall not exceed 100 foot increments. Provide "keyed" shut-off locations made up with form boards to limit the length of continuous placement and at abrupt changes in wall thickness. Extend reinforcing one lap length or more through shut-off.
 - a. Review all proposed locations with Architect/Engineer

- b. Horizontal construction joints are not allowed unless approved by the Engineer
 - 7. Horizontal Construction Joints: Place 2 inch slurry (specified concrete mix less coarse aggregate) at beginning of pour at the bottom of walls unless a prior review of a mock-up section demonstrates that segregation of aggregate will not occur.
- B. Expansion/Construction Joints (Dowel Joints and Control Joints):
 - 1. Interior and Exterior Slabs-on-Ground:
 - a. Expansion/Construction Joints: Provide dowel joints or control joints at a maximum dimension (in feet) of three times the slab thickness (in inches) in each direction unless noted otherwise (15'-0" maximum). Install joints to match slab level and in straight lines. Locate joints at all reentrant corners including blockouts.
 - b. Proportions: Install joints to divide slab into rectangular areas with long dimensions less than 1.5 times short dimension.
 - 2. Exterior Concrete Slabs-on-Ground (walkways, patios):
 - a. Expansion/ construction joints: Provide a 2 inch deep troweled groove or asphalt impregnated joint material embedded 50 percent of the slab depth at 12 feet on center, maximum.
 - b. Proportions: Place no section with a length larger than two times width. Additionally, place joints at all inside corners and at all intersections with other work.
 - 3. Retaining and Basement Walls:
 - a. Contraction Joints: Provide ¾ inch wide beveled wood strips attached to inside face of formwork on each side of the wall. Wood strips shall extend 1/8 times the wall thickness into the wall. Cut 50% of the horizontal reinforcing bars at contraction joint locations
 - b. Proportions: Place joints at 2 times the height of the wall on center max, but not less than 10'-0". Joints shall not exceed 25'-0" on center.
 - c. Review all proposed locations with Architect/Engineer
- C. Joint Types:
 - 1. Dowel Joint: A keyed joint with smooth dowels passing through to allow unrestricted movement due to contraction and expansion. Joints are as specified on the drawings.
 - 2. Control Joint(s): Shrinkage crack control joints may be of the following types when shown on the drawings. Install joints in a straight line between end points with edges finished appropriate to type. Depth shall be 25% of the slab thickness, unless noted otherwise. Fill joints with sealant as shown on the drawings or as required by related sections.
 - a. 1/4 inch wide troweled joint.
 - b. Keyed joint: Only at locations where concealed by other finishes.
 - c. Masonite Strip, 1/8 inch: Only at locations where concealed by other finishes.

- d. Saw Cut, 1/8 inch: Must be performed within eight hours of completion of finishing. Do not make saw cuts if aggregate separates from cement paste during cutting operation. Prevent marring of surface finish. Fill with flexible sealant.

3.6 VAPOR RETARDER

- A. Vapor Retarder Installation: Install as specified in PART 2, ASTM E1643, and per manufacturer's recommendations including taping and lapping of seams, sealing of penetrations, and repair of damage. Do not extend vapor retarder below footings.

3.7 FLATWORK

- A. General Requirements for All Concrete Formed & Finished Flat:
 - 1. Edge Forms and Screeds: Set accurately to produce indicated design elevations and contours in the finished surface, edge forms sufficiently strong to support screed type proposed.
 - 2. Jointing: Located and detailed as indicated.
 - 3. Consolidation: Concrete in slabs shall be thoroughly consolidated.
- B. Flatwork Schedule:
 - 1. Exterior Slabs-On- Ground: Place concrete directly over sub-base as indicated.
 - a. Sub-Base: Clean free-draining, crushed base rock, 4 inch minimum thickness, thoroughly compacted.
 - 2. Interior Concrete Slabs-On- Ground:
 - a. Sub-Base: Clean free-draining, crushed base rock, 4 inch minimum thickness, thoroughly compacted.
 - b. Vapor Retarder: Install over sub-base.

3.8 FORMED SURFACES

- A. Form all concrete members level and plumb, except as specifically indicated. Comply with tolerances specified in ACI CODE-318, ACI SPEC-301, and this specification, except that maximum permissible deviation is 1/4 inch end-to-end for any single member.
- B. Cambers: Provide all cambers indicated in the formwork construction. Set screeds to produce specified cambers in the finished concrete.

3.9 CONCRETE FINISHES

- A. Flatwork Finishing:
 - 1. Perform with experienced operators.
 - 2. Finish surfaces monolithically. Establish uniform slopes or level grades as indicated. Maintain full design thickness.

3. In areas with floor drains, maintain design floor elevation at walls; slope surfaces uniformly to drains as indicated on drawings.
 4. Flatwork Finish Types:
 - a. Wood Float Finish: Surfaces to receive quarry tile, ceramic tile, or cementitious terrazzo with full bed setting system, or wood frame for raised finished floors.
 - b. Steel Trowel Finish: Surfaces to receive carpeting, resilient flooring, seamless flooring, thin set terrazzo, thin set tile or similar finishes specified in related sections. Trowel twice, minimum.
 - c. Broom Texture Finish: Exterior surfaces as indicated or for which no other finish is indicated. Finish as for steel trowel finish, except immediately following first troweling, (depending on conditions of concrete and nature of finish required) provide uniform surfaces texture using a medium or coarse fiber broom.
- B. Other Concrete: Provide as required to achieve appearance indicated on structural and architectural drawings and related sections.
1. Repair surface defects, including tie holes, immediately after removing formwork.
 2. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.
 3. Exposed Form Finish: Finish concrete to match forms. Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:
 - a. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.
 - b. Grout Cleaned Finish: Wet areas to be cleaned and apply grout mixture by brush or spray; scrub immediately to remove excess grout. After drying, rub vigorously with clean burlap, and keep moist for 36 hours.
 - c. Cork Floated Finish: Immediately after form removal, apply grout with trowel or firm rubber float; compress grout with low-speed grinder, and apply final texture with cork float.
 4. Intermediate joint and score marks and edges: Tool smooth and flush unless otherwise indicated or as directed by the Architect.
 5. Use steel tools of standard patterns and as required to achieve details shown or specified. All exposed corners not specified to be chamfered shall have radius edges.

3.10 TOLERANCES

- A. Minimum Flatwork Tolerances: Measure flatness of slabs within 48 hours after slab installation in accordance with ACI PRC-302.1 and ASTM E1155 and to achieve the following FF and FL tolerances:
1. Exterior surfaces: 1/8 inch minimum per foot where sloped to drain. Level otherwise. FF20 and FL15.
 2. Interior surfaces not otherwise shown or required: Level throughout. FF25 and FL20

3. Interior surfaces required to be sloped for drainage: 1/8 inch in 10 ft.
4. Finish concrete to achieve the following tolerances:
 - a. Under Glazed Tile on Setting Bed: FF30 and FL20.
 - b. Under Resilient Finishes: FF35 and FL25.
 - c. Flooring manufacturer and pertinent section of Division 9.

B. Formed Surface Tolerances:

1. Permanently Exposed Joints and Surfaces: Provide maximum differential height within two feet of, and across construction joints of 1/16 inch.
2. Vertical Elevations: Elevation of surfaces shall be as shown or approved.

3.11 SEPARATE FLOOR TOPPINGS

- A. Prior to placing floor topping, roughen substrate concrete surface and remove deleterious material. Broom and vacuum clean.
- B. Place required dividers, edge strips, reinforcing, and other items to be cast in.
- C. Apply bonding agent to substrate in accordance with manufacturer's instructions.
- D. Apply sand and cement slurry coat on base course, immediately prior to placing toppings.
- E. Place concrete floor toppings to required lines and levels. Place topping in checkerboard panels not to exceed 20 feet in either direction.
- F. Screed toppings level, maintaining surface tolerances per above.

3.12 CONCRETE CURING

- A. Curing - General: Cure in accordance with ACI SPEC-308.1. Maintain concrete water content for proper hydration and minimize temperature variations. Begin curing immediately following finishing.
- B. Protection During Curing: Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury. The General Contractor is responsible for the protection of the finished slab from damage.
 1. Avoid foot traffic on concrete for minimum of 24-hours after placement.
 2. Protect concrete from sun and rain.
 3. Maintain concrete temperature at or above 50 degrees F. during the first 7 days after placement. See Article ENVIRONMENTAL REQUIREMENTS.
 4. Do not subject concrete to design loads until concrete is completely cured, and until concrete has attained its full specified 28-day compressive strength or until 14 days after placement, whichever is longer.

5. Protect concrete during and after curing from damage during subsequent building construction operations. See Article PROTECTION.
- C. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
1. Normal concrete: Not less than 7 days.
 2. High early strength concrete: Not less than 4 days.
- D. Begin curing immediately following finishing.
- E. Surfaces Not in Contact with Forms:
1. Start initial curing as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than 3 days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
 2. Begin final curing after initial curing but before surface is dry.
 - a. Moisture-retaining cover: Seal in place with waterproof tape or adhesive.
 - b. Curing compound: Apply in two coats at right angles, using application rate recommended by manufacturer.
 3. In addition, see specific conditions noted below.
- F. Slabs on Ground: Cure by one of the following methods:
1. Water Cure (Ponding): Maintain 100 percent coverage of water over floor slab areas, continuously for minimum 7 calendar days.
 2. Spraying: Spray water over floor slab areas and maintain wet for 7 days.
 3. Moisture-Retaining Film or Paper: Lap strips not less than 6 inches and seal with waterproof tape or adhesive; extend beyond slab or paving perimeters minimum 6 inches and secure at edges; maintain in place for minimum 7 days.
 4. Absorptive Moisture-Retaining Covering: Saturate burlap-polyethylene and place burlap-side down over floor slab areas, lapping ends and sides and extend beyond slab or paving perimeters 6 inches minimum; maintain in place for minimum 7 days.
 5. Liquid Membrane-forming Curing Compound: Provide only when subsequent concrete treatments or finish flooring specified in related sections will not be affected by cure/sealer. Apply curing compound in accordance with manufacturer's instructions at the maximum recommended application rate in two coats, with second coat applied at right angles to first.
- G. Formed Concrete Members: Cure by moist curing with forms in place for full curing period.
1. Protect free-standing elements from temperature extremes.
 2. Maintain forms tight for minimum 7 days. Maintain exposed surfaces continuously damp and completely covered by sheet materials thereafter.
 3. Maintain all shoring in place. Refer to related sections specifying formwork.

4. Membrane Curing Compound: Apply compound in accordance with manufacturer's instructions in one coat.

H. Foundations: Apply curing compound immediately after floating.

3.13 CONCRETE HARDENER

- A. Apply hardener to all floor slabs not receiving other finishes after 30 days minimum curing. Clean slabs of non-compatible cure/sealers or other foreign material(s) and apply in strict accordance with the manufacturer's directions.

3.14 GROUTING AND DRY PACK

- A. Set steel plates on concrete or masonry with high strength grout bed, completely fill all voids; thoroughly compact in place. See Section 05 1200 or 05 1100.
- B. Bolts or inserts dry packed or grouted in place shall cure for minimum 7 days before tensioning.

3.15 FIELD QUALITY CONTROL

- A. Testing and Inspections by Independent Testing Agency: Provided verification and inspection of concrete per CBC Table 1705.3. Provide written reports for to Engineer, Architect, Contractor and Building Official for the following tests and inspections:
- B. Testing & Inspection: Provide periodic inspection of reinforcing steel. Provide continuous inspection during placement of structural class concrete, 3000 psi or more. Non-structural class concrete with a design strength of 2500 psi or less to have periodic inspection on a 150 cubic yard basis as required to assure conformance.
 1. Provide periodic inspection of bolts in concrete prior to and during placement where so noted on the construction documents.
 2. Structural Concrete Cylinder Tests: Form in accordance with ASTM C31.
 - a. Take four standard 6 inch x 12 inch (or five 4 inch x 8 inch) cylinder specimens on the site, of each class of concrete as specified in PART 2, not less than once a day or for each 150 cubic yards or 5000 sq ft or fraction thereof placed each day.
 - b. Record the location of each concrete batch in the building in a log and also note on each specimen.
 - c. Perform standard compression test of cylinders in accordance with ASTM C39, one at 7 days and two (three for 4x8 cylinders) at 28 days.
 - d. Hold fourth (fifth) cylinder untested until specified concrete strengths are attained.
 3. Structural Concrete Slump Test and Air Tests: Perform slump in accordance with ASTM C143 and air content in accordance with C231 or C173 at the time of taking test cylinders, and/or at one-hour intervals during concrete placing.

4. Measure and record concrete temperature in accordance with ASTM C1064 upon arrival of transit mixers and when taking specimens. Note weather conditions and temperature.
5. Determine concrete density in accordance with ASTM C138 at the time of forming test cylinders.
6. Propose adjustments to reviewed mix designs for Architect / Engineer review to account for variations in site or weather conditions, or other factors as appropriate.
7. Water Vapor Transmission Tests: Floors receiving floor finishes specified in related sections will be tested prior to installation of flooring systems. Refer to sections specifying floor finishes for related requirements.

C. Services by Contractor:

1. Rejection of Concrete Materials: Do not use the following without prior written approval of the Architect/Engineer;
 - a. Materials without batch plant certificates.
 - b. Materials not conforming to the requirements of these specifications.

3.16 ADJUSTING

- A. Inspect all concrete surfaces immediately upon formwork removal. Notify Architect/Engineer of identified minor defects. Repair all minor defects as directed.
- B. Surface and Finish Defects: Repair as directed by the Architect/Engineer, at no added expense to the Owner. Repairs include all necessary materials; reinforcement grouts, dry pack, admixtures, epoxy and aggregates to perform required repair.
 1. Repair minor defective surface defects by use of drypack and surface grinding. Specific written approval of Architect/Engineer is required. Submit proposed patching mixture and methods for approval prior to commencing work.
 2. Slabs-on- Ground, Elevated Slabs and on Slabs on Metal Deck: Review for "curled" slab edges and shrinkage cracks prior to installation of other floor finishes. Grind curled edges flush, fill cracks of 1/16 inch and greater with cementitious grout.
 3. Grind high spots, fins or protrusions caused by formwork; Fill-in pour joints, voids, rock pockets, tie holes and other void not impairing structural strength. Provide surfaces flush with surrounding concrete.

3.17 DEFECTIVE CONCRETE

- A. Defective Concrete: Concrete not conforming to required compressive strength, lines, details, dimensions, tolerances, finishes or specified requirements; as determined by the Architect/Engineer.
- B. Repair or replacement of defective concrete will be determined by the Architect/Engineer who may order additional testing and inspection at his option.

The cost of additional testing shall be borne by Contractor when defective concrete is identified.

C. Specific Defects:

1. "Low-Strength"; Concrete Not Meeting Specified Compressive Strength after 28 days:
 - a. Concrete with less than 25% Fly Ash or 35% Slag as cementitious material: Test remaining cylinder(s) at 56 days. If strength requirements are met, concrete strength is acceptable.
 - b. Concrete with 25% or more Fly Ash or 35% or more Slag as cementitious material: Test remaining cylinder(s) at 70 days. If strength requirements are met, concrete strength is acceptable.
2. Excessive Shrinkage, Cracking, Cracking or Curling; Defective Finish: Remove and replace if repair to acceptable condition is not feasible.
3. Lines, Details, Dimensions, Tolerances: Remove and replace if repair to acceptable condition is not feasible.
4. Slab sections not meeting specified tolerances for trueness/flatness or lines/levels: Remove and replace unless otherwise directed by the Architect/Engineer. Minimum area for removal: Fifteen square feet area unless directed otherwise by the Architect/Engineer.
5. Defective work affecting the strength of the structure or the appearance: Complete removal and replacement of defective concrete, as directed by the Architect/Engineer.

3.18 CLEANING

- A. Maintain site free of debris and rubbish. Remove all materials and apparatus from the premises and streets at completion of work. Remove all drippings; leave the entire work clean and free of debris.
- B. Slabs to Receive Floor Finishes Specified in other sections: Remove non-compatible cure/sealers or other foreign material(s) which may affect bonding of subsequent finishes. Leave in condition to receive work of related sections.

3.19 PROTECTION

- A. Protect completed work from damage until project is complete and accepted by Owner.
- B. Construction Loads: Submit engineering analysis for equipment loads (including all carried loads) specified in article submittals.
- C. Keep finished areas free from all equipment traffic for a minimum of 4 additional days following attainment of design strength and completion of curing.
- D. Protection of Drainage Systems:
 1. Care shall be taken not to introduce any foreign material into any specified drainage, piping or duct system.
 2. Cost of work to repair or clean drainage system as a result of failure to comply with this requirement will be back charged to the contractor.

- E. Cover traffic areas with plywood sheets or other protective devices; maintain protection in place and in good repair for as long as necessary to protect against damage by subsequent construction operations.

END OF SECTION

SECTION 04 20 00

CONCRETE UNIT MASONRY

PART 1 – GENERAL**1.1 SUMMARY**

- A. Section Includes: All labor, material and equipment and perform all operations required to complete all masonry work as indicated on the drawings and specified.
- B. Additional work included in this section: Provision of concrete grout and installation of items provided by other trades that are embedded in and/or attached to masonry work; providing forms at block-outs and formed concrete grout.
- C. Related Sections:
 - 1. Pertinent Sections of Division 01 specifying Quality Control and Testing Agency services.
 - 2. Pertinent sections of other Divisions specifying formwork, reinforcement, concrete, masonry, steel, and rough carpentry.
 - 3. Pertinent Sections of other Divisions specifying work to be embedded in concrete or work penetrating concrete work.

1.2 REFERENCES AND STANDARDS

- A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC): Chapter 19 Concrete, Chapter 21 Masonry
- B. TMS 402 / ACI 530 / ASCE 5 “Building Code Requirements for Masonry Structures”.
- C. TMS 602 / ACI 530.1 / ASCE 6 “Specification for Masonry Structures”.
- D. ASTM A615 “Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement”.
- E. ASTM C90 “Load-Bearing Concrete Masonry Units”.
- F. ASTM C144 “Aggregate for Masonry Mortar”.
- G. ASTM C270 “Mortar for Unit Masonry”.
- H. ASTM C404 “Aggregates for Masonry Grout”.

- I. ASTM C476 "Grout for Masonry".

1.3 SUBMITTALS

- A. Submit in accordance with Division 01 specifying submittal procedures. The General Contractor shall review and approve submittals prior to submittal to the Architect/Engineer. Submittals that do not meet these requirements will be returned for correction without review.
- B. Limitation of Review: Structural Engineer's review will be for general conformance with design intent as indicated in the Contract Documents and does not relieve Contractor of full responsibility for conformance with the Contract Documents.
- C. Product Data: Submit manufacturer's product data, specifications, location and installation instructions for proprietary materials and reinforcement accessories. Provide samples of these items upon request.
- D. Contractor Submittals:
 - 1. Mix design for all grout and mortar, prepared by a qualified testing laboratory, per TMS 602 section 1.5. Show conformance of mix to proportion specification of ASTM C270 for mortar and ASTM C476 for grout. Alternatively, provide test results and show conformance of mix to property specification of ASTM C270 for mortar and ASTM C476 for grout. Mix shall conform to all requirements herein.
 - 2. Material certificates for all materials used in mixes.
 - 3. Submit shop drawings for all shapes and sizes of concrete unit masonry shown and scheduled on the drawings. Submit shop drawings detailing and locating all masonry reinforcement.
 - 4. Certificate of compliance and test data by concrete unit masonry supplier showing conformance to specified material strengths and properties.
 - 5. Samples: Laid up sections of masonry walls for the Architect's approval of size, texture and color of block, mortar and joint pattern.
 - 6. Layout of vertical control joints in masonry walls coordinated with structural and architectural drawings.
 - 7. Submit cold and/or hot weather construction procedures when ambient temperature is below 40°F or above 90°F. See PART 3.

1.4 QUALITY ASSURANCE

- A. For requirements of the Authority Having Jurisdiction, refer to pertinent sections of Division 01 and CBC Chapter 17.
- B. All tests shall be performed by an approved Testing Agency as specified in pertinent sections of Division 01.

- C. Testing and Inspection: Tests and inspections performed by approved Testing Agency are specified below in Articles SOURCE QUALITY CONTROL and FIELD QUALITY CONTROL and the Testing & Inspection Form. Duties and limitations of approved Testing Agency, test costs and test reports in conformance with pertinent sections of Division 01.
- D. General: Provide reports to Architect/Engineer and Authorities Having Jurisdiction (AHJ) indicating results of tests and inspections.
- E. Concrete Unit Masonry
 - 1. All testing of concrete unit masonry by the approved Testing Agency shall comply with the requirements of CBC Chapters 17 and 21.
 - 2. Approved Testing Agency shall provide Level 3 Quality Assurance Program per TMS 602 and CBC Chapter 17 by an approved inspector of masonry construction.
- F. Contractor shall provide adequate materials for sampling and shall patch core holes made by the approved Testing Agency using non-shrink, high- strength grout.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver and store packaged material in original containers with seals unbroken and labels intact until time of use.
- B. Unload masonry units carefully and store on raised platform protected from weather.
- C. Protect cementitious materials against exposure to moisture. Use of cementitious or other materials that have become caked and hardened from absorption of moisture will not be permitted.

1.6 JOB CONDITIONS

- A. Environmental Conditions: Do not place concrete unit masonry when temperature is below 40 degrees Fahrenheit or above 90 degrees Fahrenheit unless the Contractor provides means for preventing damage due to freezing or high-temperatures before and after placement and the Architect/Engineer approves. See Section PART 3.
- B. Protection: Protect surrounding work as required against damage from masonry work. Clean satisfactorily or otherwise correct damage to surrounding work resulting from masonry work. See PART 3.

1.7 SCHEDULING AND SEQUENCING

- A. Organize the work and employ shop and field crew(s) of sufficient size to minimize inspections by the approved Testing Agency.
- B. Provide schedule and sequence information to approved Testing Agency in writing upon request. Update information as work progresses.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Hollow Load-Bearing Concrete Masonry Units:
 - 1. General: All concrete masonry units shall be double open end wherever possible (single open end otherwise).
 - 2. Concrete masonry units shall be medium or light weight and shall conform to ASTM C90. Minimum compressive strength shall be 2000psi.
 - 3. Concrete masonry units exposed to view shall be 8x8x16 unless otherwise noted on the construction drawings. Concrete masonry caps shall be 2x8x16 (nominal) standard grey unless otherwise noted on the construction drawings.
- B. Portland Cement: ASTM C150, Type II, low alkali
- C. Aggregates
 - 1. For Mortar: ASTM C144.
 - 2. For Grout: ASTM C404.
- D. Hydrated Lime: ASTM C207, Type S
- E. Quick Lime: ASTM C5, high calcium
- F. Reinforcing Steel: ASTM A615 (or A706) grade 60.
- G. Water: Clean and potable, free from impurities detrimental to mortar and grout.
- H. Grout Aid: "Grout Aid" by Sika Corporation.
- I. High Strength Grout: Conform to CRD-C621 and ASTM C1107. Non-shrink, non-ferrous, minimum compressive strength at 28 days to be 7000 psi (when placed in a fluid state). Meet or exceed BASF "Master Flow 928".
- J. Pre-molded Control Joint: ASTM D2000 M2AA-805 rubber shear keys with a minimum durometer hardness of 80 or ASTM D2287 Type PVC 654-4 PVC shear keys with a minimum durometer hardness of 85.
- K. Flexible Sealant: ASTM C920.

- L. Mortar Color: Submit to Architect for approval.

2.2 FABRICATION

- A. Reinforcement: Conform to requirements of Section 03 2000, Concrete Reinforcing.

2.3 MIXES AND MIXING

- A. General Mixing Requirements:

1. Measure materials accurately. Shovel measurements will not be permitted.
2. Use mechanical mixer of at least one sack capacity.
3. Mix for minimum of three minutes and in no case less than time required for securing uniform mass and workable consistency.
4. Completely empty drum before charging succeeding batch of materials.
5. Exercise extreme care in measuring ingredients for partial batches.

- B. Mortar

1. Type M or S per ASTM C270. Minimum compressive strength at 28 days: 1800 psi (Type S), 2500 psi (Type M). Admixtures not allowed. Otherwise conform to CBC Section 2103.2.1.
2. Use and place mortar in final position within 2-1/2 hours after mixing. Mortars that have stiffened due to evaporation of water may be retempered with water as frequently as required to restore required consistency during this time period.
3. Provide integrally colored mortar to match block. Colors to be submitted to Architect for approval. Add mortar colors in accordance with manufacturer's recommendations. Ensure uniformity of mix and coloration.

- C. Concrete Grout

1. General:
 - a. Six sacks (94 pounds per sack) of cement per cubic yard minimum. Concrete masonry grout compressive strength to attain 2000 psi minimum after 28 days
 - b. One pound "Sika Grout Aid" per sack of cement (6 pounds maximum per cubic yard).
 - c. Slump: 8 to 11 inches.
 - d. "Coarse" type per TMS.
2. Otherwise conform to CBC Section 2103.3.

2.4 SOURCE QUALITY CONTROL

- A. An approved Testing Agency will perform source quality control tests and submit reports, as specified in pertinent section of Division 01 and CBC Chapter 17 and 21.
- B. Test materials per CBC Chapter 17 and TMS 602 Section 1.4B unit strength method or prism test method.

PART 3 – EXECUTION

3.1 INSPECTION BY CONTRACTOR

- A. Examine areas to receive masonry and verify following per TMS 602:
 - 1. Foundation surface is level to permit bed joint within range of 1/4 to 3/4-inch.
 - 2. Edge is true to line to permit projection of masonry to less than 1/4-inch.
 - 3. Projecting dowels are free from loose scale, dirt, concrete or other bond-inhibiting substances and properly located.
 - 4. Built-in items are properly sized and located.
- B. Do not begin work before unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean concrete surfaces to receive masonry. Remove laitance or other foreign material lodged in surface by sandblasting or other means as required. Roughen foundation bed to expose aggregate; remove loose particles and saturate before laying units.
- B. Ensure masonry units are clean and free from dust, dirt or other foreign materials before laying.

3.3 REINFORCEMENT

- A. Place bars where noted in accordance with drawings and SP-66 "ACI Detailing Manual". Do not disturb after start of masonry placement.
- B. Splice bars with dowels cast in concrete; lap bars per drawings. Bars shall not be "stabbed" after grout placement. All reinforcing shall be tied in place with wire prior to grout placement. The use of approved bar spacers is acceptable.

3.4 PLACEMENT

- A. General Requirements
 - 1. Masonry construction shall conform with TMS 602.
 - 2. Ensure masonry units are sound, clean and free of cracking at time of placement.

3. Accurately cut and fit units as required using masonry saws to accommodate work of other sections.
4. Lay masonry units plumb, true to line with level courses accurately placed. Maximum tolerance 1/4" in 8'-0".
5. Adjust unit to final position while mortar is soft and plastic.
6. Align vertical cells accurately.
7. Remove units disturbed after stiffening of mortar, clean joints and relay unit with fresh mortar.
8. Do not attach construction supports to walls.
9. Install anchor bolts and other embedded items accurately as work progresses. Use templates as necessary to meet required tolerance of other's work.
10. Brace walls adequately until supporting structure is complete.
11. Do not place conduit, pipes, wire, etc. in cells containing reinforcing steel.

B. Joints:

1. Fill joints; ensure full coverage of face shells in both horizontal and vertical joints and on webs.
2. Tool (concave) and finish joints as specified to achieve solid, smooth, watertight compacted joint.
3. Immediately fill holes made by line pin with mortar when pin is withdrawn.
4. Remove surplus mortar from joints.
5. Provide vertical control joints at 1.5 times the wall height (but not greater than 25'-0") and as detailed on the structural drawings.

C. Cold Weather Requirements

1. When ambient temperature is below 40 degrees Fahrenheit, submit cold weather protection plan per TMS 602 Section 1.8C. Ensure reinforcing, masonry units, etc. contacting mortar and grout are free of frost.

D. Hot Weather Requirements

1. When ambient temperature exceeds 90 degrees, submit hot weather protection plan per TMS 602 Section 1.8D.

E. Protection

1. Protect face materials against staining.
2. Remove misplaced grout or mortar immediately.
3. Protect sills, ledges, off-sets and similar items from mortar drippings or other damage during construction.
4. Cover top of unfinished work to protect it from weather and debris.

F. Concrete Masonry Units

1. Bond: Running bond unless specifically noted otherwise.

2. Joint Thickness: 3/8-inch both vertically and horizontally.
3. Joint Treatment:
 - a. Typical exterior and interior walls; tool joint for weather tightness.
 - b. Construction joints to be sealed with joint sealant or high strength grout as noted on the drawings.
4. Use proper units to provide for doors, bond beams lintels, etc. in order to minimize cutting.
5. Do not wet units.
6. Align vertical cells to provide continuous, unobstructed opening for grouting.
7. Corners: Provide standard masonry bond by overlapping units.
8. Provide mechanical cleanout methods as needed. To facilitate cleanout were pour height exceeds 5 feet 4 inches, provide inverted bond beam units at the bottom of each pour and provide cleanouts in these courses as necessary, not exceeding 32 inches on center. Locate cleanouts to minimize visual impact. Verify with Architect/Engineer.

3.5 GROUTING

A. General Requirements

1. Conform to requirements of TMS 602.
2. A pour is defined as the height of grout to be placed in one day. The height of masonry unit placement at the time of grouting shall not exceed the pour height. Masonry shall have cured minimum 4 hours before grout placement. Maximum pour height is 24 feet, or less, as determined by the contractor. Maximum individual lift height is 5 feet 4 inches, or less, as determined by the contractor. Allow time between lifts for initial water loss of grout to occur. Do not allow grout to cure between lifts. Contractor is responsible for adequate cleaning and prevention of blowouts.
3. Grout void between wythes and cells of concrete block.
4. Ensure grout flows into voids and completely surrounds reinforcing steel.
5. Stop grout approximately one and a half inches below top of last course except at top course without a concrete cap.
6. Grout from a non-exposed face of masonry wherever possible.
7. Where necessary to stop longitudinal run, provide suitable dam to retain grout in place.
8. Clean all cells of pour space prior to grouting. Remove all loose mortar, etc.
9. Consolidate grout with a mechanical vibrator with a 3/4" head.
10. Slushing with mortar will not be permitted.
11. Use grout pump, hopper or bucket to place grout.
12. Do not wet down grout spaces prior to grouting.
13. Do not subject masonry to design loads until masonry is completely cured, and until masonry has attained its full specified 28-day compressive strength or until 21 days after placement, whichever is longer.

3.6 FIELD QUALITY CONTROL

- A. The approved Testing Agency will perform field quality control tests, as specified in pertinent sections of Division 01 and CBC Chapters 17 and 21.
- B. The approved Testing Agency will provide inspections per the requirements of CBC Section 1705.4.
- C. Concrete masonry shall have an assumed 28 day prism strength of 2000psi.

3.7 POINTING AND CLEANING

- A. Point holes or defective mortar joints upon completion of work; where necessary, cut out and repoint defective joints.
- B. At end of workday, fiber brush new surfaces to remove mortar splashes, clean with mild detergent or enzymes, and rinse with clean water.
- C. When ordinary methods are not adequate, employ sandblasting, chipping or other special methods.
- D. Do not use acid solution to remove green stain or efflorescence resulting from vanadium salts. Follow recommendations of manufacturer for removal of such stains.
- E. Clean all surfaces upon completion of erection, leave free of grime and dirt. Remove unused materials, tools, equipment and debris from the premises and leave surfaces broomed clean.
- F. Protect work from damage by subsequent operations.

3.8 ADJUSTING

- A. Replace all defective work at Contractor's expense.
- B. Replace defective or damaged work with conforming work.
- C. Architect/Engineer shall review all proposals for the repair or replacement of damaged, defective, or missing work.
- D. Contractor to pay expenses incurred by Owner for Architect/Engineer's costs for (re-) design and obtaining approvals of Authorities Having Jurisdiction necessitated by incomplete, inefficiently scheduled, improperly performed, defective or nonconforming work, as specified in pertinent sections of Division 01.

- E. Pay expenses due to re-testing and re-inspection necessitated by incomplete, inefficiently scheduled, improperly performed, defective or nonconforming work, as specified in pertinent sections of Division 01.

END OF SECTION

SECTION 04 26 13**BRICK VENEER**

PART 1 – GENERAL**1.1 SUMMARY**

- A. Section Includes: All labor, material and equipment and perform all operations required to complete all exterior thin brick masonry veneer units as indicated on the drawings and specified.
 - 1. Scope of work includes:
 - a. Brick veneer patch and repair within a field of existing brick veneer
 - b. New brick veneer to match existing in dimension, texture, and finish
- B. Additional work included in this section: Provision of concrete mortar, grout and installation of items provided by other trades that are embedded in and/or attached to masonry work; providing forms at block-outs and formed concrete grout.
- C. Related Sections:
 - 1. Section 09 24 00: Plaster Assemblies

1.2 REFERENCES AND STANDARDS

- A. American Society for Testing and Materials (ASTM):
 - 1. A 525 – Steel Sheet Zinc-Coated – hot dip galvanized
 - 2. C 33 - Specification for Concrete Aggregates.
 - 3. C 67 - Test Methods of Sampling and Testing Brick and Structural Clay Tile.
 - 4. C 270 - Specification for Mortar for Unit Masonry.
 - 5. C 578 – Preformed Cellular Polystyrene Thermal Insulation
 - 6. C 482-02 Standard Test Method for Bond Strength of Ceramic Tile to Portland Cement
 - 7. C 270 - Specification for Mortar for Unit Masonry.
 - 8. C 1019 - Method of Sampling and Testing Grout.
 - 9. C 1088 - Standard Specification for Thin Veneer Brick Units Made from Clay or Shale.
 - 10. C 1780 – Standard Practice for Installation Methods for Adhered Manufactured Stone Masonry Veneer.
- B. ANSI
 - 1. A108.11 Installation of cementitious backer units.
 - 2. A108.13 Installation of waterproof membranes for thin-set brick.

3. A118.1 Dry-set Portland cement mortar.
 4. A118.4 latex Portland cement mortar.
 5. A118.9 Cementitious backer units.
 6. A118.10 Waterproof membranes for thin-set brick.
 7. A136.1 Organic Adhesives, Type I and Type II
- C. Building Code Requirements and Specification for Masonry Structures (TMS 402/602), adopted addition.
- D. PCA Plaster and Stucco Handbook, latest edition.
- E. TCNA Handbook for Ceramic, Glass, and Stone Tile Installations, latest edition.
- F. Masonry Veneer Manufacturers Association Installation Guide and Detailing for Compliance with ASTM C1780, latest edition

1.3 SUBMITTALS

- A. Product Data, and Evaluation Reports as required for installation.
- B. Samples: Include samples of stretcher units in sufficient quantity to illustrate color range and texture.
- C. Test Reports from an independent testing laboratory showing compliance with applicable specifications.
- D. Provide manufacturer's specification, data, and installation for review prior to fabrication of work.
- E. Submit installer's coordination drawings indicating the work of this section with that of related work of other sections for proper interface of the completed work. Installer shall coordinate and obtain approvals from the work of other related sections prior to submitting to the Architect.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum 10 years of documented experience producing the specified products.
- B. Installer Qualifications: Minimum 10 years of documented experience with work of similar scope and complexity required by this Project and acceptable to, or certified by, brick veneer manufacturer.
- C. Material Source: Obtain each specified material from the same source.

D. Mock-up:

1. Prior to starting construction of masonry, construct minimum 2 foot square mock-up.
2. Use accepted materials, containing each different kind and color of brick masonry units to illustrate wall design.
3. Show color range, texture range, bond, mortar color, joint tooling, critical design details and quality of workmanship.
4. Masonry construction may not proceed until the Architect./ Engineer approves mock-up.
5. When not accepted, construct another mock-up.
6. When accepted, mock-up will remain intact during construction, will be the standard of comparison for the remainder of masonry work.
7. Upon completion and acceptance of Project, dispose of mock-ups in legal manner at offsite location.

E. Pre-installation Conference: Seven calendar days prior to scheduled date of installation, conduct a meeting at Project site to discuss requirements, including application methods. Attendees to include Architect, Owner, Contractor, Installer, and manufacturers authorized field representative (if necessary).

F. Certification: Furnish manufacturer's certification that clay thin brick units provided meet or exceed the requirements of this specification.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Store masonry units above ground to prevent contamination by mud, dust or other materials likely to cause staining or other defects.
- B. Cover and protect masonry units from inclement weather to maintain quality control and physical requirements.
- C. Transport and handle brick masonry units as required to prevent discoloration, chipping, and breakage.
- D. Locate storage piles, stacks, and bins to protect materials from heavy traffic.
- E. Remove chipped, cracked, and otherwise defective units from jobsite upon discovery.

1.6 JOB CONDITIONS

A. Cold Weather Requirements:

1. In accordance CBC Section 2104.3.
2. Provide adequate equipment for heating masonry materials when air temperature is below 40 degrees Fahrenheit (4 degrees Celsius).

B. Hot Weather Requirements:

1. In accordance with CBC Section 2104.4.
2. When ambient air temperature exceeds 100 degrees Fahrenheit (38 degrees Celsius), or when ambient air temperature exceeds 90 degrees Fahrenheit (32 degrees Celsius) and wind velocity is greater than 8 miles per hour, implement hot weather protection procedures.
3. Wet mortar board before loading and cover mortar to retard drying when not being used.
4. Do not spread mortar beds more than 48 inches (1.22 m) ahead of placing masonry units.
5. Place masonry units within one minute of spreading mortar.

C. Wetting of Brick: shall be required at the time of laying if the unit's initial rate of absorption (IRA) exceeds 30 grams per 30 square inches per minute or 1 g/645mm².

D. Assess all preceding prior to starting brick installation and confirm all such work is complete and ready to receive the thin brick installation. Document all issues found unsuitable or not within project parameters (location, plumbness, etc.), that will impact brick installation. Report such found items to the general contractor or construction manager, as appropriate, and seek resolution prior to initiating work.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Thin Brick Veneer Units

1. Type: ASTM C 1088, Grade Exterior, Type TBS thin veneer brick.
2. Surface Texture: To be selected by Architect from manufacturer's full range of available textures.
3. Color: As selected by Architect from full color range
 - a. Basis of Design: H.C Muddox Ebony or approved equal
4. Size: 9/16 in. thick x 2 ¼ in. high x 8 in. long, unless otherwise indicated on the drawings.
5. Special Sizes and Shapes: As required for window and door locations and custom sills where indicated, corners, and other special applications to minimize cutting.
6. Manufacturers:
 - a. HC Muddox: www.hcmuddox.com
 - b. Interstate Brick: www.interstatebrick.com
 - c. Substitutions: Refer to Section 01 63 00.

B. Setting Bed Mortar

1. Site mixed mortar: Meet requirements of ANSI A118.4 or A118.15.
2. Preblended: Meet requirements of ANSI A118.4 or A118.15.

3. Mortar for use with cement backer board substrate: comply with ANSI A118.4 or A118.15.
- C. Pointing Mortar
1. Mortar used to grout or tuck-point mortar joints (sometimes called grouting mortars) between thin brick units after they are adhered to the substrate wall. Mix by proportion: 1 part Portland cement (ASTM C150); 1 part hydrated lime (ASTM C207); 6 parts sand (ASTM C144), or Modified Epoxy emulsion mortar/grout conforming to ANSI 118.07.
 2. Site mixed: Meet requirements of ASTM C270 Type N or Type S.
 3. Preblended: Meet requirements of ASTM C1714/C1714M Type N or Type S.
- D. Accessories
1. Exterior wall assembly system applied to clean and sound exterior substrate surfaces that has compatible components comprised of: liquid/fluid elastomeric WRB membrane, cementitious plaster substrate, setting/bonding mortar, and pointing mortar (grout) systems designed specifically for adhered exterior masonry veneers, including thin brick. Not applicable where it would be applied directly to a drainage layer.
 - a. Laticrete MVIS or equivalent.
 - b. 3-part system: fluid WRB + masonry veneer mortar + pointing mortar. Used for thin or thick set applications

PART 3 – EXECUTION

3.1 VENEER SUBSTRATE SURVEY

- A. Survey condition of substrate wall or backing to receive thin brick and report all non-conformance issues, including but not limited to: out of tolerance flatness, plumbness, alignment, and location. Report all pertinent issues to the General Contractor prior to initiating any work.

3.2 VENEER SUBSTRATE PREPARATION

- A. Plaster
1. Remove all deleterious substances (form release, curing compounds, paint, graffiti, etc.)
 2. Wash surface to remove dust and laitance, and allow to dry
 3. Cleaning may be waived/eliminated where new construction makes in unnecessary, and when proprietary lath systems are used, pending acceptance of Architect and lath system manufacturer.

3.3 CONFIRMATION OF MASONRY LAYOUT

- A. Prior to installation of thin brick, layout (dry) coursing to fill surface and note any adjustments that are necessary to produce the desired look, eliminating units that

are less than 1/2 of the full unit width. This may require adjusting the location of head joints and using 3/4 length (approx.) units to maintain the desired bonding pattern. Layout vertical coursing using story poles or other means to maintain standard masonry coursing modules. Tile spacers or ropes are not recommended as aids for layout.

- B. Adjust joint widths within established tolerances to accommodate brick tolerances and layout tolerances.
- C. Adjustments to layout, including but not limited to partial brick units and joint sizes must be approved by the Architect prior to installation.

3.4 BRICK MASONRY UNITS

- A. Review brick material prior to installation and report any units deemed unsatisfactory to the manufacturer. Set aside (do not discard or remove from site) all units deemed unsatisfactory for further assessment by testing agency and/or brick manufacturer's authorized representative, as deemed mutually acceptable. Immediately notify supplier if quantities that are set aside are projected to create a shortfall of useable units. Installation or units placed in service constitutes mason's acceptance of, and responsibility for, the brick quality.
- B. Select units from multiple (at least 3) pallets or cubes to blend hues to create a uniform random pattern when placed in service to avoid patches of light and dark brick. Install patterns of color as directed where a specific blend of colors is specified. In all cases lay brick in a pattern acceptable to the Architect.

3.5 EXTERIOR THIN SET APPLICATION TO FLAT CEMENTITIOUS SUBSTRATE

- A. The following guidelines are intended for exterior application over reasonably flat substrates when using thin brick with uniform thickness.
- B. Protect adjacent construction with appropriate means from mortar droppings and other effects of laying of brick masonry units.
- C. Install flashing at the perimeter of thin brick veneer wall assembly, around openings, and at base of veneer, integrated with the WRB to prevent the moisture from entering the building and to transmit the moisture to the outside of the wall. Install weeps (weep screeds) at the bottom of the walls, integrated with the WRB to transmit the moisture to the outside face of the wall. Secure flashings with fasteners.
- D. Apply liquid/fluid WRB membrane to clean plaster substrate surfaces.
- E. Spread brick setting (bonding) mortar bed onto the clean and dust-free substrate of plaster with compatible elastomeric liquid/fluid WRB using the flat side of a trowel and comb using a notched trowel (3/16" to 1/4" [5 mm to 6 mm] deep notches) to obtain an even setting bed. Use Type S polymer modified mortar (Latex-Portland Cement Mortar, per 2.02-D-2, above).

- F. Apply brick setting bed (bonding) mortar to the back of the veneer units, working into the back of the brick unit using the flat side of a trowel and comb using a notched trowel (as above) and place the unit into the setting bed on the substrate wall. Work the thin brick unit into place by tapping, or sliding slightly back-and-forth, or up-and-down, or rotating slightly, until excess mortar is squeezed out at the edges of the veneer unit, completely filling the space between unit and bonding mortar; 100% coverage on the thin brick units. The thickness of the setting/bonding mortar bed shall be between 3/8 in. and 3/4" in (10 mm and 19 mm) to accommodate variations in the substrate surface, variations in the brick, and to adjust for plumbness and flatness of the wall. Use of a 48-inch-long (min) straight edge is recommended to ensure a planar installation, sweeping over the surface, and humoring (adjusting) the brick as needed to correct for anomalies.
- G. Lay units to desired height with joints of uniform thickness. Grout the joints using Type N mortar mix per 2.03 above. Use grout bag, mortar board, hawk, or trowel to fill the joints between units. Do not smear grout over brick surface as is done with tile. Tool the joint when they are thumb print hard.
- H. Bonded units shall be plumb throughout.
- I. Lay units to avoid formation of cracks when units are placed.
- J. Lay masonry plumb, true to line, with courses level. Keep bond pattern plumb throughout. Lay masonry within the tolerances of ACI 530.1 Section 3.3 G.
- K. When positions of units shift after mortar has stiffened, when bond is broken, or when cracks are formed, remove and reinstall units in new mortar.
- L. Avoid laying units where they would bridge active cracks or established movement joints in substrate materials. Cut where necessary to respect jointing in substrate.
- M. Avoid mortar staining on the units during installation. Clean any mortar smearing or staining promptly to reduce final cleaning.

3.6 MORTAR JOINTS

- A. Make joints straight, clean, smooth, and uniform in thickness.
- B. Pointing: Tool exposed joints, slightly concave. Strike concealed joints flush.
- C. Tool joints while slightly moist and thumbprint hard.
- D. Joint Thickness: Make vertical and horizontal joints as required to achieve nominal dimensions on drawings and within tolerances listed in ACI 530.1 Section 3.3 G.

- E. Where fresh masonry joins totally or partially set masonry, clean and roughen set masonry before laying new units.

3.7 BOND PATTERN

- A. Install brick masonry units in running bond pattern to match existing masonry veneer layout on the West and North building elevations, unless otherwise indicated on the Drawings.

3.8 CUTTING BRICK MASONRY UNITS

- A. When possible, use full units of the proper size in lieu of cut units.
- B. Cut units as required to form chases, openings, for anchorage, and for other appurtenances, and at all movement joints and terminations, as required, so as to eliminate units bridging across movement joints (or cracks) in substrate.
- C. Cut and fit units with power-driven carborundum or diamond disc blade saw.
- D. Clean back of units after cutting to remove dust and other deleterious material(s).
- E. Discard units that are damaged during the cutting process, which do not meet the appearance standard of ASTM C1088.

3.9 CONTROL JOINTS / EXPANSION JOINTS

- A. Size joints to accommodate anticipated movements with respect to moisture and thermal gradients in addition to building movements commensurate with the movement potential of the joint material(s).
- B. Provide in masonry walls where indicated on the Drawings.
- C. Make full height and continuous in appearance.
- D. Control and expansion joints must be continuous through the backing, unless detailed otherwise.
- E. Insert control joint filler in joints as wall is constructed.
- F. Insert 50% compressible elastomeric (neoprene or equivalent) expansion joint material in properly sized expansion joints.
- G. Apply sealant to control joint.

3.10 FLASHING

- A. Flashing must be installed at all through wall penetrations and at lower boundaries of the adhered thin brick veneer installations.
- B. Flashings will be integrated with the WRB materials to provide effective control of moisture exiting the wall assembly, with sealed corners, end dams and other accessories as needed.

3.11 OTHER EMBEDDED ITEMS

- A. Build in wall plugs, accessories, flashings, pipe sleeves, and other items required to be built-in as the masonry work progresses.

3.12 PATCHING

- A. Patch exposed brick masonry units at completion of the Work and in such manner that patching will be indistinguishable from similar surroundings and adjoining construction.

3.13 MISCELLANEOUS

- A. Build in required items, such as anchors, flashings, weep screeds, sleeves, electrical boxes, frames, structural steel, lintels, anchor bolts, and metal fabrications, as required for complete installation.

3.14 PROTECTION

- A. Provide temporary protection for exposed masonry corners subject to damage.
- B. Clean all surfaces upon completion of erection, leave free of grime and dirt. Remove unused materials, tools, equipment and debris from the premises and leave surfaces broomed clean.
- C. Protect work from damage by subsequent operations.

END OF SECTION

SECTION 05 12 00

STRUCTURAL STEEL FRAMING

PART 1 – GENERAL**1.1 SUMMARY**

- A. Section Includes: All labor, materials, equipment and operations required to complete structural and miscellaneous metals in shapes and configurations indicated; including:
1. Structural steel columns, beams, bracing, base plates, bolts, joist hangers, and stud bolts welded to structural steel.
 2. Miscellaneous structural steel and connections; fabricated connectors and hangers installed by related sections.
 3. Anchor bolts and steel inserts embedded in concrete or masonry, installed by related sections.
 4. Fabricated steel items embedded in concrete or masonry installed by related sections.
 5. Supervision of anchor bolt setting, leveling and elevations to ensure required fit of steel work.
 6. Shop priming and field touch-up, galvanizing.
 7. Bracing, Shoring, Fabrication and Erection.
- B. Related Sections:
1. Pertinent sections of Division 01 specifying Quality Control and Testing Agency services.
 2. Pertinent Sections of other Divisions specifying concrete reinforcement, formwork, concrete, structural and miscellaneous metal fabrications, steel joists, metal decking, cold-formed metal framing, rough carpentry.

1.2 REFERENCES

- A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC): Chapter 22 Steel.
- B. American Institute of Steel Construction (AISC) 303 "Code of Standard Practice for Steel Buildings and Bridges".
- C. AISC 341 "Seismic Provisions for Structural Steel Buildings".
- D. AISC 358 "Prequalified Connection for Special and Intermediate Steel Moment Frames for Seismic Applications".
- E. AISC 360 "Specification for Structural Steel Buildings".
- F. American Welding Society (AWS) D1.1 "Structural Welding Code - Steel".

- G. AWS D1.8 "Structural Welding Code - Seismic Supplement".
- H. Research Council on Structural Connections (RCSC) "Specification for Structural Joints Using High-Strength Bolts".
- I. Underwriters Laboratories (UL) FRD "Fire Resistance Directory".

1.3 SUBMITTALS

- A. Submit in accordance with pertinent sections of Division 01 specifying submittal procedures. The General Contractor shall review and approve shop drawings prior to submittal to the Architect/Engineer. Submittals that do not meet these requirements will be returned for correction without review.
- B. Limitation of Review: Structural Engineer's review will be for general conformance with design intent as indicated in the Contract Documents and does not relieve Contractor of full responsibility for conformance with the Contract Documents.
- C. Product Data: Submit manufacturer's product data, specifications, location and installation instructions for proprietary materials and reinforcement accessories. Provide samples of these items upon request.
- D. Shop drawings: Submit each building as a complete unit. Do not mix components from multiple buildings or units of work in a submittal. Include all of the following;
 - 1. Profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
 - 2. Fabrication tolerances for all steel.
 - 3. Connections: All, including type and location of shop and field connections.
 - 4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths, type, size, and sequence. Designate demand critical welds.
 - 5. Designation of Seismic Force Resisting System (SFRS) members and connections. Locate and dimension protected zones. Braced frame gusset plates shall be drawn to scale.
 - 6. Cross-reference all shop drawing detail references to contract document detail references.
 - 7. Secure all field measurements as necessary to complete this work prior to submitting shop drawings for review.
 - 8. Provide holes, welded studs, etc. as necessary to secure work of other sections.
 - 9. Provide the following as separate submittals for each building or unit of work:
 - a. Bolt and anchor setting plans.
 - b. Layout, fabrication and erection drawings.
- E. Certifications:

1. Steel Materials: Submit the following for identified materials.
 - a. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.
 - b. Mill Test Reports: Indicate structural strength, destructive test analysis, and non-destructive test analysis.
 - c. Contractor's affidavit certifying that all identified steel materials provided are of the grades specified and match the certificates supplied.
 2. High-Strength Bolting: Certify all materials provided are the grades specified.
 3. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification per AWS D1.1.
- F. Samples: Provide samples to the Testing Agency as specified in Article SOURCE QUALITY CONTROL, at no additional costs.

1.4 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies, refer to pertinent sections of Division 01 and CBC Chapter 17.
- B. All tests shall be performed by a recognized testing agency as specified in pertinent sections of Division 01.
- C. Certification and Identification of Materials and Uses: Provide Testing Agency with access to fabrication plant to facilitate inspection of steel. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection and all material identification/test information listed below.
 1. Test all steel as required by ASTM A6.
 2. Provide manufacturer's Mill Test Reports for all materials. Include chemical and physical properties of the material for each heat number manufactured. Tag all fabricated materials with heat number.
 3. Provide letter certifying all materials supplied are from heat numbers covered by supplied mill certificates. Include in letter the physical location of each material type and/or heat number in the project (i.e. walls, braced frames etc.).
 4. Unidentified Material Tests: Where identification of materials by heat number or mill tests cannot be made, Owner's Testing Agency shall test unidentified materials.
 5. Provide all certification, verifications, and other test data required to substantiate specified material properties at no additional cost to the Owner.
- D. Testing and Inspection: Tests and Inspections performed by Independent Testing Agency are specified below in Articles SOURCE QUALITY CONTROL and FIELD QUALITY CONTROL. Duties and limitations of Independent Testing Agency, test costs and test reports in conformance with pertinent sections of Division 01.

- E. The following standards are the minimum level of quality required. Provide higher quality work as specifically indicated in the Contract Documents.
 - 1. Workmanship and details of structural steel work shall conform to the CBC and AISC 360.
 - 2. The quality of materials and the fabrication of all welded connections shall conform to AWS D1.1 and D1.8.
 - 3. Comply with Section 10 of AISC 303 for architecturally exposed structural steel.
- F. The Testing Agency will review all submittals and testing of materials.
- G. All re-inspections made necessary by non-conforming work shall be at the Contractor's expense.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to project site in bundles marked with durable tags indicating heat number, mill, member size and length, proposed location in the structure and other information corresponding with markings shown on placement diagrams.
- B. Handle and store materials above ground to prevent damage, contamination or accumulation of dirt or rust.

1.6 SCHEDULING AND SEQUENCING

- A. Organize the work and employ shop and field crew(s) of sufficient size to minimize inspections by the Testing Agency.
- B. Provide schedule and sequence information to Testing Agency in writing upon request. Update information as work progresses.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Structural Steel W Shapes: ASTM A992 Gr. 50 or ASTM A572 Gr. 50.
- B. Structural Steel Plates: ASTM A36 or ASTM A572 Gr. 50 or ASTM A529 Gr. 50
- C. Structural Steel Channels, Angles: ASTM A36 or ASTM A572 Gr. 50.
- D. HSS (Hollow Structural Sections):
 - 1. Round: ASTM A500, Gr. C.
 - 2. Rectangular or Square: ASTM A500, Gr. C.
- E. Pipe: ASTM A53, Grade B.

- F. Bolts and Washers: See FINISHES section for galvanization, where required.
1. Machine Bolts, Nuts, and Washers: Bearing and shear connections (denoted as "MB"); ASTM A307 Grade A machine bolts with ASTM A563 Grade A nuts and ASTM F844 washers to match.
 2. High Strength Bolts, Nuts, and Washers: Bearing and shear connections (denoted as "HSB"); ASTM F3125 Grade A325 with ASTM A563 Grade C nuts and ASTM F436 Type 1 washers. Where noted on the drawings provide ASTM A490 bolts with ASTM A563 Grade DH nuts and ASTM F436 Type 1 washers.
 - a. HSB-N: For use in snug tight (ST), pretensioned (PT), and slip critical (SC) joints. Conform to the RCSC Specifications.
 - b. HSB-X: For use where specified on the drawings.
 - c. At Grade A325 bolts use of Grade F1852 (twist off assemblies) is permitted conforming to requirements of RCSC Specifications. At Grade A490 bolts, Grade F2280 is permitted.
 - d. Use of ASTM F959 Load Indicator Washers is permitted conforming to the requirements of RCSC Specifications.
 - e. Slip critical (SC) bolt faying surfaces shall be prepared per RCSC as Class A, unless noted to be Class B per the drawings. Galvanized surfaces at SC bolts shall be hand wire brushed.
- G. Headed Stud Type Shear Connectors: AWS D1.1 Type B.
- H. Deformed Bar Anchors: ASW D1.1 Type C from ASTM A496 material.
- I. Anchor Bolts/Rods:
1. ASTM F1554 Grade 36 or 55 with ASTM A563 Grade A nuts and ASTM F436 Type 1 washers.
 2. ASTM F1554 Grade 105 where indicated on plans with ASTM A563 Grade DH nuts and ASTM F436 Type 1 washers.
 3. No upset thread allowed.
- J. Arc-Welding Electrodes: AWS Standards E70 or equivalent, except no E70T-4 allowed. Additionally, welding electrodes to be used in the welding of seismic force resisting system to conform to AISC 341 and AWS D1.8.
- K. Other Welding Materials: AWS D1.1; type required for materials being welded.

2.2 ACCESSORIES

- A. High Strength Grout: ASTM C1107, non-shrink, premixed compound consisting of aggregate, cement, and water reducing plasticizing agents.
1. Minimum Compressive Strength at 3 days: 3000 psi, placed in a "fluid" state.
 2. Minimum Compressive Strength at 28 days: 7000 psi, placed in a "fluid" state.
 3. Provide only non-metallic grout at exposed work.

4. Meet or exceed properties of BASF "Master Flow 928" mixed to fluid consistency. Other acceptable manufacturers: The Burke Company and W.R. Meadows, Inc.
- B. Building Structural Steel Primers: Comply with local VOC limitations of authorities having jurisdiction and the California Green Building Code. Verify compatibility with finish coats specified in other sections. Follow manufacturers printed instructions. Apply one coat unless otherwise directed.
1. Type A: Self-Crosslinking Hydrophobic Acrylic passing 2000 hours ASTM D4585 and 7000 hours ASTM D5894. "Series 115 Uni-Bond DF" by Tnemec (2.0 to 4.0 mils DFT).
 2. Type B: Organic Zinc-Rich Urethane passing 50,000 hours ASTM B117 and 15000 hours ASTM G85. "Series 90-97 Tneme-Zinc" by Tnemec (2.5 to 3.5 mils DFT) or "Series 94-H20 Hydro-Zinc" by Tnemec (2.5 to 3.5 mils DFT).
 3. Type C: MIO-Zinc Filled Urethane passing 10,000 hours ASTM B117 and 5000 hours ASTM D4585. "Series 394 PerimePrime" by Tnemec (2.5 to 3.5 mils DFT).
- C. Galvanizing: ASTM A153 and A123.
- D. Touch-Up Primer for Galvanized Surfaces: Type B primer.

2.3 FABRICATION

- A. Shop fabricate to greatest extent possible.
- B. Continuously seal built up members by continuous welds where exposed to weather.
- C. Fabricate connections for bolt, nut, and washer connectors.
- D. Protect all materials, before and after fabrication, from rust, corrosion, dirt, grease, and other foreign matter.
- E. Fabricate framing members free from twists or bends. Form holes, cut and sheared edges neatly without kinks, burrs, or warped edges.
- F. Exposed Steel: Straight, smooth, free of nicks, scars or dents.
- G. Gas Cutting: Gas cutting of holes in a member shall not be permitted.
- H. Splicing of members: Members requiring splicing due to length requirements may be spliced using full penetration butt welds when such welds and procedures are inspected and certified by the Testing Agency, in conformance with AWS and AISC standards. The location of splices shall be approved by the Architect/Engineer in writing prior to fabrication.
- I. Welding: Welding of structural steel connections shall be performed by qualified

welders in accordance with AWS Standards. All weld sizes shall match those shown on the drawings.

1. Preparation: Clean all surfaces free of rust, paint and all foreign matter. Remove paint or scale by brushing, chipping or hammering as required. Chip clean and wire brush burned or flame cut edges before welding. Space and alternate welds, clamping as necessary to prevent warp or misalignment.
 2. Sequence Welding: When welds enclose, or partially enclose, the perimeter or portion of the surface of a member, make weld bead in sequence, or staggered. Minimize internal stresses. Weld groups of members occurring in a single line in staggered sequence to minimize distortion of the structural frame.
 3. Faulty and Defective Welding: Welds failing to meet AWS standards and the Contract Documents shall be rejected and remade at Contractor expense. All welds showing cracks, slag inclusion, lack of fusion, bad undercut or other defects, ascertained by visual or other means of inspection shall be removed and replaced with conforming work.
 4. Minimum Weld Strengths: All welds shall match the minimum weld sizes recommended by AISC. Details of fabrication not specifically shown shall match similar details which are specifically shown. All bevel and groove welds shall be full penetration unless size is noted otherwise.
 5. Threaded studs, headed studs, and deformed bar anchors shall be full-fusion welded conforming to ASW D1.1.
- J. Camber: Fabricate all beams cambered as indicated on the drawings.
1. Fabricate beams without camber for installation with any "natural" crown up.
 2. Exception: Fabricate cantilever beams with "crown" down.
- K. Grinding: Grind smooth the following structural steel and connections;
1. Exposed cut ends of structural and fabricated shapes.
 2. All welds exposed to view.
 3. Mitered and fit-up corners and intersections.
- L. Back-Up Bars: Required for all complete penetration welds. See requirements of AISC 358.
- M. Bolt Holes: Edge, end distances and spacing shall conform to dimensions shown on the drawings, and as follows;
1. Round: Size indicated and 1/16 inch maximum oversize, except 1 inch and larger bolts may have 1/8 inch maximum oversize.
 2. Slotted: At locations specifically noted on the drawings, provide size indicated and 1/16 inch by 1/4 inch oversize slotted in direction perpendicular to applied loads.
 3. Holes in base plates for anchor bolts may be 1/8 inch oversize.

- N. Comply with Section 10 of AISC 303 for architecturally exposed structural steel (AESS). See architectural & structural drawings for locations of AESS.

2.4 FINISHES

- A. Steel exposed to inclement atmospheric conditions or weather (such as coastal moisture or seasonal rain) shall be sufficiently primed or otherwise protected against corrosion. If condition of steel is suspect due to weathering/corrosion, Contractor shall bear cost of inspection to determine if excessive corrosion is present and if steel member(s) requires repair or replacement. Contractor shall bear cost of repair or replacement.
- B. Prepare and finish structural and miscellaneous steel component surfaces as follows, unless a higher standard-of-care is determined necessary per item A:
1. Unpainted, interior, dry exposure surfaces need not be primed.
 2. Finished painted, interior, dry exposure surfaces:
 - a. Surface Preparation: SSPC-SP2 Hand-Tool and/or SP3 Power-Tool Cleaning. Apply Primer Type A. Field touchup with same primer.
 - b. Where jobsite exposure is expected to exceed 6 months, SSPC-SP6 / NACE No. 3 Commercial Blast-Cleaning is required. Apply Primer Type B or C. Field touchup with same primer.
 3. Finish painted surfaces with exterior exposure, interior exposure subject to wet conditions or fumes, or surfaces to receive high performance finish coatings (for example epoxy or urethane coatings).
 - a. Surface Preparation: SSPC-SP6 / NACE No. 3 Commercial Blast-Cleaning to create a dense, uniform angular surface profile of 2.0 mils minimum. For severe (immersion) exposure, SSPC-SP10 / NACE No. 2 Near-White Blast-Cleaning is required.
 - b. Apply Primer Type B. Field touchup with same primer.
 4. Surfaces to be fire proofed need not be primed unless required by the fireproofing manufacturer or if jobsite exposure is expected to be inclement per item A. Where unprimed steel is to receive fireproofing, prepare steel surface as required by fireproofing manufacturer. If fireproofed surfaces are to be primed, provide primer as follows:
 - a. Surface Preparation: SSPC-SP3 Power-Tool Cleaning.
 - b. Apply Primer Type C. Field touchup with same primer.
 5. Exterior exposed (unpainted) surfaces and as otherwise indicated to receive galvanizing:
 - a. Galvanize per ASTM A123 Class 55 minimum. Passivation agents are not permitted on galvanized metal that is to be painted. Provide vent holes per ASTM A385 at closed sections (such as HSS). Submit proposed location of vent holes for review by Engineer.
 - b. Connection hardware shall be hot-dip galvanized per ASTM A153 or F2329. Grade A325 high-strength bolt assemblies may be mechanically galvanized per ASTM B695 class 55 or hot-dip galvanized per ASTM F2329. Mating bolts and nuts shall receive the same zinc-coating process.

- c. Repair all uncoated, damaged, or altered galvanized surfaces per ASTM A780.
- C. Do not prime the following surfaces unless otherwise indicated:
 - 1. Connections to be field welded.
 - 2. Steel in contact with concrete.
 - 3. Surfaces to receive welded metal decking.
- D. Slip critical bolted connection surfaces shall either be unfinished & prepared per the RCSC or primed per item B3 or B4.
- E. Do not cover up work with finish materials until inspection is complete and work is approved by the Testing Agency.

2.5 SOURCE QUALITY CONTROL

- A. An independent Testing Agency will perform source quality control tests and submit reports, as specified in pertinent sections of Division 01.
- B. Steel Materials Testing:
 - 1. No testing is required for materials identified in accordance with CBC Section 2202.1 (heat number, grade stencil, etc.).
 - 2. Unidentified steel- General: Test all structural shapes. In addition, test to verify Fy and Fu values when engineering requirements exceed Fy = 25 ksi for design.
 - 3. Charpy V-Notch (CVN) testing requirements are per AISC 341. Heavy sections requiring CVN testing are indicated on the documents.
- C. Shop Welding Inspection:
 - 1. Testing Agency shall inspect and certify all structural welds, unless the fabricating shop has been accredited in conformance with CBC requirements. Submit certification to the Architect/Engineer for review and the Building Official for approval.
 - 2. Welder Qualifications: Welding inspector shall verify that all the welders are properly qualified prior to steel fabrication and state the qualifications of each welder in the welding inspection report.
 - 3. Welding Inspection: Continuous inspection required unless otherwise noted below. Comply with requirements of AWS D1.1, AWS D1.8 and AISC 341.
 - a. Welding Inspector shall check all welds, materials, equipment and procedures.
 - b. Welding Inspector shall provide reports certifying the welding is as required and has been done in conformity with the plans, specifications and codes.
 - c. Welding Inspector shall use radiographic, ultrasonic, magnetic particle, or any other necessary aid to visual inspection to assure adequacy of welds.

- 4. Periodic Inspection Acceptable:
 - a. Single pass fillet welds not exceeding 5/16 inch.
 - b. Welding of studs to beams.
- D. Bolts, Nuts and Washers: Provide samples to Testing Agency for required testing, at no additional cost.
- E. High Strength Bolted Connections: Provide testing and verification of shop-bolted connections in accordance with RCSC specifications. Test all bolts at each connection.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.2 ERECTION

- A. Erect structural steel in compliance with AISC 303.
- B. Framing:
 - 1. Erect all structural steel true and plumb.
 - 2. Verify proper final alignment prior to making final connections.
- C. Field Connections:
 - 1. Workmanship of field bolted and welded connections shall conform in all respects to methods and tolerances specified for fabrication.
 - 2. Field weld components indicated on shop drawings. Sequence field welds to minimize built-up stress and distortion of the structural frame. Verify sequence with Engineer. Coordinate field welding schedule with Testing Laboratory.
 - 3. Welded Studs: Install in accordance with manufacturer's instructions and structural welding code AWS D1.1 and AWS D1.8.
- D. Templates: Provide bolt setting templates for all anchor bolts. Provide instructions for the setting of anchors and bearing plates, verify these items are set correctly as work progresses.
- E. Column base plates: Set level to correct elevations, support temporarily on steel wedges, shims, or leveling nuts where shown, until the supported members are plumbed and base plate is grouted.
 - 1. Grout solid the full bearing area under base plates prior to installation of floor and/or roof decks.
 - 2. Comply with manufacturer's instructions for high strength grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees, or form edges

vertical 1in-2in away from base plate edges. Top of grout outside of base plate footprint shall not extend higher than bottom of base plate.

F. Bolting - General:

1. Inspect mating surfaces to ensure that bolt head and nut will have full bearing and that metal plies will mate flush between bolts.
2. Install bolts in matching holes. Do not distort metal or enlarge holes by drifting during assembly. Remake mismatched components to achieve tolerances indicated.
3. Holes mismatched in excess of 1/8 inch will be rejected.
4. Holes mismatched less than 1/8 inch may be reamed to the next larger size bolt.
5. Do not enlarge holes by flame cutting or air/arc ("plasma") cutting.
6. Provide flat washer(s) at over-size holes.
7. Provide washers for all conditions per RCSC Section 6 and under nuts to connected parts less than 1/4 inch thick.
8. Provide ASTM F436 beveled washers when the slope of the surfaces of parts in contact with the bolt head or nut is greater than 1:20.
9. Do not install bolts with damaged threads.
10. Threads shall commence outside of the shear plane where noted as HSB-X on drawings.

G. Bolting - Specific:

1. Machine Bolts (MB): Install and tighten to a snug condition (ST) such that laminated surfaces bear fully on one another, using an impact wrench or "full effort" of an installer using a standard spud wrench.
2. High Strength Bolts in Bearing/Shear or Static Tension joints snug tight (ST):
 - a. Provide a hardened washer at the head/nut at slotted holes
 - b. Install and tighten as per Machine Bolts (MB) snug tight (ST) and other requirements of RCSC specification Section 8.
 - c. Use ASTM F436 washer only in snug tight connections with static tension loads.
3. High Strength Bolts in Pretensioned joints (PT):
 - a. Provide ASTM F436 washer per requirements of RCSC Section 6.
 - b. Install and tighten in accordance with the requirements of RCSC Section 8.
 - c. Install bolts in all holes of the joint and compact the joint until the connected plies are in firm contact prior to pretensioning.
 - d. The following tightening methods and bolt type are acceptable for PT joints:
 - (a) Turn-of-the-nut pretensioning method
 - (b) Calibrated wrench pretensioning method
 - (c) Twist-off-type tension-control bolts
 - (d) Direct-tension-indicator washer pretensioning method.
4. High Strength Bolts in Slip Critical (SC) joints:
 - a. Provide tensioning for High Strength Bolts (PT) per above.
 - b. Faying surfaces to be prepared per RCSC Section 3 and PART 2.

- H. Supports, Shoring and Bracing: Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing. Conform to requirements of all applicable laws and governing safety regulations. Resist imposed loads, including those of stored materials and equipment.
 - 1. Provide all temporary supports, shoring and bracing necessary to achieve work of tolerances indicated.
 - 2. Provide all necessary temporary flooring, planking and scaffolding required for erection of steel, and support of erection machinery.
 - 3. Construction Loading: Do not overload the structure or temporary supports with stored materials, equipment or other loads.
 - 4. Maintain temporary bracing and shoring until work is complete, and longer as required to ensure stability and safety of structure.
- I. Do not make final connections until structure is aligned to meet specified tolerances.

3.3 ERECTION TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.

3.4 FIELD QUALITY CONTROL

- A. The independent Testing Agency will perform field quality control tests, as specified in pertinent sections of Division 01.
- B. Field Welding Inspection: Conform to all requirements of section SOURCE QUALITY CONTROL.
- C. High Strength Bolting: Provide testing and verification of field-bolted connections in accordance with RCSC Section 9.
 - 1. Inspect mating surfaces.
 - 2. Test all materials prior to use. Use only materials meeting specified requirements.
 - 3. Inspector shall review installation and verify "full effort" with installers for ST joints and shall randomly manually verify "full effort" on 10 percent of installed bolts.
 - 4. Inspector shall verify installation for 100% of SC and PT joints.
 - 5. Review installation procedures for all types of HSB joints and verify installation of "Twist-off" and load-indicator type bolts.
 - 6. If any bolt fails testing, all bolts at the joint shall be loosened and re-tightened. Exception: Galvanized bolts shall be replaced prior to re-testing.
- D. Welded Studs: Test headed studs electro-magnetically welded through metal deck to directly to steel members as follows:

1. Install minimum of two trial studs.
2. Testing Agency shall bend studs with a hammer to minimum 30 degrees out of axis.
3. Any failure shall require new studs be welded for another test and welding apparatus adjusted.

3.5 ADJUSTING

- A. Touch-up damaged finishes with compatible specified primer.
- B. Replace defective or damaged work with conforming work. Replace all defective work at Contractor's expense.
- C. Straighten materials by means that will not injure the materials.
- D. Replace defective or damaged work which cannot be corrected in the field with new work, or return defective items to the shop for repair.
- E. Architect/Engineer shall review all proposals for the repair or replacement of damaged, defective, or missing work.
- F. Pay expenses incurred by Owner for Architect/Engineer's costs for (re-)design and obtaining approvals of Authorities Having Jurisdiction (AHJ) necessitated by incomplete, inefficiently scheduled, improperly performed, defective or nonconforming work, as specified in pertinent sections of Division 01.
- G. Pay expenses due to re-testing and re-inspection necessitated by incomplete, inefficiently scheduled, improperly performed, defective or nonconforming work, as specified in pertinent sections of Division 01.

3.6 CLEANING AND PROTECTION

- A. Clean all surfaces upon completion of erection; leave free of grime and dirt. Remove unused materials, tools, equipment and debris from the premises and leave surfaces broomed clean.
- B. Protect work from damage by subsequent operations.

END OF SECTION

SECTION 05 51 00**METAL FABRICATIONS**

PART 1 - GENERAL**1.1 SUMMARY**

- A. Section Includes: Provide stock and custom fabricated metal items complete in respect to function as intended.
 - 1. Fabricated Steel Trash Enclosure Gates and Hardware.
 - 2. Fabricated Stainless Steel Brackets for countertop support.
 - 3. Fabricated Stainless Steel Brackets for bench support.
 - 4. Stainless Steel Corner Guards.
 - 5. Pre-engineered support systems and braces.
 - 6. Miscellaneous metal fabrications includes items made from iron and steel shapes, plates, bars, strips, tubes, pipes and castings which are not a part of a structural steel or metal system specified elsewhere.
- B. Related Work:
 - 1. Section 06 40 00: Architectural Woodwork and Countertops
 - 2. Section 12 36 00: Stainless Steel Countertops

1.2 REFERENCES

- A. American Welding Society (AWS): D1.1, Structural Welding Code.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's literature for products used in metal fabrications, including paint, grout and manufactured items.
- B. Shop Drawings: Submit for fabrication and erection of metal fabrications. Indicate materials, profiles, sizes, connection, reinforcing and anchorage.
 - 1. Provide templates for anchorage installation by others.

PART 2 - PRODUCTS**2.1 MATERIALS**

- A. Steel Shapes, Plates and Bars: ASTM A36.

- B. Structural Steel Sheet: Hot rolled, ASTM A1011; or cold rolled, ASTM A1008, Class 1; of grade required for design loading.
- C. Steel Pipe: ASTM A53, Type S seamless, grade as selected by fabricator and as required for design loading; minimum standard weight, STD or Schedule 40.
- D. Steel Tubing: Cold formed ASTM A500; or hot rolled, ASTM A501; minimum Grade B; seamless where exposed.
- E. Castings: Gray iron, ASTM A48, Class 30; malleable iron, ASTM A47.
- F. Stainless Steel: ASTM A666, Type 304, corrosion resistant nonmagnetic stainless steel with No. 4 satin direction polish finish.
- G. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron ASTM A47, or cast steel ASTM A27. Provide bolts, washers and shims as required, hot-dip galvanized, ASTM A153.
- H. Grout: Non-shrink meeting ASTM C1107, non-metallic, pre-mixed, factory-packaged, non-staining, non-corrosive; type specifically recommended by manufacturer as applicable to job condition.
 - 1. Manufacturers:
 - a. Master Builders/Masterflow 713.
 - b. Five Star Products, Inc./Five Star Grout.
 - c. Bostik Construction Products/Upcon Grout.
 - d. Protex Industries, Inc./Propak.
 - e. Substitutions: Refer to Section 01 63 00.
- I. Fasteners and Rough Hardware: Type required for specific usage; provide zinc-coated fasteners for exterior use or where built into exterior walls.
- J. Welding Materials: AWS D1.1, type required for materials being welded.
- K. Powder Coat Paint Finish: The paint finish on all exterior exposed metal surfaces shall be shop-applied spray-applied Fluorocarbon Resin utilizing 70% Kynar 500 resins. Color as selected from manufacturer's standard color chart including premium colors.
 - 1. Number of Coats: 3-coats. The coating shall be shop applied. The coating shall consist of a 0.2 mil prime coat, a 0.70 mil barrier coat, a 0.70 mil color coat containing 70% Kynar resins.
 - 2. Color Gray to match existing or as selected by Architect from full color range.
 - 3. Relevant to the color selected, material to be painted in accordance with either AAMA specification 2605 or 2604.

- L. Interior High Performance Paint: The paint finish on all interior structural steel exposed fasteners and connections shall be as specified in Section 09 96 00 – High Performance Coatings.

2.2 FABRICATION

- A. Fabricate items with joints neatly fitted and properly secured.
- B. Grind exposed welds continuous, smooth and flush with adjacent finished surfaces, and ease exposed edges to approximate 1/32" uniform radius.
- C. Exposed Mechanical Fastenings: Flush countersunk fasteners unobtrusively located, consistent with design of structure.
- D. Fit and shop assemble in largest practical sections for delivery.
- E. Make exposed joints flush butt type, hairline joints where mechanically fastened.
 - 1. Fabricate joints exposed to weather in manner to exclude water or provide weep holes where water could accumulate.
- F. Supply components required for proper anchorage of metal fabrications; fabricate anchorage and related components of same material and finish as metal fabrication.
- G. Pre-Engineered Support Systems: Provide manufactured pre-engineered support system consisting of minimum 12 gage "C" channel supports with anchors, attachments, and accessories as required for complete installation.
 - 1. Manufacturers:
 - a. Unistrut Inc./Unistrut.
 - b. Grinnell Corp./PowerStrut.
 - c. Thomas & Betts, Inc./Superstrut.
 - d. Substitutions: Refer to Section 01 63 00.
 - 2. Finish: Manufacturer's standard prime paint finish for channel supports; galvanized or similar plated anchors and fasteners; hot dip galvanized where at exterior and exterior exposed applications.
- H. Stainless Steel Corner Guards: Manufacturer's standard paper-covered satin finish, 16-gage minimum, stainless steel corner guards, height as shown on drawings, with 1.25" by 1.25" wings. Provide 90 degree turn unless otherwise indicated and formed edges. Mount with concealed epoxy or roll tape.
 - 1. Manufacturers:
 - a. American Floor Products Co., Inc.; www.americanfloorproducts.com; Lunar Style L-1.
 - b. Pawling Corporation; www.pawling.com; Type CG-51 Series.
 - c. Substitutions: Refer to Section 01 63 00

- I. Finishes: Galvanize and prime paint exterior work and prime paint interior work unless otherwise noted in Schedule; comply with requirements of Section 09 91 00 - Paints and Coatings
 - 1. Thoroughly clean surfaces of rust, scale, grease and foreign matter prior to applying finish.
 - 2. Do not shop prime surfaces in contact with concrete or requiring field welding; shop prime in one coat.
 - 3. Galvanized Coating: Provide coating comparable to ASTM A924 and A653, minimum G90 hot dip galvanized coating.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible; do not delay job progress; allow for trimming and fitting where necessary.

3.2 ERECTION

- A. Obtain Architect's review prior to site cutting or making adjustments which are not part of scheduled work.
 - 1. Perform necessary cutting and altering for installation and coordination with other work.
- B. Install items square and level, accurately fitted and free from distortion or defects detrimental to appearance or performance.
 - 1. Supply items required to be cast into or embedded in other materials to appropriate trades.
 - 2. Ensure alignment with adjacent construction; coordinate with related work to ensure no interruption in installation.
- C. Make provision for erection stresses by temporary bracing; keep work in alignment.
- D. Field bolt and weld to match standard of shop bolting and welding; hide bolts and screws whenever possible, where not hidden, use flush countersunk fastenings.
 - 1. Perform field welding in accordance with AWS D1.1.
- E. After installation, touch-up field welds and scratched and damaged surfaces; use primer consistent with shop coat or recommended for galvanized surfaces, as applicable.

F. Replace items damaged in course of installation and construction.

3.3 SCHEDULE

A. Supply and install metal fabrications listed in Schedule, complete with anchorage and attachments necessary for installation.

1. Schedule lists principal items only, refer to Drawings for items not listed.

B. Schedule:

1. Iron and steel shapes, sleeves, anchors, connectors and fastenings required to complete construction work, and which are not provided in other Specification sections.

a. Rough hardware, including bolts, fabricated plates, anchors, hangers, dowels and miscellaneous metals.

b. Ledge and shelf angles, channels and plates not attached to structural steel.

c. Angle and channel frames for doors and wall openings.

d. Beams of structural shapes, not supported by structural steel.

2. Fabricated stainless steel.

3. Stainless steel corner guards.

4. Trash enclosure gates.

END OF SECTION

SECTION 06 01 20**WOOD SILL RESTORATION**

PART 1 - GENERAL**1.1 SUMMARY**

- A. Section includes: Removal of existing paint and deteriorated or dry rot wood from all existing wood sills, applying epoxy sealers and fillers where required, and preparing all wood sills to receive new paint finish as specified.
 - 1. Determination of deteriorated or dry rot wood: Field analysis by the Architect and Contractor during course of construction.
 - 2. Deteriorated wood shall be identified and summarized by the level of deterioration present.
 - a. Moderate deterioration of the wood has a porosity in any particular dimension which is abnormally higher than that of wood recognized by an architect or structural engineer as being mechanically sound.
 - b. Gross deterioration of the wood is present when portions of the wood element are missing, or some of the wood in the area being examined is of a soft, crumbly texture, easily removable by the bare fingers. Behind an area of gross deterioration will be found wood having high porosity and somewhat better mechanical properties, and behind that will be found wood of comparatively better mechanical properties and less porosity. Eventually, sound wood which is consistent in its porosity and mechanical properties is reached.
- B. Related Sections:
 - 1. Section 06 20 00: Finish Carpentry
 - 2. Section 09 91 00: Paints and Coatings

1.2 SUBMITTALS

- A. Product Data: Submit literature and repair procedures for manufactured epoxy products.
- B. Survey: Submit a summary of all existing wood sill conditions present including location, type of deterioration observed, and proposed repair.
- C. Field Mockup: Perform epoxy repair of deteriorated wood sill as a mockup for review by the Architect prior to proceeding with the Work.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver materials until site conditions are adequate to receive work; protect items from weather while in transit.
- B. Store materials indoors, in ventilated areas with constant but minimum temperature of 60 degrees F and maximum relative humidity of 25% to 55%.

PART 2. PRODUCTS

2.1 MATERIALS

- A. Wood Epoxy Sealer:
 - 1. Basis of Design: Smith's Clear Penetrating Epoxy Sealer
 - a. Smith & Co. Restoration Products, Richmond, CA, Phone: 1-800-234-0330.
 - b. Substitutions: Refer to Section 01 63 00.
- B. Wood Epoxy Filler:
 - 1. Basis of Design: Smith's Fill-It Epoxy Filler
 - a. Smith & Co. Restoration Products, Richmond, CA, Phone: 1-800-234-0330.
 - b. Substitutions: Refer to Section 01 63 00.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine, inventory, and prepare a survey of all existing window sill conditions prior to start of work.
 - 1. All window sills shall require some degree of repair or restoration.
 - 2. Inventory window sills and identify or categorize each sill as follows:
 - a. Condition 1: Strip existing paint and prepare existing wood surfaces to receive new paint as per Specification Section 09 91 00 – Paints and Coatings.
 - b. Condition 2: Strip existing paint, remove deteriorated or dryrot wood, install epoxy sealer and epoxy filler, and prepare all surfaces to receive new paint as per Specification Section 09 91 00 – Paints and Coatings.
 - c. Condition 3: Remove existing wood sill, scribe and install new wood sill, and prepare to receive new paint as per Specification Section 09 91 00 – Paints and Coatings.
 - 1) Wood sill replacement shall be performed under the requirements of Specification Section 06 20 00 – Finish Carpentry.

- B. Submit survey of all existing wood sill conditions present including location, type of deterioration observed, and proposed repair for review by Architect prior to start of Work.
- C. Verify surfaces are ready to receive work.
 - 1. Beginning installation signifies acceptance of conditions.

3.2 PAINT AND DETERIORATED WOOD REMOVAL

- A. Remove all paint from all wood sill surfaces.
 - 1. Paint removal shall be accomplished by a combination of chemical stripping and mechanical sanding.
 - a. Protection of adjacent plaster finishes shall be required. Protect plaster finish, including texture, in place.
- B. Update wood sill survey as necessary upon completion of paint removal and resubmit to Architect for review.
- C. Where identified as either moderate or gross deterioration, remove all deteriorated wood so that only sound wood remains.
 - 1. Where deterioration is so significant that more than 50% of the wood sill is removed, then the entire wood sill shall be replaced as per Specification Section 06 20 00 – Finish Carpentry.
 - 2. Elements which are or appear to be structural in nature or function may be inspected by an architect or structural engineer prior to commencement of any work by restoration personnel.
 - a. Before any further work is done, the structural wood element shall be inspected by an architect or structural engineer. By inspection, tests or measurements satisfactory to the architect or structural engineer, it shall be determined that the remaining portion of the wood element is sufficient to support its load, based on appropriate standards.
- D. Upon completion of paint and deteriorated wood removal, prepare wood sills to receive epoxy and paint finishes.

3.3 EPOXY SEALER AND FILLER

- A. Sealer Application:
 - 1. The work area must be protected from rain, snow or condensation from the beginning of any restoration work until final painting.
 - 2. Apply clear penetrating epoxy sealer according to manufacturer's written instructions.

- B. Epoxy Filler Preparation: The surface of any region to be filled shall be first treated with epoxy sealer in accordance with manufacturer's written instructions..
- C. Filler Application:
 - 1. The work area must be protected from rain, snow or condensation from the beginning of any restoration work until final painting.
 - 2. Apply epoxy filler according to manufacturer's written instructions.
 - 3. After curing, sand filler to match existing wood sill profile.
 - 4. Prepare surface to receive paint finish as specified.

3.4 CLEAN-UP, PROTECTION, AND REPAIR

- A. Clean-Up: During progress of work, remove discarded epoxy materials, rubbish, cans and rags from site at end of each workday.
 - 1. Clean glass and paint-spattered surfaces immediately by proper methods of washing and scraping, using care not to scratch or damage finished surfaces.
- B. Protection: Protect work of other trades, whether to be painted or not; correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.
 - 1. Provide "Wet Paint" signs to protect newly epoxied finishes.
 - 2. Remove temporary protective wrappings provided by others for protection of their work, after completion of operations.
- C. Repair: At completion of work of other trades, touch-up and restore damaged surfaces or defaced epoxy surfaces.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL**1.1 SUMMARY**

- A. Section Includes: All labor, materials and equipment and all operations required to complete all rough carpentry and structural framing as indicated on the drawings; to produce shapes and configurations as shown, as required; and as specified herein, including:
1. Structural floor, wall, and roof framing.
 2. Floor, wall, and roof sheathing.
 3. Rough hardware, framing connectors and fasteners.
 4. Treatment of wood.
 5. Concealed wood blocking for support of toilet and bath accessories, wall cabinets, wood trim, and other work requiring supporting blocking.
 6. Miscellaneous wood nailers and furring strips, including roof applications, other wood framing, furring, shims or blocking as required to complete the work.
- B. Related Sections:
1. Pertinent sections of Division 01 specifying Quality Control and Testing Agency services.
 2. Pertinent sections of Division 01 specifying Structural Product Requirements: Structural Product Options, Substitution procedures and limitations, transportation, handling and storage.
 3. Pertinent sections of Division 03 specifying wood formwork construction and/or setting anchors in concrete.
 4. Pertinent section of Division 06 specifying wood construction and materials.
 5. Pertinent sections of other divisions specifying steel or concrete construction.

1.2 REFERENCES

- A. California Code of Regulations, Title 24, latest adopted edition (herein noted as CBC): Chapter 23 Wood.
- B. American National Standards Institute (ANSI) / American Wood Council (AWC) "NDS - National Design Specification for Wood Construction".
- C. National Institute of Standards and Technology (NIST) / Engineered Wood Association (APA) "PS 1 - Voluntary Product Standard for Structural Plywood".

- D. NIST / APA "PS 2 - Performance Standard for Wood-Based Structural-Use Panels".
- E. NIST "PS 20 - American Softwood Lumber Standard".
- F. Redwood Inspection Bureau (RIS) "Standard Specifications for Grades of California Redwood Lumber".
- G. West Coast Lumber Inspection Bureau (WCLIB) "Standard Grading Rules for West Coast Lumber No. 17".
- H. Western Wood Products Association (WWPA) "Western Lumber Grading Rules".
- I. American Wood Preservers Association (AWPA) "Book of Standards".

1.3 SUBMITTALS

- A. Submit in accordance with pertinent sections of Division 01 specifying submittal procedures. Submit for review prior to fabrication. Submittals that do not meet these requirements will be returned for correction without review.
 - 1. Substitutions for products specified require conformance to substitution requirements in Division 01.
 - 2. Review of materials and hardware for substitution to products specified is at the additional expense of the Contractor.
- B. Limitation of Review: Structural Engineer's review will be for general conformance with design intent as indicated in the Contract Documents and does not relieve Contractor of full responsibility for conformance with the Contract Documents. The General Contractor shall review and approve shop drawings prior to submittal to the Architect/Engineer.
- C. Product Data:
 - 1. Submit manufacturer's product data, specifications, and installation instructions for & location of framing connectors, wood preservative materials, application instructions, and fasteners. Include complete, accurate equivalence data when submitting alternate products to those specified. Provide samples of these items upon request.
 - 2. Submit product data and current ICC-ES report for machine-driven nails, fasteners, and equipment, including dimensions of all fasteners, including head, shank diameter and length.
- D. Shop drawings: For manufactured wood products, submit each building as a complete unit. Do not mix components from multiple buildings or units of work in a submittal. Include all of the following;

1. Indicate profiles, sizes, and spacing locations of structural members.
 2. Cross-reference all shop drawing detail references to contract document detail references.
 3. Secure all field measurements as necessary to complete this work.
- E. Manufacturer's Certificate: Submit all certifications of physical and chemical properties of materials as specified below in Article titled QUALITY ASSURANCE.
1. Certify that wood products supplied for rough carpentry meet or exceed specified requirements, including specified moisture content.

1.4 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies, refer to pertinent sections of Division 01 and CBC Chapter 17.
- B. All tests shall be performed by a recognized testing agency as specified in pertinent sections of Division 01.
- C. Inspection of fabricators is required per CBC 1704.2.5 unless fabricator is registered and approved by the building official. Wood product quality standards:
1. All wood products to comply with article REFERENCES.
 2. Factory-mark each piece of lumber and sheathing with type, grade, mill, and grading agency, except omit marking from surfaces to be exposed with transparent finish or without finish.
 3. Sheathing panels to be marked by APA (The Engineered Wood Association).
- D. End-Jointed lumber shall not be used.
- E. Hardware and engineered wood products shall have current ICC ES Evaluation/research reports that are equivalent to products specified.
- F. Employ competent workers experienced in work of the types specified and required.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Comply with pertinent requirements of Division 01.
- B. Delivery: Time delivery and installation of carpentry products to avoid delaying other trades whose work is dependent on or affected by this section and to comply with moisture content, protection and storage requirements.

- C. Keep materials dry at all times. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber and sheathing panels to prevent deformation and provide air circulation within stacks.
 - 1. Store materials for which a maximum moisture content is specified only in areas where relative humidity has been reduced to a level where specified moisture content can be maintained.
 - 2. Handle and store materials above ground to prevent damage, contamination, or accumulation of dirt or foreign materials.
 - 3. Provide special protection for horizontal sheathing panels. Deformation of panels due to moisture is not acceptable.

1.6 PROJECT/SITE CONDITIONS

- A. Verify all conditions at project site affecting the work; work to field dimensions as required. Coordinate carpentry installation with size, location, and installation of service utilities.
- B. Sequence rough carpentry installation activities to allow sufficient time for:
 - 1. Review of all submittals.
 - 2. Indicate submittal review, procurement, and testing activities in the project schedule prior to the start of installation. Installation durations shall be based on hand-nailed installation methods specified.
 - 3. Attainment of specified maximum lumber moisture content.

PART 2 - PRODUCTS

2.1 DIMENSIONED LUMBER

- A. General
 - 1. Size per industry standards for nominal sizes shown; S4S (sanded four sides).
 - 2. Warped/twisted and excessively checked members shall not be used regardless of grade marks.
 - 3. At the Contractor's option, engineered lumber of equivalent size and material properties may be substituted for solid sawn lumber where material is difficult to source due to length, availability, etc. Submit proposed substitution to Engineer for review prior to purchasing materials.
- B. Moisture content of framing:
 - 1. All sawn lumber to be maximum 19% at time of fastener installation and at time of close-in, unless noted otherwise.
 - 2. The Owner's Testing Laboratory will test for moisture content prior to commencement of close-in.

3. The Contractor shall recognize that excessive shrinkage of lumber results from excess moisture content at the time of installation. The Contractor will compensate for use of such lumber by waiting for acceptable moisture content before close in and/or by replacing/repairing lumber that has sagged, twisted, or warped prior to close in.
 4. Deviation from this specification would require structural redesign of connections and fasteners.
- C. Sills/ledgers on concrete or masonry: No. 2 pressure treated Douglas Fir and as called for on the drawings.
- D. Interior structural framing shall be Douglas Fir (D.F.) with grades as noted below, unless otherwise specified on the drawings. All grades are per WCLIB standard grading rules.
1. All permanently exposed (interior or protected from weather) framing shall be select structural grade with no box heart.
 2. Except per 1 above, unless noted otherwise, minimum grades are:
 - a. Floor/roof joists/rafters (2x) and 2x8 & larger studs: D.F. No. 2
 - b. 2x4 and 2x6 studs and plates: D.F. No. 2
 - c. 4x and larger: D.F. No. 1
 - d. Blocking: D.F. No. 2
 - e. 6x8 and larger posts and beams may be SGL/CGL per below unless noted otherwise on the drawings.
- E. Exterior structural framing (exposed to weather) shall be redwood select structural grade or pressure treated D.F. No. 1, unless noted otherwise.
- F. Structural decking shall be D.F. select decking or White Pine select where not exposed to moisture. Where directly exposed to moisture or high humidity for prolonged periods of time, decking shall be Alaskan Yellow Cedar or Port Orford Cedar. Moisture content at time of installation to be less than 12%.
- G. Framing not otherwise shown or specified: Douglas Fir construction grade per WCLIB paragraphs applicable to uses and sizes required.

2.2 MANUFACTURED LUMBER

- A. All engineered lumber to be maximum 16% at time of fastener installation and at time of close-in, unless noted otherwise.
- B. Structural (Certified) Glued Lumber (SGL): SGL shall be manufactured following the American Lumber Standards Committee (ALSC) "Glued Lumber Policy" and meet the requirements of Voluntary Product Standard PS 20 "American Softwood Lumber Standard". Grading shall be per the West Coast Lumber Inspection Bureau (WCLIB) or Western Wood Products Association (WWPA). SGL shall be manufactured with waterproof adhesive. "Stud use only" SGL is not permitted.

1. Acceptable products:
 - a. "RMT" by Rosboro.
 - b. Approved equal.
 2. Where specified for use on plan, SGL shall be entirely Douglas Fir lumber. SGL shall be grademarked to match the grade as would be specified for solid sawn lumber in the same location/use.
 3. At the contractor's option, SGL may be substituted for solid sawn lumber. SGL species and grade shall match that for the solid sawn member. SGL shall not be substituted for glued-laminated (glulam) members.
- C. Laminated Veneer Lumber (LVL): for use as joists, beams, blocking, or studs when so noted on the drawings. Conform to ICC AC 47. Minimum $F_b = 2,600$ PSI. Minimum $E = 2,000,000$ PSI. Acceptable products:
1. "Microllam LVL" by Trus Joist, ICC ESR-1387
 2. "Redlam LVL" by RedBuilt, ICC ESR-2993
 3. Approved equal
- D. Laminated Strand Lumber (LSL): for use as blocking (flat or vertical) or rim joist when used with I-joist or LVL, when so noted on the drawings. Conform to ICC AC 124. Minimum $F_b = 1,700$ PSI. Minimum $E = 1,300,000$ PSI. Acceptable products:
1. "Timberstrand LSL" by Trus Joist, ICC ESR-1387
 2. "Redlam LSL" by Redbuilt, ICC ESR-1387
 3. Approved equal
- E. Parallel Strand Lumber (PSL): for use as beams and posts when so noted on the drawings. Conform to ICC AC 47. Minimum material properties for beams: $E = 2,200,000$ psi; $F_b = 2,900$ psi; $F_c = 2,900$ psi (parallel); $F_v = 290$ psi. Minimum material properties for posts: $E = 1,800,000$ psi; $F_b = 2,400$ psi; $F_c = 2,500$ psi (parallel); $F_v = 190$ psi. Acceptable products:
1. "Parallam PSL" by Trus Joist, ICC ESR-1387
 2. Approved equal

2.3 STRUCTURAL SHEATHING PANELS

- A. All sheathing to be maximum 16% at time of fastener installation and at time of close-in, unless noted otherwise.
- B. Plywood: Structural sheathing shall conform to product standard PS-1 or PS-2. All panels shall have a minimum bond classification of "Exposure 1" and bear the trademark of the Engineered Wood Association (APA) or other qualified agency. Grades shall be "Rated Sheathing" or "Structural 1" as required on the drawings.

- C. Oriented Strand Board (OSB): All structural OSB shall be grade marked by a qualified agency for conformance with Product Standard PS-2 and shall be fabricated with exterior glue. Grades shall be as required on the drawings.

2.4 TREATED WOOD:

- A. Treated Lumber and Plywood: Comply with requirements of AWWA Standard U1. See Standard U1 for "Use Category" designations. Do not provide higher Use Category lumber than that specified. Maximum moisture content shall be the same as required above for respective product type.
- B. Preservative Treated Lumber
 - 1. General
 - a. Preservatives shall be waterborne. Preservative retention rate shall be as required per AWWA Standards U1 & T1. Lumber shall be Douglas Fir No. 2 (or better). Cut faces of treated wood shall be brush treated (two complete applications) prior to installation.
 - b. Lumber less than 8 inches above grade and lumber less than 6 inches above exterior hard-surface flatwork shall be treated.
 - c. Each piece of wood shall be stamped by the wood preservative applicator to identify its treatment and preservative retention.
 - 2. Lumber at interior, non-weather exposed locations installed adjacent to concrete or masonry shall be Use Category UC2. Examples include sill plates & ledgers and lumber in contact with roofing, flashing, or water proofing. Borate treated lumber meeting AWWA UC2 is acceptable in this application.
 - 3. Lumber at exterior locations, not in contact with soil/ground, shall be Use Category UC3B. Examples include Douglas Fir decking and deck framing.
 - 4. Lumber in contact with soil/ground shall be Use Category UC4A. Examples include timber retaining walls.
 - 5. Poles, posts, and sheathing panels shall be treated as recommended by AWWA Standard U1 per use and exposure.
 - 6. Maximum Volatile Organic Compound (VOC) content of field-applied preservative shall meet local air quality standards and the California Green Building Code. Provide either of the following:
 - a. Copper Azole (CA-B) per ICC-ES AC308.
 - b. Alkaline/Copper/Quaternary (ACQ).
- C. Fire Retardant Treatment: Product and application process must be recommended by manufacturer of treatment as being suitable for painting. Application shall be by a California State Fire Marshal approved licensed contractor.
 - 1. Exterior Type: Use Category UCFB, chemically treated, and pressure impregnated; capable of providing a maximum flame spread rating of 25 when tested in accordance with ASTM E84, with no evidence of

significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.

- a. Treat exposed exterior rough carpentry items, including stairways, balconies, and covered walkways.
 - b. Do not use treated wood in direct contact with the ground.
2. Interior Type: Use Category UCFA, low temperature (low hygroscopic) type, chemically treated, and pressure impregnated; capable of providing a maximum flame spread rating of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
- a. Treat rough carpentry items as indicated.
 - b. Do not use treated wood in applications exposed to weather or where the wood may become wet.

2.5 FASTENERS AND ACCESSORIES

A. General requirements for fasteners:

1. Fasteners shall be of adequate size, spacing, and number to resist design loads under intended use, and types shall be appropriate for the materials or conditions for which used.
2. Provide washers, pre-drilling, etc. as required for proper installation and to prevent damage to framing.
3. Fasteners shall be hot-dip galvanized (ASTM A153), mechanically galvanized (ASTM B695 class 55 minimum), stainless steel (type 303, 304, 305, or 316), silicon bronze, or copper by approved methods for the following applications:
 - a. Exterior, exposed use.
 - b. In contact with preservative or fire-retardant treated wood.
 - c. Nails in contact with preservative treated wood containing ammonia shall be stainless steel.
4. Fasteners in moist corrosive atmosphere to be of stainless steel (type 303, 304, 305, or 316).
5. Where the retention level of ACQ or MCQ preservative is greater than 0.40 pcf, CBA-A preservative is greater than 0.41 pcf, or CA-B preservative is greater than 0.21 pcf, provide stainless steel fasteners (type 303, 304, 305, or 316).
6. All fasteners specified by manufacturer shall be installed in framing hardware, unless noted otherwise.
7. At borate treated lumber a clear zinc coating per ASTM F1941 is acceptable.

B. Nails and nailing not otherwise shown or specified:

1. Comply with requirements of governing building code.

2. For securing materials to hardened concrete or masonry provide hardened steel masonry nails or Simpson Strong-Tie "Titen" screws.
 3. For framing and general woodwork: Common bright wire nails (not box nails) with centered full-round heads per ASTM F1667 including Supplement S1. 16d cement coated sinker nails may be used in lieu of common nails for framing, where noted on the drawings. Unless otherwise noted on drawings, nail sizes shall be as follows
 - a. 8d Common: 0.131" $\varnothing$ x 2-1/2" long with 0.281" $\varnothing$ head.
 - b. 10d Common: 0.148" $\varnothing$ x 3" long with 0.312" $\varnothing$ head.
 - c. 16d Common: 0.162" $\varnothing$ x 3-1/2" long with 0.344" $\varnothing$ head.
 4. Nails for sheathing panels shall be of common wire with full round heads and shall be of sufficient length to fully develop the nails.
 5. Machine-driven nails of all types must comply with the requirements of this section. All proposed nails shall match diameter and penetration of specified nails.
 6. Staples shall conform to length and gauges specified and shall be installed to match specified patterns and spacing.
 7. Power Actuated Fasteners (PAF): Use only as approved by the Architect/Engineer; operators shall be qualified.
- C. Bolts: Malleable iron washers or steel plate washers, unless otherwise shown, shall be provided under all bolt heads and nuts.
1. Machine Bolts: ASTM A307 and ANSI/ASME B18.2.1, standard semi-finished machine bolts as shown or required. Nuts shall be standard size unless noted otherwise and shall be per ASTM A563.
 2. Anchor bolts or threaded rod anchors shall conform to ASTM F1554, ASTM A307, or ASTM A36. Anchor bolts shall be headed or end in two nuts tightened against one another, unless noted otherwise. Provide embedded plate washer as indicated on drawings. No upset threads allowed. No L or J bolts allowed.
- D. Lag screws: Standard hex lag screws per ANSI/ASME B18.2.1.
- E. Wood screws: Standard wood screws per ANSI/ASME B18.6.1.
- F. Power Actuated Fasteners (PAF): Hilti X-CP72, ICC ESR-2379; Simpson PDPAWL-300 MG, ICC ESR-2138.
- G. Framing hardware: Fabricated sheet metal timber framing connectors shall be manufactured from painted or galvanized G90 steel by Simpson Strong-Tie (connectors specified on drawings are per Simpson Strong Tie, or approved equivalent. Connectors shall be at least 16 gauge material, (1/8 inch plate materials where welded), unless otherwise noted, punched for nailing. All heavy hardware to be fabricated from A36 steel per Division 05, Metals. All hardware intended for exterior exposed use shall be galvanized per G185 ASTM A653 or stainless steel.

1. For contact with preservative or fire-retardant treated wood, provide minimum G185 galvanizing per ASTM A653.
 2. Nails and nailing shall conform to the manufacturer's instructions with a nail provided for each punched hole. Nails to be used with framing accessories are subject to the requirements specified in this Section for fasteners and anchors.
- H. Subfloor Glue: Water proof, water base, air cure type, cartridge dispensed conforming to APA Standard AFG-01 or ASTM D3498. Maximum Volatile Organic Compound (VOC) shall meet local air quality standards and the California Green Building Code.

2.6 SOURCE QUALITY CONTROL

- A. The Testing Agency, as specified in the Article QUALITY ASSURANCE, will perform testing for moisture content of all lumber at time of fastener installation.
- B. The Testing Agency will submit reports as specified in Division 01.

PART 3 - EXECUTION

3.1 REQUIREMENTS FOR STRUCTURAL FRAMING

- A. General
1. Refer to drawings for layouts, notes and details, provide framing as required; comply with governing building code requirements.
 2. Provide framing to achieve true alignments as surfaces receiving finish materials.
 3. It shall be the responsibility of the Contractor to provide and install all wood blocking, furring strips, or grounds detailed or required to provide anchorage for all finishes, accessories, fixtures, etc. as required to complete all work. All blocking and/or backing shall be securely bolted or otherwise anchored in place.
 4. Contractor shall be responsible for layout of anchor bolts, and other hardware embedded in concrete when placed by other trades.
 5. Provide and install all structural framing, blocking, fasteners, brackets, clips, etc. as required to complete work specified in the Construction Documents.
- B. Framing
1. Sill Plates and Ledgers:
 - a. Sill plates and ledgers on concrete shall be anchored with bolts, unless noted otherwise, shall have full bearing on concrete, and shall be placed for sheathing panel nailing as indicated. All bolt nuts shall be provided with a cut plate steel washer for bearing on wood.

- b. Provide a minimum of two sill anchor bolts per sill piece with a bolt no less than 4 ½" and no more than 12" from the end of the sill. Bolts to be 5/8" diameter x 12" (18" at curb) long at 48" on centers, unless otherwise shown or noted. Provide additional anchor bolts each side of a notch or hole, as per a typical plate splice, where notch or hole is in excess of 1/3 the plate width. At shear walls, provide a plate washer 3" x 3" x 0.229" minimum between the sill and nut at anchor bolts. Plate washer to extend within ½ inch of the structural wall sheathing. Offset and/or stagger anchor bolts, or provide larger plate washer as required.
 - c. Anchor bolt holes in sill plates or ledgers shall be 1/16" maximum larger than anchor bolt.
2. Stud Walls and Framing:
- a. Cut studs and posts with square ends, unless otherwise shown or noted. All posts and beams shall be "cut to bear" unless otherwise detailed.
 - b. All studs in walls shall be placed with the shortest dimension parallel to the run of the wall. Bearing studs shall extend full height to be the supporting framing as shown; non-bearing studs shall extend to the supporting framing.
 - c. Provide double studs on each side of all openings, unless shown or noted otherwise.
 - d. All openings in stud walls and partitions shall be framed with headers across the top, as shown, with a minimum size (6" nominal depth x stud width) resting on short cripple studs, and as shown on the drawings.
 - e. All stud partitions and walls shall have horizontal solid blocking not less than 2x and of the same width as the stud, fitted and nailed into the studs at mid-height of stud, for studs over 8 feet in height, except as otherwise shown or specified. This blocking shall be so spaced that there shall be no concealed air spaces greater than eight feet in any dimension.
 - f. Stud partitions containing plumbing, heating or other pipes shall be so framed as to give proper clearance for piping. Plumbing, heating and vent pipes exceeding 1-1/2" in inside diameter shall not be placed in partitions used as bearing or shear walls unless completely furred clear of the wall. No notching shall be allowed. Pipes shall be placed in the center of the plate using a neat bored hole and the plates shall be strapped on each side with 3" x 36" x 14 gauge steel punched for 10d nails 3" on center, staggered, or as shown on the drawings.
3. Top Plates
- a. Top plates shall be double, set single. Corners where stud wall or partitions meet shall be framed with studs on all surfaces and blocking to form a "rigid" corner with nailing for all corners. Double top plates shall be lapped at corners. Lap splices and nailing per the drawings.
4. Floor, Roof and Ceiling Framing

- a. Joists and beams shall be accurately aligned and the position and spacing of all joists and beams shall be as shown and be coordinated with other framing and to other trades prior to actual construction.
- b. Place all joists and beams with crown up. Cantilevered joists and beams shall be placed with the crown down.
- c. Cutting of wood girders, beams or joists for electrical and mechanical lines shall be limited to cuts and bored holes not deeper than 1/5 of the beam depth from the top and located not farther from the support than three times the beam depth and not less than the beam depth. Cuts in excess of this, or single bored holes with a diameter of more than 1" are not permitted without special provisions for framing the beams. Location of all cuts in framing shall receive the prior review of the Architect/Engineer.
- d. Provide vent holes in rafters and/or blocking as shown and/or directed by the Architect.

3.2 STRUCTURAL SHEATHING

A. General

1. Sheathing nailing shall be as required on the drawings. Do not overdrive (Do not break skin of sheathing face sheet). Over driving will be cause for rejection.
2. Form sheathing may be re-used for concealed sheathing provided the lumber at the time of re-use is approved by the Architect, meets with the framing grade requirements specified herein, is in good condition, and is thoroughly cleaned with all nails removed.
3. Pneumatic nailing devices shall be adjustable so that nail heads do not penetrate skin of sheathing. Contractor shall submit equipment and nails for review prior to use. Refer to PART 2 for other nailing requirements.

B. Roof and Floor Sheathing: Except "Panelized Roofs", lay with face grain perpendicular to roof rafters, roof trusses or floor joists. Stagger sheets. Block all unsupported sheet edges with 2x material unless noted otherwise.

C. Wall Sheathing: Lay with face grain either parallel or perpendicular to studs. Exposed bottom edges shall be sealed as recommended by manufacturer. Block all unsupported sheet edges with 2x materials unless noted otherwise.

D. Panelized Roofs: Where sheathing is set @ 8'-0 1/8" spacing, cut every fourth sheet short by 1/2" to re-align structural framing that has been specified to be spaced at even units of 2, 4 or 8 feet.

3.3 ROUGH HARDWARE

A. General: Nails, spikes, screws, fabricated sheet metal anchors, ties, hangers and any other materials shown or required for the attachment of wood to

concrete and wood to steel and wood to wood shall be furnished and installed as part of this work.

- B. Framing Nailing: All framing nailing shall conform to minimum requirements of the Building Code, and with details shown on the drawing.
- C. Bolts, Lag Screws and Washers:
 - 1. Bolts in wood shall be machine bolts unless otherwise noted and shall be of such length that the bearing length of the threads does not exceed $\frac{1}{4}$ of the full bearing length in the member holding the threads. Bolt holes in wood shall be $\frac{1}{32}$ " oversized. Bolt holes for sill plates may be $\frac{1}{16}$ " maximum oversize. Holes in steel shall be $\frac{1}{16}$ " oversize. See Section 3.1 for anchor bolts at sill plates and ledgers.
 - 2. Provide square plate or malleable iron washer and nut at head where bearing is against wood; cut washer under nut where it is against steel. Washer will not be required under head of carriage bolts. Provide malleable iron washers where exposed.
 - 3. All nuts shall be tightened when placed and retightened at completion of the job or immediately before closing with final construction.
 - 4. Lag screws shall be screwed (not driven) into place. Drill pilot hole to 70% of shank diameter. Drill clearance hole to full shank diameter and depth of unthreaded screw length.
- D. Wood Screws: Minimum penetration is 10 diameters unless noted otherwise. Where fastening hardwood timber species or where wood tends to split, provide pilot hole 70% of screw shank diameter.
- E. Proprietary Fasteners and Hardware: Install per manufacturer's published installation instructions (MPII) and code approval report (e.g. ICC ESR, IAPMO ER, etc). Provide MAX quantity, size, and length of fastener at hardware (i.e. joist hangers, framing, clips, etc) unless otherwise noted per plan.

3.4 INSTALLATION OF ACCESSORIES AND MISCELLANEOUS WOOD

- A. Coordinate installation of wood decking, metal-web wood joists, glued-laminated wood construction, shop-fabricated wood trusses, and wood I- joists.
- B. Curb roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members. Fasten curbs corner-to-corner and to rafters with framing connectors configured for this application.
- C. Blocking:
 - 1. Provide fire blocking at locations and spacing's as required by CBC Chapter 7. Locate other blocking, supplementary framing, backing plates and bracing to facilitate installation of finish materials, fixtures, equipment, services, accessories, and trim requiring attachment and support.

2. Solid block joists and rafters over all supports with blocking of the same size and material as the joist or rafter.
- D. Furring:
1. Nominal 1 inch x 3 inch minimum, continuous and spaced at 16 inches on center, maximum.
 2. Install plumb, rigid, and level. Shim where necessary to provide a true, even plane suitable to receive the finish required.
 3. Attach to concrete and masonry as shown in the contract drawings.
- E. Bridging: Use 2 inch solid cross bridging. Nail bottom ends of bridging only after sheathing has been nailed.
- F. Stair Framing: Provide with 3 stair stringers for each set of stairs, unless otherwise shown. Cut notches to receive exact size of treads and risers (if any) shown, with no change in dimensions between landings. Provide stringers of size shown, or if not shown, of a size to allow not less than 3-1/2 inch of effective depth, measured perpendicular to the rake of the stringer, after notching.
- G. Install miscellaneous metal angles, bolts, and other items; secure into formwork where embedded in concrete.
- H. Install accessory items not otherwise set under other sections; after completion of painting and other finishing work; in locations shown or directed by the Architect. Set items plumb, level, and secure using appropriate fastening as applicable.

3.5 FIELD APPLIED WOOD TREATMENT

- A. Field treat all end cuts and holes in preservative treated materials per PART 2.
- B. Apply two brush coats; or full-immersion dip not less than 15 minutes; or as required to thoroughly saturate all surfaces after cutting.
- C. Air dry 2-hours minimum before installation.

3.6 TOLERANCES

- A. Framing Members: 1/4 inch from true position, maximum.
- B. Surface Flatness of Floor: 1/8 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.
- C. Variation from Plane (Other than Floors): 1/8 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum. Provide framed substrates meeting requirements for application of finishes specified in other sections.

- D. Exposed surfaces shall be free from dents and tool marks, unsanded rough or torn faces and corners, and other defects.

3.7 FIELD QUALITY CONTROL

- A. The Testing Agency, as specified in the Article QUALITY ASSURANCE, will perform the following tests and submit reports as specified in Division 01:
 - 1. Moisture content of all lumber at time of close-in.
 - 2. Periodic special inspection of nailing, bolting, and other fastening within the seismic-force-resisting system including shear walls, wood diaphragms, etc. per CBC Section 1705.13.2, excluding systems with sheathing nailing spacing greater than 4" on center.
 - 3. Special inspection of high load diaphragms per CBC Section 1705.5.1 where designated on documents.

3.8 ADJUSTING

- A. Replace all defective work at Contractor's expense.
- B. Replace defective or damaged work with conforming work.
- C. Correct defects using means that will not injure the materials.
- D. Replace defective or damaged work which cannot be corrected in the field with new work, or return defective items to the shop for repair.
- E. Repair or replace framing lumber sagged, twisted or warped due to shrinkage from excessive moisture content at time of installation, or from other causes.
- F. Adjust to meet specified tolerances.
- G. Architect/Engineer shall review all proposals for the repair or replacement of damaged, defective, or missing work.
- H. Pay expenses incurred by Owner for Architect/Engineer's costs for (re-)design and obtaining approvals of Authorities Having Jurisdiction (AHJ) necessitated by incomplete, inefficiently scheduled, improperly performed, defective or nonconforming work.
- I. Pay expenses due to re-testing and re-inspection necessitated by incomplete, inefficiently scheduled, improperly performed, defective or nonconforming work.

3.9 CLEANING AND PROTECTION

- A. Clean all surfaces upon completion of erection, leave free of grime and dirt. Remove unused materials, tools, equipment, and debris from the premises and leave surfaces broomed clean.

- B. Waste Disposal: Comply with the requirements of pertinent sections of Division 01 specifying cleaning and disposal.
 - 1. Comply with applicable regulations.
 - 2. Do not burn scrap on project site.
 - 3. Do not burn scraps that have been pressure treated.
 - 4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- C. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.
- D. Prevent sawdust and wood shavings from entering the storm drainage system.
- E. Protect work from damage by subsequent operations.

END OF SECTION

SECTION 06 20 00**FINISH CARPENTRY**

PART 1 - GENERAL**1.1 SUMMARY**

- A. Section Includes: Provide finish carpentry with accessories as required for complete installation.
 - 1. Provide exterior wood trim including:
 - a. Compressor enclosure wood fascia and barge board trim.
 - b. Wood sill replacement as determined during field survey conducted as per Specification Section 06 01 20.
 - 2. Provide interior wood trim including:
 - a. Wood door frames and trim as detailed.
 - b. Trim at wall and ceiling transitions including crown molding as detailed.
 - c. Chair rail trim.
 - d. Multi-component built-up wood baseboards as detailed.
- B. Related Sections:
 - 1. Section 06 01 20: Wood Sill Restoration
 - 2. Section 06 40 10: Architectural Woodwork & Countertops
 - 3. Section 08 21 00: Wood Doors
 - 4. Section 08 70 00: Hardware
 - 5. Section 09 91 00: Paints and Coatings

1.2 SUBMITTALS

- A. Product Data: Submit literature for manufactured items.
- B. Shop Drawings: Indicate materials and wood species, component profiles, fastening, joining details, finishes, and accessories.
- C. Samples: Furnish samples of each type of wood trim.
- D. Certificates:
 - 1. Quality Standards Certification: Certification shall not be required for finish carpentry trim work however the Architect and Owner's Representative reserves

the right to retain Architectural Woodwork or Woodwork Institute representatives for field inspection services if quality of work is of questionable quality or integrity.

2. Wood Product Certification: Furnish certification indicating wood products are from “well-managed” forests.

1.3 QUALITY ASSURANCE

- A. Standards: Perform finish carpentry in accordance with standards of Architectural Woodwork Standards (AWS), 1st Edition.
- B. Certified Wood Products: Wood products to be from forests certified “well-managed” by an agency accredited by Forest Stewardship Council (FSC) including SmartWood Program and Forest Conservation Program.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver materials until site conditions are adequate to receive work; protect items from weather while in transit.
- B. Store materials indoors, in ventilated areas with constant but minimum temperature of 60 degrees F and maximum relative humidity of 25% to 55%.
- C. Do not begin installation of finish carpentry until space is fully enclosed and mechanical systems are fully operational.
 1. Maintain interior installation areas at 70 degrees F and 50% to 55% relative humidity.
- D. Immediately remove from site materials with visible mold and materials with mildew.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Painted Exterior Wood Sills:
 1. Quality: AWS - Premium Grade C or Better
 2. Wood: Select Douglas Fir
 3. Cut: Clear Vertical Grain
 4. Texture: S4S
 5. Dimensions: 1x and 2x as detailed
- B. Transparent, Stained, or Painted Interior Wood Trim and Baseboard:
 1. Quality: AWS - Premium Grade C or Better
 2. Wood: Select Douglas Fir
 3. Cut: Clear Vertical Grain
 4. Texture: S4S
 5. Dimensions: 1x and 2x as detailed
- C. Transparent, Stained, Painted Interior Wood Jambs, Sills, Frames, and Stops:

1. Quality: AWS - Premium Grade C or Better
2. Wood: Select Douglas Fir
3. Cut: Clear Vertical Grain
4. Texture: S4S
5. Dimensions: 1x and 2x as detailed

D. Anchors, Nails and Screws: Select the material, type, size and finish required by each substrate for secure anchorage; provide toothed steel or lead expansion bolt screws for drilled-in-place anchors.

E. Wood Filler: Color to match wood being filled.

2.2 FABRICATION

- A. Fabricate finish carpentry items in accordance with specified quality standard.
- B. Use exposed fastening devices or nails only when approved and unavoidable; arrange neatly.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication where possible; do not delay job progress, allow for trimming and fitting.
- B. Verify surfaces are ready to receive work and field measurements are as shown on shop drawings.
 1. Beginning installation signifies acceptance of conditions.
- C. Ensure mechanical and electrical items affecting work are properly placed, complete, and have been inspected by applicable authorities prior to commencement of installation.
- D. Inspect each piece of finish carpentry and discard damaged and defective pieces.

3.2 INSTALLATION

- A. Install work consistent with specified AWS quality grade, plumb, level, true and straight with no distortions; shim as required, using concealed shims.
 1. Prime paint surfaces in contact with cementitious materials prior to installation; comply with requirements of Section 09 91 00 – Paints and Coatings.
- B. Secure work to blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation.
- C. Scribe and cut for accurate fit to other finished work.

- D. Install trim in single, unjointed lengths for openings and runs less than 10'-0".
 - 1. For longer runs, use only one piece less than 10'-0" in any straight run; provide scarf joints between members. Field verify location of all end or butt joints with Architect prior to proceeding with installation.
 - 2. Cope at returns and miter at corners.
- E. Install exterior wood sills in a full bed of mastic sealant on all surfaces that interface with existing construction to provide a watertight assembly.
- F. Accessories: Install accessories in accordance with manufacturer's recommendations in locations indicated or as directed by Architect.
- G. Acceptable Tolerances:
 - 1. Variation from True Position: Maximum 1/16" at any position and maximum 1/8" in any 10'-0" length.
 - 2. Adjoining Surfaces of Same Material: No variation permitted.
 - 3. Offset with Abutting Materials: Maximum 1/32".
- H. Preparation for Field Finishing:
 - 1. Sand work smooth and set exposed nails and screws.
 - 2. Apply wood filler in exposed nail and screw indentations and leave ready to receive site-applied finishes.
 - 3. Seal concealed and semi-concealed surfaces; brush apply only, using primer consistent with finish coats specified under Section 09 91 00 - Paints and Coatings.
 - a. Primer prohibited at stain finish locations.

END OF SECTION

SECTION 06 40 10

ARCHITECTURAL WOODWORK & SOLID COUNTERTOPS

PART 1 - GENERAL**1.1 SUMMARY**

- A. Section Includes: Provide mill fabricated architectural woodwork with accessories as required for complete finished installation including cabinet hardware including but not limited to:
 - 1. Plastic laminate finish cabinet.
 - 2. Quartz solid surface countertops.
 - 3. Plastic laminate fixed and adjustable shelving.
 - 4. Shop fabricated and finished wood benches.
- B. Project shall meet all of the requirements for a Woodwork Institute Certified Compliance Program (CCP).
- C. Related Sections:
 - 1. Section 05 51 00: Metal Fabrications
 - 2. Section 06 20 00: Finish Carpentry
 - 3. Section 06 61 00: Solid Surface Wall Panels
 - 4. Section 08 70 00: Hardware

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's literature for manufactured items.
- B. Shop Drawings: Submit shop drawings in conformance with Architectural Woodwork Standards (AWS) Section 1 – Submittals. Indicate materials and wood species, component profiles, fastening, joining details, finishes, and accessories.
 - 1. Certification: Provide Woodworking Institute (WI) Manual of Millwork Certified Compliance Label on shop drawings.
- C. Samples: Furnish samples of each of the following.
 - 1. Plastic laminates.
 - 2. Quartz color range for countertops.
- D. Certificates: WI certification is required.
 - 1. General: Before delivery to jobsite, provide WI Certified Compliance Certificate indicating grade of millwork products to be furnished and certify that AWS requirements for specified grades shall be met.

2. Casework: Each unit to bear WI Certified Compliance Label.
3. Installation: Provide WI Certified Compliance Certificate for Installation.

1.3 QUALITY ASSURANCE

- A. Fabricator Qualifications: Member of Architectural Woodworking Institute (AWI) or Woodwork Institute (WI) with minimum five years successful experience fabricating architectural woodwork similar to that required for Project.
- B. Standards: Perform architectural woodwork in accordance with recommendations of the AWS, 1st Edition.
 1. Installation Certification Program: Install work in this section as specified in the AWS and provide WI Certified Compliance Certificate for installation at completion of Project installation.
- C. Seismic Anchorage: Provide seismic anchorage for wall cabinets; comply with California Code of Regulations (CCR), Title 24, Part 2, load requirements for essential facilities.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver architectural woodwork until site conditions are adequate to receive work; protect items from weather while in transit.
 1. Allow architectural woodwork shop finish to completely dry prior to delivery to site; allow materials to off-gas volatile organic compound (VOC) emissions off site.
- B. Store materials indoors, in ventilated areas with constant but minimum temperature of 60 degrees F and maximum relative humidity of 25% to 55%.
- C. Do not begin installation of architectural woodwork until space is fully enclosed and mechanical systems are fully operational.
 1. Maintain interior installation areas at 70 degrees F and 50% to 55% relative humidity.
- D. Immediately remove from site materials with visible mold and materials with mildew.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Plastic Laminate Finished Casework:
 1. Quality:
 - a. AWS - Premium Grade, Type A, flush overlay type.
 - b. WI - Premium Grade, Type I, Style A, flush overlay type.

2. Plastic Laminates:
 - a. Types: NEMA LD-3.1 high pressure laminates.
 - 1) Horizontal Surfaces: General Purpose Type, nominal 0.050".
 - 2) Vertical Surfaces: Vertical Surface Type, nominal 0.032".
 - 3) Unexposed Surfaces: Balanced with 0.030" melamine backing sheet.
 - b. Manufacturers:
 - 1) Formica Corp.
 - 2) Wilsonart, Ralph Wilson Plastics.
 - 3) Nevamar Corp.
 - 4) Pioneer Plastics Corp./Pionite.
 - 5) Substitutions: Refer to Section 01 63 00.
 - c. Colors: As selected by Architect from manufacturer's full range of available colors and patterns, excluding metallics.
 3. Particleboard Core: Provide Medite Corp. (Sierrapine) Medite II or Rodman Industries/Resincore I with no added formaldehyde medium density fiberboard (MDF) or particleboard made from recycled wood products.
- B. Solid Polymer Countertop Systems: Generally consisting of natural quartz particles, reacted monomers and resins, pigments and various performance-enhancing additives manufactured as slabs of various specific calipers. Quartz surface materials are solid, non-porous and homogeneous and exhibit strength, hardness and durability. Provide manufacturer recommended joint adhesive; exposed surfaces finished to match top.
1. Quality: Comparable to AWS or WI Premium Grade.
 2. Type: Not less than 3/4" thick sheet.
 - a. Designed to accept undercounter mounted bowls as indicated and as specified in Division 22; finish exposed edges at under counter mounted bowls.
 - b. Color: All of the specified manufacturer's standard and premium color range options, regardless of price group, as solely selected by Architect.
 - c. Manufacturers:
 - 1) DuPont Co. - Corian Quartz (formerly known as DuPont Zodiac Quartz)
 - 2) Substitutions: Refer to Section 01 63 00.
- C. Shop Fabricated and Finished Wood Benches: Provide complete wood bench system; coordinate with stainless steel supports in Section 05 51 00.

1. Quality: WI MoM/Premium Grade, for transparent/stained finish.
 2. Wood: Hard White Maple.
- D. Casework Hardware: Provide casework hardware items as required for complete installation as indicated; provide types as listed in AWS or WI "Manual of Millwork" but no less than following types.
1. Adjustable Shelf Standards and Supports (Plastic Laminate and Opaque Painted Casework): Flush mounted in cabinet.
 - a. Manufacturers:
 - 1) Futura/No. AS 662 with AS 563/663 support.
 - 2) Knape & Vogt/No. 255 with No. 256 support.
 - 3) Substitutions: Refer to Section 01 63 00.
 2. Cabinet Hinges: European concealed type, minimum 160 degree opening, with spring closer.
 3. Cabinet Pulls:
 - a. Doors: European Bar type, 13.23" long with 10" center to center spacing, 1" net clearance between pull and cabinet, satin stainless steel.
 - 1) Manufacturers:
 - a) House of Knobs/No. HOK-32546.
 - b) Equal to Match Above.
 - b. Drawers: European Bar type, 5.25" long with 3" center to center spacing, 1" net clearance between pull and cabinet, satin stainless steel.
 - 1) Manufacturers:
 - a) House of Knobs/No. HOK-32553.
 - b) Equal to Match Above.
 - c. Substitutions: Refer to Section 01 63 00.
 4. Drawer Slides: Full extension, soft close, rail mounted type, minimum 100 lb. capacity with ball-bearing rollers.
 - a. Manufacturers:
 - 1) Accuride.
 - 2) Knape & Vogt.
 - 3) Substitutions: Refer to Section 01 63 00.

5. Cabinet Locks: Pin and tumbler slide bolt lock, two keys each.

a. Manufacturers:

- 1) Schlage Lock Co./46-002 Cabinet Locks.
- 2) Best Access Systems/5L Series.
- 3) CompX International/Timberline Locks.
- 4) Substitutions: Refer to Section 01 63 00.

E. Anchors, Nails and Screws: Select material, type, size and finish required by each substrate for secure anchorage; provide toothed steel or lead expansion bolt screws for drilled-in-place anchors.

F. Wood Filler: Color to match wood being filled.

2.2 FABRICATION

A. General: Fabricate architectural woodwork in accordance with specified quality standards.

B. Plastic Laminate:

1. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes.
2. Make corners and joints hairline; slightly bevel arises.
3. Locate butt joints at least 2'-0" from cutouts.
4. Cap exposed edges with plastic laminate of same finish and pattern.
5. Apply laminate backing sheet to reverse side of laminate surfaces.
6. Provide cutouts for inserts, fixtures and fittings; verify locations from on-site dimensions.
7. Prime paint contact surfaces of cutouts.

C. Quartz Countertops: Provide maximum sizes available. Locate butt joints at least 2'-0" from cutouts where more than one piece countertops are required.

1. Make corners and joints hairline; slightly bevel arises.
2. Provide cutouts for inserts, fixtures and fittings; verify locations from on-site dimensions.
3. Backsplashes shall be made from one continuous length of material, no joints.

D. Use exposed fastening devices or nails only when approved and unavoidable; arrange neatly.

- E. Assemble woodwork in shop in sizes easily handled and to ensure passage through building openings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication where possible; do not delay job progress, allow for trimming and fitting.

3.2 INSTALLATION

- A. Install work consistent with specified quality grade, plumb, level, true and straight with no distortions.
 - 1. Shim as required, using concealed shims.
- B. Ensure mechanical and electrical items affecting architectural woodwork are properly placed, complete, and have been inspected by Architect prior to commencement of installation.
- C. Secure work to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation.
- D. Scribe and cut for accurate fit to other finished work.
- E. Install architectural woodwork under supervision of factory-trained mechanics.
- F. Attach architectural woodwork securely in place with uniform joints providing for thermal and building movements.
- G. Acceptable Tolerances:
 - 1. Variation from True Position: Maximum 1/16" at any position and maximum 1/8" in any 10'-0" length.
 - 2. Adjoining Surfaces of Same Material: No variation permitted.
 - 3. Offset with Abutting Materials: Maximum 1/32".

END OF SECTION

SECTION 06 61 00

POLYMER WALL CLADDING AND FABRICATION

PART 1 - GENERAL**1.1 SUMMARY****A. Work described in this section:**

1. Shower wall panels and trim mounted on cementitious backer board
2. Preformed shower floor pans
3. Preformed shower cubbies
4. Preformed shower seats
5. Restroom wall panels and trim mounted on cementitious backer board
6. Window sills

B. Cementitious backer board for all wall panel installation shall be as specified in Section 09 30 13 – Tile.**C. Related Sections:**

1. Section 06 40 00: Architectural Woodwork & Countertops
2. Section 09 24 00: Plaster Assemblies
3. Section 09 29 00: Gypsum Board Assemblies
4. Section 09 30 13: Tile
5. Division 22 - Plumbing
6. Division 26 - Electrical

1.2 REFERENCES**A. Applicable Standards: Standards of the following, as referenced herein:**

1. American National Standards Institute (ANSI)
 - a. ANSI A108.1: Installation of Tile with Portland Cement Mortar.
 - b. ANSI A108.5: Installation of Tile with Latex-Portland Cement Mortar.
 - c. ANSI A108.10: Installation of Grout in Tilework.
 - d. ANSI A108.11: Interior Installation of Cementitious Backer Units.
2. Tile Council of North America (TCNA): Handbook for Ceramic Tile Installation.
3. American Society for Testing and Materials (ASTM)
4. National Electrical Manufacturers Association (NEMA)
5. Federal Specifications (FS)

B. SUBMITTALS

1. Product data: Indicate product description, fabrication information and compliance with specified performance requirements.
2. Shop drawings: Indicate dimensions, component sizes, fabrication details, attachment provisions and coordination requirements with adjacent work.
3. Samples: Submit minimum 2" x 2" (50 mm x 50 mm) samples. Indicate full range of color and pattern variation.
 - a. Upon color selection(s) by Architect, submit minimum 12" x 12" sample of selected color(s) for final approval. Approved sample(s) will be retained as standards for work.
4. Maintenance data: Submit manufacturer's care and maintenance data, including repair and cleaning instructions. Include in project close-out documents.

1.3 QUALITY ASSURANCE

- A. Fabricator Qualifications: Member of Architectural Woodworking Institute (AWI) or Woodwork Institute (WI) with minimum five years successful experience fabricating solid polymer panels and components similar to that required for Project.
- B. Allowable Fabrication Tolerances:
 1. Variation in component size: 1/8" (3 mm).
 2. Location of openings: 1/8" (3 mm) from indicated location.

1.4 DELIVERY, STORAGE AND HANDLING

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

1.5 WARRANTY

- A. Provide manufacturer's 1 year warranty against defects in materials. Warranty shall provide material and labor to repair or replace defective materials. Damage caused by physical or chemical abuse will not be warranted.

PART 2 - PRODUCTS**2.1 MATERIALS****A. SOLID POLYMER FABRICATIONS**

1. Material: Homogeneous filled acrylic; not coated, laminated or of composite construction; meeting ANSI Z124.3 & .6, Type Six, and Fed. Spec. WW-P-541E/GEN.
 - a. Material shall have minimum physical and performance properties specified in the following Section D.
 - b. Superficial damage to a depth of 0.010" (.25 mm) shall be repairable by sanding.
 - c. Quality: Comparable to AWS or WI Premium Grade.
2. Manufacturers:
 - a. DuPont Co. - Corian
 - b. Substitutions: Refer to Section 01 63 00.
3. Fabricators:
 - a. GRIF-Form Innovations, Glide, Oregon
 - b. Substitutions: Refer to Section 01 63 00.

B. WALL PANELS

1. Shower Wall Panels: 1/4" (6mm) thick solid surface material, color(s) as selected by Architect
 - a. Panel joints and layout as detailed on the Plans.
 - b. Color: All of the specified manufacturer's standard color range options as selected by Architect.
 - c. Wall Trim: Fabricator's standard 90 degree inside corner trim.
2. Restroom Wall Panels: 1/2" (12mm) thick solid surface material, color(s) as selected by Architect
 - a. Panel joints and layout as detailed on the Plans.
 - 1) Coordinate panel installation with glass wall tile.
 - b. Color: All of the specified manufacturer's standard AND premium color range options, regardless of price group, as solely selected by Architect.
 - c. Wall Trim: Fabricator's standard 90 degree inside corner trim.

- d. Wall Panel Joints: 1/8" butt joints with grout. Grout color as selected by Architect.

C. SHOWER PANS

- 1. Preformed shower pans to the size shown on the Plans.
 - a. Fabricator Model No. 672 at Restroom 202.
 - b. Fabricator Model No. 651 at Womens 208 and Mens 210
 - c. Standard entry height. Verify height with Architect prior to fabrication.
 - d. Integral shower pan lip at all adjoining straight walls.
 - e. Field verify all shower pan dimensions prior to fabrication.
 - f. Coordinate shower pan construction with specified floor drain.

D. SHOWER SEAT

- 1. Preformed fabricated custom shower seat at Restroom 202.
 - a. Seat to be continuous from wall to wall as shown on Plans.
 - b. Provide standard 1/2" wide drain rails.
 - c. Color as selected by Architect from Price Group A, B, or C.

E. SHOWER CUBBIES

- 1. Preformed wall cubbies at Restroom 202, Womens 208, and Mens 210.
- 2. Fabricator Model No. SSC3065
 - a. Color as selected by Architect from Price Group A, B, or C.

F. WINDOW SILLS

- 1. 1/2" thick by depth noted on plans.
- 2. All exposed edges shall be eased 1/8"
- 3. Color as selected by Architect from Price Group A, B, or C.

- G. Joint adhesive: Manufacturer's standard two-part adhesive kit to create inconspicuous, non-porous joints, with a chemical bond.

2.2 FABRICATION

- A. Fabrications to be performed by a manufacturer trained fabricator/installer.

- B. Fabricate components in shop to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and manufacturer's requirements.
- C. Form joints between components using manufacturer's standard joint adhesive. Joints shall be inconspicuous in appearance and without voids.
- D. Provide for mounting of seats, cubbies, grab rails, etc. as indicated on the drawings.
- E. Finish component edges to a smooth, uniform finish. Repair or reject defective or inaccurate work.
- F. Finish: All surfaces shall have uniform finish with a gloss rating of 10-30.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication where possible; do not delay job progress, allow for trimming and fitting.
- B. Coordinate with the installation of cementitious backer board and waterproofing as specified elsewhere.

3.2 INSTALLATION

- A. Prior to start of work, Contractor to use a combination of shims and planes on either existing or new wood stud wall faces to ensure that the wall panel cementitious backer board sub-straight is true and level to within the tolerances stated herein.
 - 1. Wood stud wall plane work to be performed prior to installation of wall panel cementitious backer board sub-straight.
 - 2. For cementitious backer board installation, refer to Specification Section
- B. Install wall panel work consistent with specified quality grade, plumb, level, true and straight with no distortions.
 - 1. When installing wall panels, follow ANSI Guidelines for the installation of large format tile.
 - 2. Do not proceed with wall panel installation over sub-straight until wall surface has been verified to be within the tolerances stated herein.
 - 3. Install in accordance with approved shop drawings and product installation details.
 - 4. Shim wall panels as required, using concealed shims.

- C. Ensure mechanical and electrical items affecting wall panels are properly placed, complete, and have been inspected by Architect prior to commencement of installation.
- D. Secure work to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation.
- E. Scribe and cut for accurate fit to other finished work.
- F. Attach wall panels securely in place with uniform joints providing for thermal and building movements.
- G. Acceptable Tolerances:
 - 1. Variation from True Position: Maximum 1/16" at any position and maximum 1/8" in any 10'-0" length.
 - 2. Adjoining Surfaces of Same Material: No variation permitted.
 - 3. Offset with Abutting Materials: Maximum 1/32" (thickness of a credit card) between two wall panels or tile at abutting joints that are less than 1/4".
 - a. Acceptable tolerances for lippage (the difference in height between adjacent wall panels and tile) shall meet ANSI A108.02 and TCNA guidelines.

3.3 CLOSEOUT

- A. Components shall be clean and defect free on Date of Substantial Completion.
- B. Protect surfaces from damage until Date of Substantial Completion. Repair or replace damaged work that cannot be repaired.
- C. Fabricator/Installer is to provide written maintenance instructions and review maintenance procedures with Owner.

END OF SECTION

SECTION 07 13 00**BUILDING ENVELOPE UNDERLAYMENT**

PART 1 - GENERAL**1.1 SUMMARY****A. Section Includes:**

1. Single-Ply Roofing Underlayment over tapered rigid insulation: Provide glass fiber reinforced asphalt saturated felt or building paper slip sheet on horizontal or vertical surfaces where recommended by single-ply roof manufacturer.
2. Flashings, Sheet Metal, and Penetrations Flashing or Underlayment: Provide self-adhering sheet membrane underlayment with rosin building paper slip sheet at window flashings and sheet metal underlayment, with accessories as required for complete watertight installation.
 - a. Width varies depending on application, location, or detail requirement.
3. Exterior Wall Underlayment: Provide water-resistive barrier (WRB) underlayment under all plaster wall and soffit surfaces as follows:
 - a. Vertical Wall and Horizontal Soffit Surfaces:
 - 1) Two layers of asphalt saturated felt or two layers of Grade D building paper. Each layer applied independently.

B. Related Sections:

1. Section 07 52 00: Single-Ply Roofing
2. Section 07 60 00: Flashing and Sheet Metal
3. Section 09 24 00: Plaster Assemblies

1.2 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature for each type of underlayment.
- B. Samples: Furnish samples of each material.

1.3 QUALITY ASSURANCE

- A. Pre-Installation Meeting: Convene one week prior to commencing work; require attendance of parties directly affecting underlayment.
 1. Review procedures and coordination required with related work.

1.4 WARRANTY

- A. Special Warranty: Provide for correcting failure of underlayment to resist penetration of water. Repair underlayment and pay for or replace damaged materials or surfaces.
 - 1. Special Warranty Period: Two years

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Self-Adhering Sheet Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 40 mils thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.
 - 1. Thermal Stability: Stable after testing at 240 deg F; ASTM D 1970.
 - 2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D 1970.
 - 3. Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carlisle Products - WIP 300HT.
 - b. Grace - Ice and Water Shield HT.
 - c. Henry Company - Blueskin PE200 HT.
 - d. Kirsch Building Products, LLC - Sharkskin Ultra SA.
- B. Asphalt Saturated Felt: Provide 15lb. glass fiber reinforced organic felt
 - 1. Meet or exceed ASTM D 6757 for reinforced underlayments.
 - 2. Meets performance criteria of ASTM D 226 Type I (#15)
 - 3. Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Atlas Products – Gorilla Guard EVERFELT.
 - b. Owens Corning – Fiberglas Felt
 - c. Certainteed – Roofer's Select.
- C. Building Paper: Rosin sized, unsaturated paper, 60 Minute Grade D in accordance with ICC-ES Acceptance Criteria AC 38.
- D. Bituminous Paint: Acid and alkali resistant type; black color.
- E. Accessories: Provide as recommended by underlayment manufacturers for specific applications.
 - 1. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.

- F. Volatile Organic Compound (VOC) Emissions: Provide materials conforming to applicable air quality management district limitations on volatile organic compound (VOC) emissions.

PART 3 – EXECUTION

3.1 PREPARATION

- A. Install underlayment over surfaces that are dry, free of ridges, warps and voids that could damage paper.
- B. Coordinate installation with installation of components and items projecting through underlayment.

3.2 UNDERLAYMENT INSTALLATION

- A. General: Install sheets and accessory materials according to underlayment manufacturer's written instructions and according to recommendations in ASTM D 6135.
 - 1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous underlayment sheet produced for low-temperature application. Do not install low-temperature sheet if ambient or substrate temperature is higher than 60 deg F.
- B. Install underlayment in accordance with recommendations of underlayment manufacturer and of manufacturers products covering underlayment; comply with applicable code requirements.
 - 1. Weatherlap joints as recommended by system manufacturer.
 - 2. Secure underlayment in place, stagger joints between layers; lap ends minimum 6"; stagger end joints.
 - 3. Apply layer of self-adhering sheet membrane extending minimum 18" from penetrations, including windows and doors; start at bottom of penetration and weatherlap joints; apply top layer over metal flashing to direct water to exterior.
- C. Weatherlap items projecting through underlayment and seal with sealer recommended by sheet membrane underlayment manufacturer at sheet membrane underlayment.
- D. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations with termination mastic and according to ASTM D 6135.
- E. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by underlayment sheet on same day. Reprime areas exposed for more than 24 hours.

1. Prime glass-fiber-surfaced gypsum substrate board with number of prime coats needed to achieve required bond, with adequate drying time between coats.
- F. Apply and firmly adhere modified bituminous sheets horizontally over area to receive air barrier. Accurately align sheets and maintain uniform 6"-inch- minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure airtight installation.
1. Apply sheets in a shingled manner to shed water without interception by any exposed sheet edges.
 2. Roll sheets firmly to enhance adhesion to substrate.
- G. Install underlayment sheet and accessory materials to form a seal with adjacent construction and to maintain a continuous air barrier. Connect and seal roof underlayment membrane continuously to exterior wall membrane air barrier.
- I. Install a slip sheet between all underlayment and metal roofing or metal flashing.
- J. At end of each working day, seal top edge of underlayment material to substrate with termination mastic.
- K. Apply joint sealants forming part of underlayment assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- L. Repair punctures, voids, and deficient lapped seams in air barrier. Slit and flatten fishmouths and blisters. Patch with underlayment sheet extending 6 inches beyond repaired areas in all directions.
- M. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply underlayment components.

END OF SECTION

SECTION 07 21 16**BATT INSULATION**

PART 1 - GENERAL**1.1 SUMMARY****A. Section Includes:**

1. Provide thermal batt insulation accessories in all exterior wall and roof cavities except where spray applied insulation is required.
 - a. Work includes batt facing as specified including both paper and polypropylene facing.
 - b. Coordinate with Specification Section 07 21 19 so that all roof cavities are insulated.

B. Related Sections:

1. Section 06 10 00: Rough Carpentry
2. Section 07 21 19: Spray Foam Insulation
3. Section 09 29 00: Gypsum Board Assemblies (acoustical batts)

1.2 SUBMITTALS**A. Product Data:** Furnish manufacturer's literature for each type of insulation.

1. Submit Underwriter's Laboratory approval numbers for required fire ratings; approvals of other laboratories contingent upon acceptance of applicable authorities.

PART 2 - PRODUCTS**2.1 MATERIALS****A. Paper Faced Thermal Batt Insulation:** Preformed slag mineral or glass fiber with thermosetting resin binders, conforming to ASTM C665; formaldehyde-free.**1. Manufacturers:**

- a. Johns Manville/Formaldehyde-Free Fiberglass Insulation
- b. USG Interiors, Inc.
- c. Owens-Corning Fiberglas Corp.
- d. Substitutions: Refer to Section 01 63 00.

2. Laminate Facing:

- a. Fiberglass Reinforced Polypropylene scrim at Apparatus Bay 127
 - 1) Film thickness: 0.0015 inch

- 2) Weight: 17lbs per 1,000 sq. ft.
- 3) Polypropylene scrim color: White
- b. Kraft Paper at all other batt insulation areas.
- 3. R-Value:
 - a. Walls: Minimum R-13 in 2x4 wall framing, R-19 in 2x6 wall framing, or as indicated on plans or Title 24 Compliance.
 - b. Roofs: Minimum R-30 or as indicated on plans or Title 24 Compliance.
- 4. Flame Spread/Smoke Density Rating: No Rated
- 5. Vapor Retarder: Type II, paper vapor retarder on one side. Provide extended flanges for installation between wood framing members.
- 6. Penetration Type Insulation Supports: Galvanized or electroplated steel penetration supports with adhesive attachment to substrate and support disc.
- 7. Vapor Retarder Tape: Minimum 2" wide self-adhering type designed to maintain vapor retarder integrity and complying with fire resistance ratings as required by applicable codes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify substrate and adjacent materials are dry and ready to receive insulation; beginning installation signifies acceptance of conditions.
- B. Ensure mechanical and electrical items affecting work are properly placed, complete, and have been inspected by Architect prior to commencement of installation.

3.2 INSTALLATION

- A. Batt Insulation:
 - 1. Install insulation in accordance with manufacturer's instructions with vapor retarder toward inside of building.
 - 2. Cut and trim insulation neatly, to fit spaces.
 - a. Backed Insulation: Use insulation free of ripped backs and edges.
 - 3. Fit insulation tight within spaces and tight to and behind mechanical and electrical services within insulation plane; leave no gaps or voids; maintain integrity of thermal barrier.
 - 4. Friction fit in place; use tape or penetration supports as necessary to assure permanent installation.

- a. Taping: Tape joints and tears in vapor retarder, including joints between insulation and surrounding construction, to ensure vapor-tight installation. Tape exposed edges at sides of high density board insulation.
 - b. Penetration Supports: Cut or bend pins in locations accessible to maintenance personnel, to eliminate potential hazards from exposed pin points.
- 5. Where required, install insulation with impaling pins (minimum 2 per piece) or wire supports as necessary to eliminate sag.
- B. Polypropylene scrim:
 - 1. Attach scrim to face of existing 1x2 furring strips.
 - a. Neatly trim scrim at each steel truss.
 - b. Install wood closer at eave edge of scrim where scrim intersects the wall plane.
 - c. Scrim attachment type and spacing shall be so that the installed scrim is taught and without sags.

3.3 CLEANING AND PROTECTION

- A. Remove trash and construction debris from insulation and / or framing surfaces prior to application.
- B. Do not leave installed board insulation exposed to weather for more than 60 days after installation
 - 1. Remove and replace installed insulation that has become damaged, with new insulation.

END OF SECTION

SECTION 07 21 19**SPRAY FOAM INSULATION**

PART 1 - GENERAL**1.1 SUMMARY****A. Section Includes:**

1. Provide Spray-in-place, medium-density, semi-rigid, closed-cell polyurethane foam insulation in assemblies indicated on the Drawings, to provide an air barrier and insulation.
 - a. Spray foam shall be required at all roof cavities of the 1970 one-story addition.
 - 1) Approximate roof area occurs between floor plan Grid Lines J and P, and Grid Lines 1 and 10.

B. Related Sections:

1. Section 06 10 00: Rough Carpentry
2. Section 07 21 16: Batt Insulation

1.2 REFERENCES**A. ASTM International (ASTM):**

1. ASTM C 423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
2. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
3. ASTM D 1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
4. ASTM D 1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics.
5. ASTM D 1623 - Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.
6. ASTM D 2126 - Standard Test Method for Response of Rigid Cellular Plastic to Thermal and Humid Aging.
7. ASTM D 2842 - Standard Test Method for Water Absorption of Rigid Plastics.
8. ASTM D 6226 - Standard Test Method for Open Cell Content of Rigid Cellular Plastics.

9. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building

B. Materials.

1. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials.
2. ASTM E 283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
3. ASTM E 413 - Classification for Rating Sound Insulation.

1.3 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature for each type of insulation.
1. Submit Underwriter's Laboratory approval numbers for required fire ratings; approvals of other laboratories contingent upon acceptance of applicable authorities.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications:
1. Contractor performing work under this section shall be trained and certified by manufacturer in the application of spray polyurethane foam insulation.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Materials shall be delivered in manufacturer's original containers clearly labeled with manufacturer's name, product identification, safety information, net weight of contents and expiration date.
- B. Material shall be stored in a safe manner and where the temperatures are in the limits specified by the material manufacturer.
- C. Empty containers shall be removed from site on a daily basis.

1.6 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.
- B. Ventilate insulation application area in accordance with the Spray Foam Coalition's Guidance on best practices for the installation of Spray Polyurethane Foam.
- C. Protect workers as recommended by the standards of the Spray Foam Coalition's Guidance on best practices for the installation of Spray Polyurethane Foam.
- D. Protect adjacent surfaces, windows, equipment and site areas from damage of overspray.

1.7 WARRANTY

A. Manufacturer's Warranty

1. Special Warranty Period: Lifetime of installation

B. Installer Warranty: Provide for correcting failure of spray applied insulation.

1. Special Warranty Period: Two years from date of Substantial Completion

PART 2 - PRODUCTS

2.1 SPARY FOAM MATERIALS

A. Spray Applied Semi Rigid Polyurethane Closed Cell Foam Insulation System: Two component, medium density.

B. Manufacturers:

1. Thermoseal
2. Carlisle Seal Tite
3. Johns Manville Corbond
4. Owens-Corning Ultra Pure
5. Substitutions: Refer to Section 01 63 00.

C. Application:

1. Approved for use in wall cavities, floor assemblies, ceiling assemblies or attics and crawl spaces in Building Types I, II, III, IV, and V construction under IBC and CBC.
2. Spray foam insulation R-Value:
 - a. Roofs: Minimum R-36 or as indicated on plans or Title 24 Compliance.
3. Spray foam to contain zero ozone depleting agents, catalysts, polyols, and fire retarding materials.
4. Fills cracks, crevices, and voids to form air seal and thermal insulation.

D. Physical Properties:

1. Density (ASTM D 1622):
 - a. 2.23 lb/cf Summer
 - b. 2.17 lb/cf Winter
2. Thermal Resistance (ASTM C 518):
 - a. R-6.7 (sf.h degree F/BTU) at 1 inch Summer
 - b. R-6.9 (sf.h degree F/BTU) at 1 inch Winter
3. Closed Cell Content (ASTM D 6226): Greater than 93 percent.

4. Water Vapor Transmission - Permeance (ASTM E 96): Less than 1 Perms at 1.625 inches.
5. Air Leakage (ASTM E 283): Less than 0.002 L/sm².
6. Compressive Strength (ASTM D 1621):
 - a. 18 psi Summer
 - b. 23 psi Winter
7. Tensile Strength (ASTM D 1623):
 - a. 18 psi Summer
 - b. 54 psi Winter
8. Dimensional Stability (ASTM D 2126):
 - a. 5.45 percent Summer
 - b. 4.14 percent Winter
9. Water Absorption by volume (ASTM D 2842):
 - a. 0.87 percent Summer
 - b. 0.81 percent Winter
10. VOC Emissions - UL Greenguard Gold
11. Fungi Resistance (ASTM C 1338): Zero Rating.
12. Surface Burning Characteristics (ASTM E 84): Class 1 Pass, Flame Spread Index 5, Smoke Developed Index 350 Summer, 450 Winter.
13. Thermal Barrier (NFPA 286): Pass at 88.88 sq.ft./gal at 18 mils wet, 12 mils dry, coverage rate of 1.136 gallons (4.3 L) per 100 square feet (9.2 m²).

2.2 ACCESSORIES

A. Water Based Intumescent Coating:

1. Application: Follow manufacturer's application recommendations.
2. Physical Properties:
 - a. Surface Burning Characteristics (ASTM E 84): Class I. Flame Spread Index of 10, Smoke Developed Index less than 25
 - b. Flash Point: None.
 - c. Volatility/VOC: Less than 50 g/L.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Commencement of work outlined in this section shall be deemed as acceptance of existing work and conditions.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Apply only when surfaces and environmental conditions are within limits prescribed by the material manufacturer.
- C. 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 approved submittals. Apply as recommended by manufacturer to thickness as indicated on drawings.
- B. Apply thermal barrier as required by applicable codes including installation of thermal plastic barriers via gypsum board or intumescent paint.

3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.
- C. Verify substrate and adjacent materials are dry and ready to receive insulation; beginning installation signifies acceptance of conditions.
- D. Ensure mechanical and electrical items affecting work are properly placed, complete, and have been inspected by Architect prior to commencement of installation.

3.5 CLEANING AND PROTECTION

- A. Remove trash and construction debris from insulation and / or framing surfaces prior to application.
- B. Remove and replace installed insulation that has become damaged, with new insulation.

END OF SECTION

SECTION 07 26 00

SLAB-ON-GRADE VAPOR RETARDER

PART 1 - GENERAL**1.1 SUMMARY**

- A. Section Includes: Provide reinforced vapor retarder system for slab-on-grade concrete, including sealing joints and protrusions through vapor retarder, over a sand bed located below the vapor retarder as may be required by the structural plans.
 - 1. Coordinate requirements of this section with structural notes and details.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's literature.

1.3 PROJECT CONDITIONS

- A. Do not apply vapor retarder during inclement weather or when air temperature is below 40 degrees F.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. Fortifiber Corp./Ultra 15.
- B. Stego Industries, Inc./Stego Wrap (15 mil).
- C. Raven Industries, Inc./Vapor Block # VB 15 (15 mil Blue).
- D. Substitutions: Refer to Section 01 63 00.

2.2 MATERIALS

- A. Vapor Retarder: ASTM E1745, Class A vapor retarder consisting of 15 mil polyolefin film.
 - 1. Permeance: Maximum 0.025 perms, ASTM F1249 and E154 tests.
 - 2. Resistance to Puncture: Minimum 2200 grams, ASTM D1709, Method B.
 - 3. Tear Resistance: Minimum 8.74 lbs., ASTM D1004.
 - 4. Tensile Strength: Minimum 35 lbs/in., ASTM E154, Section 9, Method D-882, in both directions.
- B. Joint Sealer: Pressure sensitive tape as recommended by vapor retarder manufacturer and providing comparable permeance to vapor retarder.

- C. Sand Bed: Clean natural sand; free from silt, clay, loam, friable or soluble materials, and organic matter.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Ensure sleeves, curbs and projections that pass through vapor retarder are properly and rigidly installed.
- B. Ensure substrate is free of projections and irregularities that may be detrimental to proper installation of vapor retarder.

3.2 INSTALLATION

- A. Spread and roll sand to provide smooth, even bed for vapor retarder.
- B. Apply vapor retarder in accordance with manufacturer's recommendations and installation instructions and in accordance with ASTM E1643; comply with most restrictive where conflicts occur.
 - 1. Seal items projecting through vapor retarder with pressure sensitive tape.
- C. Seams: Minimum 6" overlap, sealed with pressure sensitive tape for vapor tight seal.
- D. Lay vapor retarder membrane smooth with no fishmouths or bunches of material.
- E. Inspect and repair vapor retarder prior to application of concrete slab; tape tears and repair damage.

END OF SECTION

SECTION 07 52 00**SINGLE-PLY ROOFING**

PART 1 - GENERAL**1.1 SECTION INCLUDES**

- A. A single-ply mechanically fastened or adhered membrane roofing system over an existing 1x dimensional wood nailable deck or plywood deck, laid either perpendicular to or diagonally to sub-structure.
 - 1. Upon field examination by a duly licensed roofing contractor certified to install Thermoplastic Polyolefin (TPO) roofing membranes:
 - a. Cutting and patching into the existing single-ply roof membranes shall be of the same manufacture or material composition as the existing single-ply roof assembly. It is assumed that the existing single-ply roof membrane is TPO. Contractor to field verify existing roof type.
 - 2. Provide tapered insulation units as necessary to maintain positive roof slope to pre-established drain locations if required during cutting and patching.
 - 3. Provide a perlite cover board over nailable 1x dimensional wood deck as required by manufacturer to secure warranty stated if required during cutting and patching.
- B. Related Work:
 - 1. Section 07 13 00: Building Envelope Underlayment
 - 2. Section 07 60 00: Flashing and Sheet Metal
 - 3. Division 22: Plumbing
 - 4. Division 23: HVAC
 - 5. Division 26: Electrical

1.2 REFERENCES

- A. Roofing Terminology: Refer to the following publications for definitions of roofing work related terms used in this Section:
 - 1. ASTM D 1079 "Terminology Relating to Roofing and Waterproofing."
 - 2. Glossary of NRCA's "The NRCA Roofing and Waterproofing Manual."
 - 3. Roof Consultants Institute "Glossary of Roofing Terms."
- B. Sheet Metal Terminology and Techniques: SMACNA Architectural Sheet Metal Manual, Sixth Edition and/or National Roofing Contractors Association Roofing and Waterproofing Manual, Fifth Edition.

1.3 DESIGN CRITERIA

- A. General: Installed roofing membrane systems shall remain watertight; and resist specified wind uplift pressures, thermally induced movement, and exposure to weather without failure.
- B. Material Compatibility: Roofing materials shall be compatible with one another under conditions of service and application required, as demonstrated by roofing system manufacturer based on testing and field experience.
- C. Wind Uplift Performance: Roofing system shall be identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist wind uplift pressure calculated in accordance with ASCE-7.
- D. EPA Energy Star:
 - 1. Roofing membrane shall achieve an initial reflectance of greater than 0.70 and a three year aged reflectance of greater than 0.63.
- E. T24/CRRC-1:
 - 1. Roofing system shall comply with the requirements of Title 24.
 - 2. Roofing membrane shall be tested by CRRC-1.

1.4 SUBMITTALS

- A. Product Data: Manufacturer's data sheets for each product to be provided.
- B. Detail Drawings: Provide roofing system plans, elevations, sections, details, and details of attachment to other Work, including:
 - 1. Base flashings, cants, and membrane terminations.
 - 2. Tapered insulation, including slopes.
 - 3. Crickets, saddles, and tapered edge strips, including slopes.
 - 4. Insulation fastening patterns.
- C. Verification Samples: Provide for each product specified.
- D. Maintenance Data: Manufacturer's maintenance data for each product.
- E. Warranties: As referenced herein.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and is eligible to receive the specified manufacturer's guarantee.
- B. Manufacturer Qualifications: Qualified manufacturer that has UL listing for roofing system identical to that used for this Project.

- C. Source Limitations: Obtain all components from the single source roofing system manufacturer guaranteeing the roofing system. All products used in the system must be labeled by the single source roofing system manufacturer issuing the guarantee.

1.6 HANDLING

- A. Deliver roofing materials in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storage.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.7 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when current and forecasted weather conditions permit roofing system to be installed in accordance with manufacturer's written instructions and guarantee requirements.

1.8 GUARANTEE AND WARRANTY

- A. Manufacturer Guarantee: Provide roofing manufacturer's system guarantee equal to full replacement value of the installed roof assembly.
 - 1. Single-Source special guarantee includes roofing plies, base flashings, liquid applied flashing, roofing membrane accessories, and other single-source components of roofing system marketed by the manufacturer.
 - 2. Guarantee Period: 15 years from date of Substantial Completion.
- B. Installation Warranty: Provide roofing Installer's warrantee signed by Installer, covering Work of this Section, including all components of roofing system for the following guarantee period:
 - 1. Special Warrantee Period: 2 Years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Firestone Building Products
- B. Carlisle Syntec Systems
- C. Substitutions: Refer to Section 01 63 00.

2.2 SINGLE-PLY ROOFING MEMBRANE

- A. General: Upon field examination by a duly licensed roofing contractor certified to install TPO roofing membranes, field verify single-ply roofing membrane type and comply with the following:
 - 1. Thermoplastic Polyolefin roofing membrane - TPO
 - a. Fabric-Reinforced Thermoplastic Polyolefin Sheet: ASTM D 6878, uniform, flexible sheet formed from a thermoplastic polyolefin, internally fabric or scrim reinforced.
 - b. Thickness (minimum): 80 mils.
 - c. Exposed Face Color: White

2.3 AUXILIARY ROOFING MATERIALS – SINGLE PLY

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
- B. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.
- C. Sheet Flashing: Manufacturer's sheet flashing of same material, type, reinforcement, thickness, and color as sheet membrane.
- D. Primer Material: Manufacturer's standard synthetic-rubber polymer primer.
- E. Seaming Material: Manufacturer's standard 3-inch-wide minimum, butyl splice tape with release film.
- F. Bonding Adhesive: Manufacturer's standard water-based bonding adhesive for membrane, and solvent-based bonding adhesive for base flashings.
- G. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.
- H. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum bars, with anchors.
- I. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
- J. Miscellaneous Accessories: Provide sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, sealants and other accessories.

2.4 COVER BOARD

- A. Perlite Board: ASTM C 728; composed of expanded perlite, cellulosic fibers, binders and waterproofing agents with top surface seal-coated.

2.5 TAPERED INSULATION

- A. Tapered Insulation: ASTM C 1289, provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48), unless otherwise indicated.

2.6 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.
- B. Provide factory preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain.
- C. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and furnished by roofing system manufacturer.
- D. Urethane Adhesive: Manufacturer's two component urethane adhesive formulated to adhere insulation to substrate.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with the requirements affecting performance of roofing system.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean and remove from substrate sharp projections, dust, debris, moisture, and other substances detrimental to roofing installation in accordance with roofing system manufacturer's written instructions.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction.
- C. Prime surface of concrete deck with asphalt primer at a rate recommended by roofing manufacturer and allow primer to dry.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 ROOF CUT AND PATCH PREPARATION

- A. Remove all single-ply roofing membrane surfacing, coverboards, insulation, fasteners, adhesives, etc. as shown on demolition plans.
- B. Remove an area no larger than can be re-roofed in one day.

- C. Tear out all base flashings, counterflashings, pitch pans, pipe flashings, vents and like components necessary for application of new membrane.
- D. Remove abandoned equipment curbs, skylights, smoke hatches, and penetrations.
- E. Raise (disconnect by licensed craftsmen, if necessary) all HVAC units and other equipment supported by curbs to conform with the following:
 - 1. Modify curbs as required to provide a minimum 8" base flashing height measured from the surface of the new membrane to the top of the flashing membrane.
 - 2. Nail top of flashing and install new metal counterflashing prior to re-installation of unit.
 - 3. Perimeter nailers must be elevated to match elevation of new roof insulation.
- F. Immediately remove all debris from roof surface. Demolished roof system may not be stored on the roof surface.
- G. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 SUBSTRATE BOARD INSTALLATION

- A. Install substrate board with thickness to match existing conditions with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
- B. Fasten substrate board to existing deck according to recommendations in FMG's "Approval Guide" for specified Windstorm Resistance Classification.
- C. Fasten substrate board to existing deck to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturer's written instructions.
- D. Proceed with installation only after any or all unsatisfactory conditions have been corrected.

3.5 TAPERED INSULATION INSTALLATION

- A. Install tapered insulation under area of roofing to conform to slopes indicated

3.6 ROOFING MEMBRANE INSTALLATION, GENERAL

- A. Roof Membrane Application: Apply roofing membrane in accordance with manufacturer's instructions and NRCA recommendations for roof type.
 - 1. Apply membrane smooth, free from wrinkles, fishmouths, prominent lap joints, and free from tears.
 - 2. Carry membrane up cant strips to vertical surfaces and secure to nailing strips and reglets.
 - 3. Comply with manufacturer's recommendations for installation of base, wall, and field flashings.
 - 4. Coordinate metal flashings and counterflashing.

5. Coordinate installation of roof drains and related flashings.
 6. Seal flashings and flanges of items projecting through membrane.
- B. Install roofing membrane in accordance with roofing system manufacturer's written instructions, applicable recommendations of the roofing manufacturer and requirements in this Section.
 - C. Where roof slope exceeds 1/2 inch per 12 inches (1:24, contact the membrane manufacturer for installation instructions regarding installation direction and back nailing.
 - D. Coordinate roof membrane system installation so insulation and other components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is imminent.
 - E. Provide tie-offs at end of each day's work to cover exposed roofing membrane sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt with joints and edges sealed.
 - F. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
 - G. Remove and discard temporary seals before beginning work on adjoining roofing.
 - H. Proceed with installation only after unsatisfactory conditions have been corrected.

3.7 ROOFING MEMBRANE INSTALLATION

- A. Install roofing membrane over area to receive roofing in accordance with roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing.
- B. Accurately align roofing membranes and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- C. Apply roofing membrane with side laps shingled with slope of roof deck where possible.
- D. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping roofing membranes according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of roofing membrane terminations.
- E. Seams: Clean seam areas, overlap roofing membrane, and hot-air weld side and end laps of roofing membrane according to manufacturer's written instructions to ensure a watertight seam installation.
- F. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roofing membrane.

3.8 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates in accordance with membrane roofing system manufacturer's written instructions.
- B. Flash penetrations and field-formed inside and outside corners with sheet flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean seam areas and overlap and firmly roll sheet flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Owner may elect to engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.
 - 1. Cost of roof membrane testing shall be paid for by the Owner.
- B. Final Roof Inspection: At the Owner's request, arrange for roofing system manufacturer's Registered Roof Observer (RRO) to inspect roofing installation on completion and submit report to Architect.
- C. Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.

3.10 PROTECTION AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period.
- B. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.
 - 1. Remove markings caused by reroofing from finished surfaces.
 - 2. In areas where finished surfaces are soiled caused by roofing work, consult manufacturer of finished surfaces for recommended cleaning methods.
- C. Leave completed roof free from debris and uniform in appearance.

END OF SECTION

SECTION 07 60 00**FLASHING AND SHEET METAL**

PART 1 - GENERAL**1.1 SUMMARY**

- A. Section Includes: Provide metal flashings and sheet metal including accessories as required for complete weathertight installation including:
 - 1. Exposed and concealed flashing systems, reglets, and similar fabricated components.
 - a. Curb flashing and counter flashing.
 - b. Parapet flashing and counterflashing.
 - c. Wall flashing and counterflashing.
 - d. Cap flashing at HVAC platforms.
 - 2. Concealed sealants used in conjunction with installation of metal flashing and sheet metal.
 - 3. Miscellaneous sheet metal flashing and reglets not provided by other trades or suppliers.
 - a. Where reglets are to be installed in conjunction with other work, provide in adequate time for installation.
 - b. Where reglets are to be surface applied, provide continuous gasket between reglet and surface.
- B. Related Sections:
 - 1. Section 07 13 00: Building Underlayment.
 - 2. Section 07 52 00: Single-Ply Roofing.
 - 3. Section 07 90 00: Joint Sealers.

1.2 SYSTEM DESCRIPTION

- A. Design Requirements: Allow for movement of components without causing buckling, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to 100 year seasonal temperature ranges.

1.3 REFERENCES

- A. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): Architectural Sheet Metal Manual, Latest Edition.

- B. National Roofing Contractors Association (NRCA): Roofing and Waterproofing Manual, Fifth Edition.

1.4 SUBMITTALS

- A. Product Data: Furnish literature for manufactured products.
- B. Shop Drawings: Clearly indicate dimensioning, layout, general construction details including closures, flashings, locations and types of sealants, anchorages, and method of anchorage.
- C. Samples: Furnish samples of typical metal flashing fabrication indicating standard soldered joints and edge conditions.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Provide strippable film protective covering on aluminum flashing materials to protect materials through shipping, fabrication and installation.

1.6 WARRANTY

- A. Special Warranty: Provide for correcting failure of metal flashing system to resist penetration of water and damage from wind.
 - 1. Special Warranty Period: Two years.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Flashing and Sheet Metal:
 - 1. Galvanized Steel: ASTM A924 and A653 G90 galvanized steel; 22 gage. No Exceptions Taken.
 - a. Mill phosphatized where indicated to be field painted.
 - 2. Accessories: Provide strainers, outlet tubes, screens, baffles, hangers and gutter ends as required for a complete system and complying with SMACNA and/or NRCA Manual.
 - 3. Provide heavier gage metal where recommended by SMACNA and/or NRCA Manual for size of component.
 - 4. Finish:
 - a. Exposed to view (including exposed portions of clips):
 - 1) Fluoropolymer coating based on Kynar 500 or Hylar 5000.

- a) Color: As selected by Architect from standard color range.
 - b. Concealed from view:
 - 1) Exposed galvanized finish with optional field paint (as selected or chosen by Architect).
 - a) Color: As selected by Architect.
- B. Manufactured Reglets: Snap-on type, for two piece flashing; metal to match flashing and sheet metal.
 - 1. Manufacturers:
 - a. Fry Reglet Corp./Springlok System.
 - b. MM Systems Corp./Snap-Tite System.
 - c. W.P. Heckman Co./The Leading Edge Drive Lock System.
 - d. Substitutions: Refer to Section 01 63 00.
- C. Solder and Fasteners: As recommended by SMACNA and/or NRCA and complying with applicable codes and regulations; hot dipped galvanized minimum coating comparable to G90.
- D. Fasteners: Stainless steel fasteners of type, size, and length for proper installation.
 - 1. Exposed fasteners to match flashing finish.
 - 2. Provide neoprene washers at all exposed fasteners.
- E. Concealed Sealant: Butyl type for use in conjunction with sheet metal; non-staining; non-corrosive; non-shrinking and non-sagging; ultra-violet and ozone resistant for exterior concealed applications.
- F. Bituminous Paint: Acid and alkali resistant type; black color; asbestos free.
- G. Plastic Cement: Cutback asphaltic type; asbestos free.
- H. Sealing Compound: Type recommended by roofing manufacturer; asbestos free.
- I. Gaskets: Type suitable for use in conjunction with sheet metal; non-staining, non-corrosive, non-shrinking, non-sagging, ultra-violet resistant, and ozone resistant; for exterior concealed applications.
 - 1. Manufacturers:
 - a. Sandell Manufacturing Co./Polytite Joint Sealant.
 - b. Emseal USA, Inc./Emseal Secondary Seal.
 - c. Substitutions: Refer to Section 01 63 00.

2.2 FABRICATION

- A. Fabricate sheet metal in accordance with SMACNA and/or NRCA Manual.

- B. Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
 - 1. Fabricate corners and intersections in shop with solder joints; watertight fabrication.
- C. Form sections in 20'-0" lengths; make allowance for expansion at joints.
- D. Exposed rivets shall be avoided. Provide 6" wide cover plates at all flashing section joints.
- E. Hem all exposed edges on underside 1/2" including ends and cover plates.
- F. Backpaint flashings with heavy bodied bituminous paint where in contact with cementitious materials or dissimilar metals.
- G. Form pitch pans watertight, with minimum 4" upstand and 4" flanges; form pans minimum 6" wider than item passing through roof membrane.
- H. Form umbrella flashings with minimum 2" overhang, to shed water away from pitch pans.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install metal flashing and sheet metal in accordance with SMACNA and/or NRCA Manual.
 - 1. Install tight in place, with corners square, surfaces true and straight in planes, and lines accurate to profiles as indicated on Drawings.
 - 2. Lap joints in direction of water flow.
- B. Exercise care when cutting materials on site, to ensure cuttings do not remain on finished surfaces.
- C. Provide expansion joints concealed within system.
- D. Use concealed fasteners, continuous cleat type, except where specifically approved by Architect.
 - 1. Exposed fasteners may be used, where clearly indicated on shop drawings and approved by Architect, at areas not exposed at exterior walls nor in sight of interior spaces.
- E. Apply sealing compound at junction of metal flashing and felt flashing.
- F. Lock seams and end joints; fit flashing tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

- G. Counter-flash mechanical and electrical items projecting through roof membrane.
- H. Install sealants where required to prevent direct weather penetration.
 - 1. Install continuous gasket behind surface applied reglets.
- I. Completed installation shall be free of rattles, noise due to thermal and air movement, and wind whistles.
- J. Install pitch pans and fill with plastic cement.
- K. Install umbrella flashing with draw band collars with sheet metal sealant between penetrating member and flashing; use wood blocking at angle type penetrations and cover blocking with sealant.

3.2 CLEANING

- A. Remove protective coating from shop finished sheet metal when no longer required to protect roofing and flashing from construction.
- B. Touch-up scratched and damaged finish to match new; remove and replace sheet metal units that cannot be repaired to look identical to adjacent sheet metal when viewed from 15'-0" away.

END OF SECTION

SECTION 07 90 00

JOINT SEALERS

PART 1 - GENERAL**1.1 SUMMARY**

- A. Section Includes: Provide joint sealers, for joints not specified elsewhere, with backing rods and accessories as required for complete installation.
 - 1. Includes sealants and calking as indicated for wet areas.
- B. Related Sections:
 - 1. All Specification Sections.

1.2 SYSTEM DESCRIPTION

- A. Performance Requirements:
 - 1. Select materials for compatibility with joint surfaces and indicated exposures.
 - 2. Where not indicated, select modulus of elasticity and hardness or grade recommended by manufacturer for each application indicated.
 - 3. Comply with applicable limitations on volatile organic compound (VOC) emissions.

1.3 SUBMITTALS

- A. Product Data: Furnish manufacturer's descriptive literature.
- B. Shop Drawings: Shop Drawings:
 - 1. Indicate joint locations, dimensions, and adjacent construction.
 - 2. Provide details for transitions in plane and direction for continuity of seal through watertight transitions from wall expansion joint to other interfacing expansion joint systems at adjacent construction.
- C. Samples: Furnish samples of each type of exposed joint sealer in required colors.
- D. Certifications:
 - 1. Furnish manufacturer's certification joint sealers comply with Contract Documents and are suitable for Project applications.
 - 2. Furnish certification indicating installers are trained in proper use of specified products, qualified, and familiar with proper installation techniques.

1.4 QUALITY ASSURANCE

- A. Qualification of Installer: Installer to have completed not less than five similar successful installations which have been in service for at least 5 years.
 - 1. Installers shall be familiar with proper application procedures to ensure maximum joint sealer expansion and contraction capabilities.
 - 2. Installers shall be familiar with proper application procedures in a natatorium and/or enclosed swimming pool environment.
 - 3. Provide a list of such installations including owner, address of installation, size or scope of project, date of installation, architect of record, project contact person and phone number of contact person

1.5 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 period for use, cure time, and mixing instructions.

1.6 SITE CONDITIONS

- A. Do not proceed with installation of joint sealers under unfavorable weather conditions.
- B. Install elastomeric sealants when temperature is in lower third of temperature range recommended by manufacturer.

1.7 WARRANTY

- A. Special Warranty: Repair or replace joint sealers which fail to perform as intended, because of leaking, crumbling, hardening, shrinkage, bleeding, sagging, staining, loss of adhesion, and loss of cohesion.
 - 1. Special Warranty Period: Two years.

PART 2 - PRODUCTS**2.1 MATERIALS**

- A. Elastomeric Sealants:
 - 1. Single Component Low Modulus Silicone Sealant: ASTM C920 Type S, Class 25, Grade NS; minimum 50% expansion and compaction capability.
 - a. Provide at exterior locations not exposed to traffic.
 - b. Manufacturers:
 - 1) General Electric Co./Silpruf, Silglaz or GESIL.

- 2) Dow Corning Corp./790 or 795.
 - 3) Pecora Corp./864 Architectural Silicone.
 - 4) Tremco/Spectrum 3.
2. Multi-Component Polyurethane Sealant: ASTM C920, Type M, Grade P, Class 25, self-leveling; minimum 25% expansion and compaction capability.
 - a. Provide at traffic bearing locations.
 - b. Manufacturers:
 - 1) Pecora Corp./NR-200 Urexpan.
 - 2) Tremco/Vulkem 245.
 - 3) Sonneborn Division of ChemRex /SL 2
 - 4) Substitutions: Refer to Section 01 63 00.
3. Mildew-Resistant Silicone Rubber Sealant: ASTM C920, Type S, Grade NS, Class 25, compounded with fungicide, specifically for mildew resistance and recommended for interior joints in wet areas.
 - a. Provide at interior joints in wet areas.
 - b. Manufacturers:
 - 1) General Electric Co./SCS 1702 Sanitary Sealant.
 - 2) Dow Corning Corp./786 Bathtub Caulk.
 - 3) Pecora Corp./898 Sanitary Mildew Resistant Sealant.
 - 4) Tremco/Tremsil 200.
4. Acrylic-Emulsion Sealant: ASTM C834 acrylic or latex-rubber-modified acrylic sealant, permanently flexible, non-staining and non-bleeding; recommended for general interior exposure; compatible with paints specified in Section 09 91 00.
 - a. Provide at general interior applications.
 - b. Manufacturers:
 - 1) Pecora Corp./AC-20.
 - 2) Sonneborn Division of ChemRex/Sonolac.
 - 3) Tremco/Ultrem 1500
 - 4) Substitutions: Refer to Section 01 63 00.

B. Miscellaneous Materials:

1. Primers/Sealers: Non-staining types recommended by joint sealer manufacturer for joint surfaces to be primed or sealed.
2. Joint Cleaners: Non-corrosive types recommended by joint sealer manufacturer; compatible with joint forming materials.

3. Bond Breaker Tape: Polyethylene tape as recommended by joint sealer manufacturer where bond to substrate or joint filler must be avoided for proper performance of joint sealer.
4. Sealant Backer Rod: Compressible polyethylene foam rod or other flexible, permanent, durable non-absorptive material as recommended by joint sealer manufacturer for compatibility with joint sealer.
 - a. Oversize backer rod minimum 30% to 50% of joint opening.
- C. Colors: Provide colors indicated or as selected by Architect from manufacturer's full range of colors.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare joint surfaces in accordance with ASTM C1193 and as recommended by joint sealer manufacturer.
- B. Clean joint surfaces immediately before installation of joint sealer; remove dirt, insecure materials, moisture and other substances which could interfere with bond of joint sealer.
- C. Prime or seal joint surfaces where recommended by joint sealer manufacturer; do not allow primer/sealer to spill or migrate onto adjoining surfaces.
- D. Ensure protective coatings on surfaces in contact with joint sealers have been completely stripped.

3.2 INSTALLATION

- A. Comply with manufacturer's printed instructions and ASTM C1193, except where more stringent requirements are shown or specified.
- B. Set sealant backer rods at proper depth or position in joint to coordinate with other work, including installation of bond breakers and sealant; do not leave voids or gaps between ends of backer rods.
- C. Install bond breaker tape as required to avoid three-sided bond of sealant to substrate and where required by manufacturer's recommendations to ensure joint sealers will perform properly.
- D. Size materials to achieve required width/depth ratios.
- E. Employ installation techniques that will ensure joint sealers are deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of bond surfaces equally on opposite sides.

- F. Joint Configuration: Fill sealant joint to a slightly concave surface, slightly below adjoining surfaces, unless otherwise indicated.
- G. Where horizontal joints are between a horizontal surface and vertical surface, fill joint to form a slight cove, so that joint will not trap moisture or dirt.
- H. Install joint sealers to depths recommended by joint sealer manufacturer but within the following general limitations, measured at center (thin) section of bead.
 - 1. Horizontal Joints: 75% width with minimum depth of 3/8".
 - 2. Elastomeric Joints: 50% width with minimum depth of 1/4".
 - 3. Non-Elastomeric Joints: 75% to 125% of joint width.
- I. Spillage: Do not allow sealants or compounds to overflow or spill onto adjoining surfaces, or to migrate into voids of adjoining surfaces.
 - 1. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage.
- J. Cure joint sealers in compliance with manufacturer's instructions to obtain high early bond strength, internal cohesive strength and surface durability.
- K. Maintain finished joints free of embedded matter, ridges and sags.

END OF SECTION

SECTION 08 11 00**STEEL DOORS AND FRAMES**

PART 1 - GENERAL**1.1 SUMMARY**

- A. Section Includes: Provide full flush steel man doors and pressed steel frames, including anchors and silencers as scheduled and detailed on the plans.
 - 1. Section includes steel frames at head and jambs of sectional overhead doors as detailed.
 - a. Provide factory or shop applied finish as specified herein.
- B. Related Sections:
 - 1. Section 08 36 13: Sectional Aluminum Overhead Doors
 - 2. Section 08 70 00: Hardware
 - 3. Section 08 81 00: Glazing

1.2 REFERENCES

- A. Steel Door Institute (SDI): SDI-100 (ANSI/SDI A250.8) - Recommended Specifications - Standard Steel Doors and Frames.
- B. National Association of Architectural Metal Manuf. (NAAMM): Hollow Metal Manual.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturers' literature.
- B. Shop Drawings: Indicate general construction, configuration, jointing methods, reinforcements, anchorage methods, hardware locations, and locations of cut-outs.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. The Ceco Corporation.
- B. Curries.
- C. Amweld Building Products Inc.
- D. Pioneer Industries Division, Core Industries, Inc.

2.2 MATERIALS

- A. Doors: Hollow metal flush steel door, 1-3/4" thick.
 - 1. Typical: Full flush with steel channel or welded edge; not less than 16 gage, close top with flush end closer treatment, bottom optional flush or recessed channel; steel stiffened core, insulated at exterior doors.
- B. Frames: Welded (pre-assembled) type, not less than 16 gage.
 - 1. Door Silencers: Manufacturer's standard resilient type; removable for replacement.
 - 2. Mortar Guard Boxes: Minimum 22 gage mortar guard boxes welded in place; provide where frames may be grouted.

2.3 FABRICATION

- A. Conform to requirements of SDI (ANSI A250 Series) or NAAMM.
- B. Reinforce and prepare doors and frames to receive hardware.
 - 1. Refer to Section 08 70 00 for hardware requirements.
- C. Frames: Accurately form and cut mitered corners of welded type frames; continuously weld on inside surfaces (fully welded); grind welded joints to smooth uniform finish.
 - 1. Head Reinforcement: Reinforce frames wider than 4'-0" with minimum 12 gage formed steel channels welded in place, flush with top of frames.
- D. Door Silencers:
 - 1. Place minimum three single bumpers on single door frames; space equally along strike jambs.
 - 2. Place minimum of two single bumpers on double door frames; place on frame heads.
- E. Provide jamb anchors per SDI-100 (ANSI/SDI 250.8) and NAAMM; weld floor jamb anchors in place.
- F. Edge Clearances:
 - 1. Between Doors and Frames: Maximum 1/8" at head and jambs.
 - 2. Door Sills: Maximum 3/8".
 - 3. Between Edges of Pairs of Doors: Maximum 1/8".
- G. Finish:
 - 1. Exterior and interior doors and frames: Galvanize and prime paint. Comply with requirements of Section 09 91 00 for primer including application and compatibility with specified finishes.

- a. Galvanized Coating: Apply minimum A60 non-spangle galvanized coating, ASTM A924 and A653.
 - 1) Surface treat after galvanizing to remove oils and prepare for painting and apply one coat of primer; comply with requirements in Section 09 91 00 – Paints and Coatings.
- 2. Powder coat paint finish at Apparatus Bay sectional door frames: The paint finish on all exterior exposed metal surfaces shall be shop-applied spray-applied Fluorocarbon Resin utilizing 70% Kynar 500 resins. Color as selected from manufacturer's standard color chart including premium colors.
 - a. Number of Coats: 3-coats. The coating shall be shop applied. The coating shall consist of a 0.2 mil prime coat, a 0.70 mil barrier coat, a 0.70 mil color coat containing 70% Kynar resins.
 - b. Color: RAL color as selected by Architect from full color range.
 - c. Relevant to the color selected, material to be painted in accordance with either AAMA specification 2605 or 2604.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install doors and frames in accordance with SDI-100 (ANSI/SDI A250.8) and ANSI/SDI A250.11 or NAAMM "Hollow Metal Manual" and with manufacturer's recommendations and installation instructions.
 - 1. Install fire rated units in conformance with fire label requirements and NFPA 80.
- B. Install doors and frames plumb and square, and with maximum diagonal distortion of 1/16".
 - 1. Coordinate hardware installation with requirements of Section 08 70 00.
- C. Remove and replace doors and frames damaged during delivery, storage, installation and construction.
 - 1. Paste filler repair shall not be permitted.
- D. After installation, touch-up scratched paint surfaces.

END OF SECTION

SECTION 08 11 16**ALUMINUM DOORS AND FRAMES**

PART 1 - GENERAL**1.1 SUMMARY****A. Section includes:**

1. Aluminum Entrance Door and Frame at fire station main entrance.

B. Related Sections:

1. Section 08 70 00: Door Hardware.
2. Section 08 81 00: Glazing

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM)
- B. Aluminum Association (AA)
- C. American Architectural Metal Manufacturers (AAMA): Aluminum Store Front and Entrance Manual.
- D. American Architectural Manufacturers Association (AAMA) 1303.5: Voluntary Specifications for Forced-Entry Resistant Aluminum Sliding Glass Doors
- E. American National Standards Institute (ANSI):
 1. ANSI Z97.1: Safety Glazing Materials Used in Buildings - Methods of Test.
 2. ANSI A156.10: For Power Operated Pedestrian Doors; Sliding Doors section.
 3. ANSI A156.5: Standard for Auxiliary Locks and Associated Products
- F. Glass Association of North America (GANA): Glazing Manual.
- G. National Association of Architectural Metal Manuf. (NAAMM): Metal Finishes Manual.

1.3 SYSTEM DESCRIPTION**A. General:** In addition to requirements shown or specified, comply with:

1. Applicable provisions of AAMA Aluminum Storefront and Entrance Manual for design, materials, fabrication and installation of component parts.

B. Performance Requirements: Each assembly tested by a recognized testing laboratory or agency in accordance with specified test methods.

- C. Tested by the dual moment corner joint strength test.
- D. Design Criteria:
 - 1. Strength: Design system to withstand wind loads acting normal to plane of wall as required by California Building Code but no less than following minimum requirements:
 - a. Wind Loads: Minimum 20 psf acting inward and outward.
 - b. Deflection: Maximum $L/175$, ASTM E330.
 - c. Safety Factor: Design for specified pressures with no glass breakage, no permanent damage to fasteners, and no permanent deformation of framing in excess of 0.2% of member clear span.
 - 2. Water Penetration: No uncontrolled water penetration, ASTM E331, with no water on exposed interior components; static pressure differential of 20% of inward wind load, with minimum 6 psf load.
 - 3. Air Leakage: Maximum 0.06 cfm/sf, ASTM E283, at differential static pressure of 6.24 psf at fixed glazing and not more than 0.3 cfm/sf at doors.

1.4 SUBMITTALS

- A. Product Data: Manufacturer's fabrication and installation instructions.
- B. Shop Drawings:
 - 1. Provide standard installation details for typical architectural conditions.
 - 2. Provide details of connections to special construction and other custom features.

1.5 QUALITY ASSURANCE

- A. Single Source Responsibility:
 - 1. Obtain entrances, storefronts, ribbon walls, window walls, curtain walls, window systems, and finish through one source from a single manufacturer.
 - 2. Manufacturer's Qualifications: Manufacturer to have minimum (5) five years successful experience in the fabrication of automatic doors of the type required for this project. Manufacturer capable of providing field service representation during installation, approving acceptable installer and approving application method.
- B. Provide test reports from AAMA accredited laboratories certifying the performances as specified in 1.3.
- C. Installers Qualifications: Installer shall be factory trained, certified by Manufacturer and experienced to perform work of this section.

1.6 WARRANTY

- A. Special Warranty: Provide for correcting failures including wind damage and water penetration to interior surfaces, excessive deflections, and deterioration of finishes, weather-stripping and accessories.

- 1. Special Warranty Period: Two years.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver door and frame packaged to provide protection during transit and storage at project site.
- B. Inspect door and frame upon delivery for damage.
 - 1. Replace components that have damaged finishes or profiles.
- C. Store door and frame at project site under cover and as near as possible to final installation location. Do not use covering material that will cause discoloration of aluminum finish.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not begin installation of aluminum frame until area of work has been completely enclosed and interior is protected from the elements.
- B. Maintain temperature and humidity in areas of installation within reasonable limits, as close as possible to final occupancy standards. If necessary, provide artificial heating, cooling, and ventilation to maintain required environmental conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design:
 - 1. Arcadia, Inc., 235L Series, Logo Panel Entrance, 1-3/4".
 - a. Vertical Stiles: 5 inches.
 - b. Top Rail: 5-1/8 inches.
 - c. Intermediate Logo Panel: 7-1/2 inches.
 - d. Bottom Rail: 10/12 inches.
 - e. Beveled Glazing Stops: Snap-in type for 1/4" glass infill.
- B. Substitutions: Refer to Section 01 63 00.

2.2 MATERIALS

- A. Door members: Extruded 6063-T6 aluminum alloy (ASTM B221-Alloy G.S. 10a T6).
- B. Door stiles, rails and frames shall have a nominal .125" and inserts shall have a .050" wall thickness.
- C. Screws, fastening devices, and internal components: Aluminum, stainless steel, or zinc plated steel in accordance with ASTM A-164. Shall be aluminum or steel, providing the steel is properly isolated from aluminum.
- D. Glazing Gasket (compression-type design).

2.3 HARDWARE

- A. Hardware furnished and installed by the door manufacturer, and include the following standard hardware.
 - 1. Refer to Drawings for Hardware Schedule.
- B. Weatherstripping: Hard-backed poly pile in door and/or frame. Meeting stile of all pair of doors have a double line hard-backed poly-pile astragal.

2.4 FINISH

- A. Powder Coat Paint Finish: The paint finish on all exterior exposed metal surfaces shall be shop-applied spray-applied Fluorocarbon Resin utilizing 70% Kynar 500 resins.
 - 1. Number of Coats: 3-coats. The coating shall be shop applied. The coating shall consist of a 0.2 mil prime coat, a 0.70 mil barrier coat, and a 0.70 mil color coat containing 70% Kynar resins.
 - 2. Custom color to match RAL 3003 – Ruby Red.
 - 3. Relevant to the color selected, material to be painted in accordance with either AAMA specification 2605 or 2604.

2.5 GLASS

- A. Single Pane Tempered Glass. See Specification Section 08 81 00.

2.6 DOOR FABRICATION

- A. Stiles and rails shall be tubular sections accurately joined, flush and hairline at corners with heavy concealed reinforcement brackets secured with machine bolts, with optional MIG weld. Exposed screws not permitted.
- B. Each door leaf equipped with an adjusting mechanism, located in the top rail near the lock stile.

- C. Prepare internal reinforcement for door hardware.
- D. Custom hardware templates and physical hardware must be submitted prior to any fabrication.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine surfaces of openings and verify dimensions.
- B. Installation of frame and door constitutes acceptance of existing conditions.

3.2 INSTALLATION

- A. Install in accordance with approved shop drawings and manufacturers installation instructions.
- B. Assemble and anchor various components to allow for expansion and contraction, maintaining weather-tight condition.
- C. Install frame and door in strict compliance with manufacturer's recommendations and installation instructions.
- D. Install work plumb, straight, square, level and in their proper elevation, plane and location, and in proper alignment with other work.
- E. Anchor securely in place, separate aluminum and other corrodible metal surfaces from corrosion and electrolytic action with other materials.
- F. Upon completion of installation, remove protective coatings or coverings and clean aluminum surfaces.
- G. Adjust hardware for proper operation.
- H. Repair or replace damaged metal components, cracked glass, and broken glass.

END OF SECTION

SECTION 08 13 76

FOLDING ALUMINUM DOORS AND FRAMES

PART 1 - GENERAL**1.1 SUMMARY****A. Section includes:**

1. Aluminum Folding Door and Frame at Vehicle Display 128.

B. Related Sections:

1. Section 08 11 16: Aluminum Doors and Frames
2. Section 08 81 00: Glazing

1.2 REFERENCES**A. American Society for Testing and Materials (ASTM)****B. Aluminum Association (AA)****C. American Architectural Metal Manufacturers (AAMA): Aluminum Store Front and Entrance Manual.****D. American National Standards Institute (ANSI):**

1. ANSI Z97.1: Safety Glazing Materials Used in Buildings - Methods of Test.
2. ANSI A156.10: For Power Operated Pedestrian Doors; Sliding Doors section.
3. ANSI A156.5: Standard for Auxiliary Locks and Associated Products

E. Glass Association of North America (GANA): Glazing Manual.**F. National Association of Architectural Metal Manuf. (NAAMM): Metal Finishes Manual.****1.3 SYSTEM DESCRIPTION****A. General: In addition to requirements shown or specified, comply with:**

1. Applicable provisions of AAMA Aluminum Storefront and Entrance Manual for design, materials, fabrication and installation of component parts.

B. Performance Requirements: Each assembly tested by a recognized testing laboratory or agency in accordance with specified test methods.

1.4 SUBMITTALS

- A. Product Data: Manufacturer's fabrication and installation instructions.
- B. Shop Drawings:
 - 1. Provide standard installation details for typical architectural conditions.
 - 2. Provide details of connections to special construction and other custom features.

1.5 QUALITY ASSURANCE

- A. Single Source Responsibility:
 - 1. Obtain entrances, storefronts, ribbon walls, window walls, curtain walls, window systems, and finish through one source from a single manufacturer.
 - 2. Manufacturer's Qualifications: Manufacturer to have minimum (5) five years successful experience in the fabrication of automatic doors of the type required for this project. Manufacturer capable of providing field service representation during installation, approving acceptable installer and approving application method.
- B. Installers Qualifications: Installer shall be factory trained, certified by Manufacturer and experienced to perform work of this section.

1.6 WARRANTY

- A. Special Warranty: Provide for correcting failures including wind damage and water penetration to interior surfaces, excessive deflections, and deterioration of finishes, weather-stripping and accessories.
 - 1. Special Warranty Period: Two years.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver door and frame packaged to provide protection during transit and storage at project site.
- B. Inspect door and frame upon delivery for damage.
 - 1. Replace components that have damaged finishes or profiles.
- C. Store door and frame at project site under cover and as near as possible to final installation location. Do not use covering material that will cause discoloration of aluminum finish.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not begin installation of aluminum frame until area of work has been completely enclosed and interior is protected from the elements.

- B. Maintain temperature and humidity in areas of installation within reasonable limits, as close as possible to final occupancy standards. If necessary, provide artificial heating, cooling, and ventilation to maintain required environmental conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design:

- 1. Panda Windows and Doors, Los Vegas, NV.
 - a. Model FS.51
 - 1) Panda 100 Throw Handle
 - 2) Panda 200 Pull Handle
 - 3) Track: 1/2" ADA Surface Track
 - 4) Glazing: See glass types noted on plans.

B. Substitutions: Refer to Section 01 63 00.

2.2 MATERIALS

- A. Door members: Extruded 6063-T6 aluminum alloy (ASTM B221-Alloy G.S. 10a T6).
- B. Door stiles, rails and frames shall have a nominal .125" and inserts shall have a .050" wall thickness.
- C. Screws, fastening devices, and internal components: Aluminum, stainless steel, or zinc plated steel in accordance with ASTM A-164. Shall be aluminum or steel, providing the steel is properly isolated from aluminum.
- D. Glazing Gasket (compression-type design).

2.3 HARDWARE

- A. Hardware furnished and installed by the door manufacturer, and include standard hardware noted above.
- B. Weatherstripping: Hard-backed poly pile in door and/or frame. Meeting stile of all pair of doors have a double line hard-backed poly-pile astragal.

2.4 FINISH

- A. Powder Coat Paint Finish: The paint finish on all exterior exposed metal surfaces shall be shop-applied spray-applied Fluorocarbon Resin utilizing 70% Kynar 500 resins.

1. Number of Coats: 3-coats. The coating shall be shop applied. The coating shall consist of a 0.2 mil prime coat, a 0.70 mil barrier coat, and a 0.70 mil color coat containing 70% Kynar resins.
2. Custom color to match RAL 3003 – Ruby Red.
3. Relevant to the color selected, material to be painted in accordance with either AAMA specification 2605 or 2604.

2.5 GLASS

- A. Single Pane Tempered Glass. See Specification Section 08 81 00.

2.6 DOOR FABRICATION

- A. Stiles and rails shall be tubular sections accurately joined, flush and hairline at corners with heavy concealed reinforcement brackets secured with machine bolts, with optional MIG weld. Exposed screws not permitted.
- B. Each door leaf equipped with an adjusting mechanism, located in the top rail near the lock stile.
- C. Prepare internal reinforcement for door hardware.
- D. Custom hardware templates and physical hardware must be submitted prior to any fabrication.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine surfaces of openings and verify dimensions.
- B. Installation of frame and door constitutes acceptance of existing conditions.

3.2 INSTALLATION

- A. Install in accordance with approved shop drawings and manufacturers installation instructions.
- B. Assemble and anchor various components to allow for expansion and contraction, maintaining weather-tight condition.
- C. Install frame and door in strict compliance with manufacturer's recommendations and installation instructions.
- D. Install work plumb, straight, square, level and in their proper elevation, plane and location, and in proper alignment with other work.

- E. Anchor securely in place, separate aluminum and other corrodible metal surfaces from corrosion and electrolytic action with other materials.
- F. Upon completion of installation, remove protective coatings or coverings and clean aluminum surfaces.
- G. Adjust hardware for proper operation.
- H. Repair or replace damaged metal components, cracked glass, and broken glass.

END OF SECTION

SECTION 08 21 00**WOOD DOORS**

PART 1 - GENERAL**1.1 SUMMARY**

- A. Section Includes: Provide raised panel paint grade solid core wood doors as scheduled.
 - 1. Wood doors to have heads, stiles, and rails as indicated on the plans.
 - 2. Wood doors to be factory sanded and prime painted.
 - a. Match existing door finishes as directed by Architect.
 - b. Coordinate with Section 09 91 00.
 - 3. Wood doors to include wood stops to match existing for glazed panels where scheduled.
- B. Related Work
 - 1. Section 08 11 00: Steel Doors and Frames
 - 2. Section 08 70 00: Door Hardware
 - 3. Section 09 91 00: Paints and Coatings

1.2 REFERENCES

- A. Architectural Woodwork Institute: Architectural Woodwork Standards (AWS)
- B. Woodwork Institute (WI): Manual of Millwork.
- C. Window and Door Manufacturer's Association (WDMA): Guide Specifications.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's literature.
- B. Shop Drawings: Indicate general construction, jointing methods, hardware locations, and locations of cut-outs.
- C. Samples: Furnish samples of wood door corner section.
 - 1. Shop finished wood door section where doors are furnished shop finished.
- D. Certificates: Submit manufacturer certification indicating compliance to applicable requirements of AWS, WI, and WDMA

1.4 PROJECT CONDITIONS

- A. Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized in accordance with referenced standards requirements applicable to Project location.

1.5 WARRANTY

- A. Special Warranty: Provide for replacing, rehanging, and refinishing wood doors exhibiting defects in materials or workmanship including warp and delamination.
 - 1. Special Warranty Period: Lifetime of Door Installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Algoma Hardwoods, Inc.
- B. Eggers Industries Architectural Door Division.
- C. Marshfield Door Systems, Inc.
- D. VT Industries.
- E. Substitutions: Refer to Section 01 63 00.

2.2 MATERIALS

- A. Solid Core Raised Panel Wood Doors: WI - Premium Grade, solid wood framed glued block construction; 1-3/4" thick for swing doors.
 - 1. WDMA: In addition to WI, conform to requirements of WDMA; where conflicts occur, comply with most restrictive requirement.

2.3 FABRICATION

- A. Fabricate doors in accordance with requirements of specified standards.
 - 1. Prefit wood doors.
 - 2. Prepare doors to receive hardware in shop, refer to Section 08 70 00 for hardware requirements and templates.
 - 3. Factory machine doors for mortise hardware.
 - 4. All panels to be rabbited into heads, stiles, and rails.
- B. Bevel strike edge of single-acting doors, 1/8" in 2".
- C. Make cut-outs and provide wood stops for glass panels
 - 1. Wood stop profiles to match existing. Type as selected by Architect where not otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install wood doors in accordance with manufacturer's recommendations and installation instructions, and reference standards, plumb and square, and with maximum diagonal distortion of 1/16".

1. Coordinate hardware installation with requirements of Section 08 70 00 - Hardware.

B. Rehang or replace doors which do not swing or operate freely.

3.2 PROTECTION

A. Protection: Protect doors as recommended by door manufacturer to ensure doors are without damage at time of substantial completion.

END OF SECTION

SECTION 08 31 13**ACCESS DOORS AND FRAMES**

PART 1 - GENERAL**1.1 SUMMARY**

- A. Section Includes: Provide access doors or panels for gypsum board ceiling installation at locations shown on the reflected ceiling plan or exterior walls.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturers' literature.
- B. Shop Drawings: Indicate general construction, configuration, jointing methods, reinforcements, anchorage methods, hardware locations, and locations of cut-outs.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. Elmdor/Stoneman, a division of Acorn Engineering Company
 - 1. DWB (Dry Wall Bead) Series or Equal
- B. Substitutions: Refer to Section 01 63 00.

2.2 FABRICATION

- A. Fabricate components to be straight, square, flat and in same plane where required.
 - 1. Slightly round exposed edges and without burrs, snags and sharp edges.
 - 2. Exposed welds continuous and ground smooth.
 - 3. Weld in accordance with AWS D1.3

2.3 ACCESS DOORS, FLUSH PANEL:

- A. Door Panel:
 - 1. Form of 16 gage galvanealed steel with a factory primer finish.
 - a. Reinforce to maintain flat surface.
- B. Frame:
 - 1. Form of 16 gage galvanealed steel with a factory primer finish.

2. Provide recessed mounted units that are designed for flush installation in gypsum drywall surfaces.
3. Weld exposed joints in flange and grind smooth.

C. Hinge:

1. Concealed spring hinge to allow panel to open 175 degrees.
2. Provide removable hinge pin to allow removal of panel from frame.

D. Lock:

1. Flush, screwdriver operated cam lock.

2.4 FINISH:

- A. Provide in accordance with NAAMM AMP 500 series on exposed surfaces.
- B. Steel Surfaces: Baked-on prime coat over a protective phosphate coating.
- C. Stainless Steel: No. 4 for exposed surfaces.

2.5 SIZE:

- A. Minimum 24" x 30" door unless otherwise shown.

PART 3 – EXECUTION

3.1 LOCATION:

- A. Provide access panels or doors wherever any valves, traps, dampers, cleanouts, and other control items of mechanical, electrical and conveyor work are concealed in wall or partition, or are above ceiling of gypsum board or plaster.
- B. Use flush panels in partitions and gypsum board or plaster ceilings, except lay-in acoustical panel ceilings or upward access acoustical tile ceilings.

3.2 ANCHORAGE:

- A. Secure frames to adjacent construction using anchors attached to frames or by use of bolts or screws through the frame members.
- B. Type, size and number of anchoring device suitable for the material surrounding the opening, maintain alignment, and resist displacement during normal use of access door.

- C. Anchors for fire rated access doors shall meet requirements of applicable fire test.

3.3 ADJUSTMENT:

- A. Adjust hardware so that door panel will open freely.
- B. Adjust door when closed so door panel is centered in the frame.

END OF SECTION

SECTION 08 36 13**SECTIONAL ALUMINUM OVERHEAD DOORS**

PART 1 - GENERAL**1.1 SUMMARY**

- A. Section Includes: Glazed Aluminum Sectional Overhead Doors as scheduled on drawings.
 - 1. Sectional overhead doors to include:
 - a. Electric Trolley Type Operators and Controls.
 - 1) Including keypads and wireless remote controls
 - 2) Operator and all accessories to be compatible with the "Click2Enter" mobile or portable radio system.
 - b. Operating Hardware, tracks, and support.
- B. Related Work
 - 1. Section 06 20 00: Finish Carpentry
 - 2. Section 08 11 00: Steel Doors and Frames
 - 3. Division 26: Electrical

1.2 REFERENCES

- A. ANSI/DASMA 102 - American National Standard Specifications for Sectional Overhead Type Doors.
- B. International Electrotechnical Commission (IEC).
- C. National Electrical Manufacturers Association (NEMA): NEMA ICS 6 - Industrial Control and Systems: Enclosures.
- D. Underwriters Laboratories (UL): UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.

1.3 DESIGN / PERFORMANCE REQUIREMENTS

- A. Wind Loads: Design and size components to withstand loads caused by pressure and suction of wind acting normal to plane of wall as calculated in accordance with applicable code.
 - 1. Design pressure of 90 lb/sq ft
 - 2. Wiring Connections: Requirements for electrical characteristics
 - 3. 115 volts, single phase, 60 Hz

1.4 SUBMITTALS

- A. Product Data: Submit manufacturers' literature.
- B. Shop Drawings: Indicate plans and elevations including opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.
- C. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- D. Operation and Maintenance Data.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum (20) years' documented experience.
- B. Installer Qualifications: Authorized representative of the manufacturer with minimum (10) years approved by manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturers' unopened labeled packaging until ready for installation.
- B. Protect materials from exposure to moisture until ready for installation.
- C. Store materials in a dry, ventilated, weathertight location.

1.7 WARRANTY

- A. Doors: 20-year welded aluminum frame warranty. (Except on top sections when trolley operated.) Standard one year warranty applies to the rest of the door (track, spring, hardware.)
 - 1. Finish Warranty:
 - a. 1-year warranty finish for standard RAL Powdercoat, except on installations within 1 mile of salt water
- B. Operators: Provide operator manufacturer's complete system warranty equal to full replacement value of the installed operator and all accessories.
 - 1. Warranty Period on Operator: 5 years from date of Substantial Completion.
- C. Installation Warranty: Provide Installer's warrantee signed by Installer, covering Work of this Section, including all components of the operator system for the following period:
 - 1. Special Warrantee Period: 2 Years from date of Substantial Completion.

PART 2 - PRODUCTS**2.1 DOOR MANUFACTURER**

- A. Basis of Design: For purposes of designating type and quality of work under this Section, Drawings and Specifications are based on products manufactured by:
 - 1. Armlite Door Manufacturing Co.
 - a. Model: Custom CI
 - 2. Substitutions: Refer to Section 01 63 00.
- B. Fabrication: Units shall have the following characteristics:
 - 1. Door Assembly: Stile and rail assembly secured with concealed heli-arch welds. Through rods, bolts, and self-tapping screw construction methods will not be accepted
 - 2. Panel Thickness: 1-3/4 inches
 - 3. Center Stile Width: 3-7/8 inches
 - 4. End Stile Width:
 - a. 4-1/2 inches
 - 5. Meeting Rail Pair Width: 3-3/8 inches wide per pair
 - 6. Top Rail Width:
 - a. 4-1/2 inches
 - 7. Bottom Rail Width:
 - a. 4-1/2 inches
 - 8. Stiles and Rails to be constructed of 4-sided .075 - .085 extruded 6063 - T6 aluminum alloy.
 - 9. Springs:
 - a. 100,000 cycles
 - 10. Glazing:
 - a. 1/4 inch non-insulated laminate units - clear
- C. Powder Coat Paint Finish: The paint finish on all exterior exposed metal surfaces shall be shop-applied spray-applied Fluorocarbon Resin utilizing 70% Kynar 500 resins.
 - 1. Number of Coats: 3-coats. The coating shall be shop applied. The coating shall consist of a 0.2 mil prime coat, a 0.70 mil barrier coat, and a 0.70 mil color coat containing 70% Kynar resins.
 - 2. Custom color to match RAL 3003 – Ruby Red.
 - 3. Relevant to the color selected, material to be painted in accordance with either AAMA specification 2605 or 2604.
- D. Windload Design: Provide to meet the Design/Performance requirements specified.
- E. Hardware: All hinges and fixtures made of 14 gauge galvanized steel. Full floating, ball bearing rollers to have hardened steel races and roller sizes to be adequate for design requirements and limitations.

1. Heavy-duty, fully adjustable roller brackets are attached to each end cap to provide an easy adjustment of the door to the job for proper seal. All hardware is heavy-duty and rust resistant with galvanized fasteners.

F. Weatherstripping:

1. Flexible bulb-type strip at bottom section.
2. Flexible Jamb seals.
3. Flexible Header seal.

2.2 DOOR TRACK

- A. Provide track as recommended by manufacturer to suit loading required and clearances available.

1. Low Headroom Track as detailed on Plans.

2.3 TROLLEY-TYPE DOOR OPERATORS

- A. Basis of Design: For purposes of designating type and quality of work under this Section, Drawings and Specifications are based on products manufactured by:

1. Liftmaster
 - a. Model T Low-Profile Industrial Trolley Operator
2. Substitutions: Refer to Section 01 63 00.

- B. Industrial-Duty Operator: Continuous-duty, high-starting torque motor with overload protection and emergency disconnect for manual door operation.

1. Electric Operator: Industrial-duty assembly, cULus listed and cULus labeled, complete with electric motor and factory-prewired motor controls, internal auxiliary reversal circuit, 3-button open/close/stop control station, conduit-encased wiring from control circuit to motor, and accessories required for proper operation; operator shall be capable of driving door at a speed of approximately 8 to 12 inches (203 to 279 mm) per second. Vertical operator profile shall not exceed 12 inches (279 mm).
 - a. Drive Reduction: Heavy-duty 5L V-belt and chain/sprocket secondary; all reduction sprockets and pulleys shall be drilled and pinned to steel shafts plated for resistance to corrosion; operator shall be equipped with permanently lubricated ball bearings on output shaft, adjustable friction clutch and quick-disconnect door arm to facilitate manual operation.
 - b. Brake: Electric solenoid-actuated brake capable of stopping and holding a door at any position.
 - c. Limit Switches: Fully adjustable, linear-driven limit mechanism synchronizing operator with door; low-friction nylon limit nuts fitted on threaded steel shaft that rotates on oil-tight self-lubricating bronze bushings; motor shall be removable without affecting limit switch settings.

- d. Electric Motor: High-starting torque, continuous-duty, industrial-type protected against overload by current sensing and thermal overload devices. For single-phase applications, incoming voltage field-selectable between 115V and 230V, 60 Hz by properly positioning connector.
 - 1) Motor Specification:
 - a) 115/230V 60 Hz, single phase, 3/4 HP.
- e. Motor Control and Enclosure: Motor control shall be UL-approved microprocessor solid-state type and shall include the capability to select one of 7 wiring types; additional features shall include a maintenance alert diagnostic system, programmable Timer-to-Close with timer defeat input, mid-stop programming capabilities and a maximum run timer to provide motor overrun protection; motor control shall be housed in a NEMA 1 enclosure integral to the operator and shall conform to ANSI/NEMA ICS 6.
 - 1) Radio Receiver: 3-channel receiver with standard external antenna; equipped to accept Security+ 2.0 Rolling Code Technology remote controls and trinary DIP switch remote controls, with memory up to (30) 3-button remote controls (or 90 single-button remote controls) plus 30 wireless keypads, or an unlimited number of trinary DIP switch remote controls. Tri-band frequency (310/315/390 MHz) sends multiple radio signals to bypass radio interference.
 - 2) Internet Connectivity: MyQ Technology.
 - a) 902 to 928 MHz.
 - b) 50-channel FHSS (Frequency Hopping Spread Spectrum).
 - c) Internet gateway to enable monitoring and control of door operators and lighting controls via Internet-enabled smartphone, tablet or computer.
 - d) Provides two-way communication between commercial door operator and accessories to enable remote open, close and monitoring of commercial door.
- f. 3-Button Control Station: 3-button station providing open/close/stop functionality shall be NEMA Type 1 with maintenance alert indicator to signal intervals for routine door and operator maintenance.
- g. Door Drive: Full #41 roller chain with emergency disconnect for manual door operation.
- h. Track: Heavy-duty, double-angle, 11-gauge galvanized steel.
- i. Trolley Assembly: 2 inches H x 2 inches W galvanized steel angle rails with cast aluminum trolley including plated steel rail spacers with a nylon chain-guide assembly.

2. Primary Entrapment Protection Devices:
 - a. NEMA 1 Monitored Photo Sensors: Fully monitored, non-contact, infrared beam photo sensor system shall reverse, in conjunction with the operator control, a closing door to the full open position when an obstruction is sensed; photo sensors shall be mounted no higher than 6 inches (152 mm) maximum above the floor.
3. Monitored Sensing Edge Interface:
 - a. Sensing edge interface shall provide a means to attach a 2-wire monitored sensing edge to the operator controls for continuous monitoring purposes; the edge, in conjunction with the operator controls, shall reverse a closing door to the full open position when an obstruction is sensed; sensing edge ordered separately.
4. Additional monitored primary entrapment protection devices may be added with the appropriate interface device or plug-in accessory card.
5. Accessories:
 - a. Remote controls: Two button rolling code Security+ 2.0.
 - 1) Provide a minimum of ten (10) remote controls

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Verify that all openings are ready to receive work and opening dimensions and tolerances are within specified limits.
 1. Beginning of installation means acceptance of existing surfaces.

3.2 PREPARATION

- A. Prepare opening to permit correct installation of door unit.

3.3 INSTALLATION

- A. Install overhead doors and track in accordance with approved shop drawings and the manufacturer's printed instructions. Framing and opening preparation per submitted shops is the responsibility of the General Contractor and not the sectional door installer.
- B. Coordinate installation with adjacent work to ensure proper clearances and allow for maintenance.
- C. Anchor assembly to wall construction and building framing without distortion or stress.

- D. Secure tracks to structural members only.
- E. Fit and align door assembly including hardware, level and plumb, to provide smooth operation.
- F. Install perimeter trim and closures.
- G. Install trolley operator and controls in accordance with manufacturer's instructions and in proper relationship with adjacent construction. Test for proper operation and adjust until satisfactory results are obtained. Demonstrate operation to owner's personnel.
 - 1. Provide owner with remote fobs and operating manuals.

3.4 TOLERANCES

- A. Maintain dimensional tolerances and alignment with adjacent work
- B. Maximum variation from plumb: 1/8 inch
- C. Maximum variation from level: 1/8 inch
- D. Longitudinal or diagonal warp: plus or minus 1/8 inch from 10 ft. straight edge

3.5 CLEANING AND ADJUSTING

- A. Clean doors, frames and glass.

3.6 PROTECTION

- A. Do not permit construction traffic through overhead door openings after adjustment and cleaning.
- B. Protect installed products until completion of the project.
- C. Touch-up, damaged coatings and finishes and repair minor damage before Substantial Completion.

END OF SECTION

SECTION 08 51 00**STEEL WINDOW RESTORATION**

PART 1 - GENERAL**1.1 SUMMARY**

- A. Section includes the renovation or modification of existing steel windows with both fixed and operable components.
 - 1. Scope of work includes the renovation of existing steel windows in conformance with the Secretary of the Interior's Standards to restore surface finish, reduce moisture and air infiltration, and improve window operation.
 - 2. Scope of work includes the cutting and modification of existing steel windows to accommodate installation of replacement aluminum windows within the steel window frame.
- B. For the renovation of existing steel windows, as scheduled on the drawings, perform the following:
 - 1. Remove all existing glass panels.
 - 2. Remove all glazing putty, sealant, and glazing stops.
 - 3. Remove all paint and corrosion from the metal window frames and sash to provide a surface appropriate for the adhesion of a new high-performance paint coating system as specified in Section 09 96 00. Clean and prepare all steel window components for new paint coatings and as detailed by SSPC-SP-1 Solvent Cleaning followed by SSPC-SP-14 Industrial Blast Cleaning.
 - 4. For all paint and sealant, provide required proper handling and disposal of hazardous materials.
 - 5. Patch or fill pits or holes in metal. Consult with Architect as to whether welding, brazing, or putty infill is acceptable for the specific condition present.
 - 6. For welding and brazing spots, grind smooth surface to match adjacent steel surfaces prior to proceeding with the work.
 - 7. For putty infill, use putty material as specified in Section 2 – Products.
 - 8. Replace and/or rebuild missing or severely deteriorated frame components.
 - 9. Use salvaged frame components from modified steel windows where appropriate.
 - 10. Repaint frames using a high-performance paint system as specified in Section

09 96 00.

11. Replace glass according to Drawings and/or Window Schedule.
 12. Replace glazing stop(s) with new stops matching original or existing conditions.
 13. Restore existing operable hardware (e.g. locks, latches, and hinges etc.) so that windows are operable and close snugly. Replace components where hardware is missing or broken.
 14. Use salvaged hardware from modified steel windows where appropriate.
 15. Replace broken or missing operating hardware and hinges to restore window operability.
 16. Use salvaged hardware from modified steel windows where appropriate.
 17. Replace perimeter sealant between window frame and adjacent plaster and or wood window sill.
- C. For cutting and modifying existing steel windows, as shown or scheduled on the Drawings, perform the following:
1. Remove all existing glass panels.
 2. Remove all glazing putty, sealant, and glazing stops.
 3. Cut and remove all steel muntins, mullions, divided lite frames, and glazing stops to the remaining window frame profile shown on the plan details.
 4. Remove all paint and corrosion from the remaining metal window frames to provide a surface appropriate for the adhesion of a new high-performance primer as specified in Section 09 96 00. Clean and prepare all steel window components for new primer as detailed by SSPC-SP-1 Solvent Cleaning followed by SSPC-SP-14 Industrial Blast Cleaning.
 5. For all paint and sealant, provide required proper handling and disposal of hazardous materials.
 6. Patch/fill pits or holes in metal. Consult with Architect as to whether welding, brazing, or putty infill is acceptable for the specific condition present.
 7. For spot welding and brazing spots, grind smooth surface to match adjacent steel surfaces prior to proceeding with the work.
 8. For putty infill, use putty material as specified in Section 2 – Products.
 9. Prime frames using a high-performance primer as specified in Section 09 96 00.

1.2 RELATED SECTIONS

- A. Section 06 20 00 – Finish Carpentry
- B. Section 07 90 00 - Joints Sealers
- C. Section 08 51 13 - Aluminum Windows
- D. Section 08 81 00 - Glazing
- E. Section 09 96 00 - High Performance Coatings

1.3 REFERENCE STANDARDS

- A. Glass Association of America (GANA) Glazing Manual and Sealant Manual.
- B. Flat Glass Marketing Association (FGMA) Sealant Manual.
- C. American Society for Testing and Materials (ASTM):
- D. C920 - Specification for Elastomeric Sealant Joints.
- E. E1105 - Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.
- F. E783 - Field Measurement of Air Leakage through Installed Exterior Windows and Doors.
- G. D4541-02 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
- H. Preservation Brief #13: "The Repair and Thermal Upgrading of Historic Steel Windows", by Sharon C. Park, National Park Service.
- I. Steel Structures Painting Council Specifications; Surface Preparation Specifications.
- J. Refer to related Sections for other applicable standards.

1.4 SUBMITTALS

- A. Product Data: Indicate product standards, physical and chemical characteristics, technical specifications, limitations, maintenance instructions, and general recommendations for each material.
- B. Material safety data sheets (MSDS) for each product used.
- C. Certifications (in time for review to prevent delay in the work) by the producers of the materials specified, that materials supplied comply with the requirements of the referenced standards, and that materials are suitable for the use specified herein.

- D. Samples of all materials specified, each properly labeled with reference to specification paragraph numbers.
- E. Evidence of contractor's experience including project identification.
- F. Submittals as required by the other Sections referenced herein.
- G. Onsite mock up as noted herein.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An installer who specializes in restoring steel framed windows similar in material, design, and extent to those indicated for this project and whose work has resulted in installations with a record of successful in-service performance, and with five years minimum experience.
- B. Attend a pre-construction conference to be held with a representative of the Owner, Architect, Engineer, Preservation Consultant, Painter, Abatement Contractor, General Contractor, and other involved trades to discuss work required and the coordination for this project.
- C. Closely coordinate work of this Section with work of other Sections referenced herein to produce the best job possible.
- D. Comply with the quality requirements of other Sections referenced herein.

1.6 ONSITE MOCKUP

- A. Construct one field mockup showing stages of window renovation at a designated location selected by the Architect. Stages of mockup include:
 - 1. Initial paint and glazing removal.
 - 2. Paint removal.
 - 3. Steel frame repair or preparation.
 - 4. Priming and painting of steel frame members.
 - 5. Hardware restoration.
- B. The mockup shall include all required work of this Section and other Sections referenced herein. The completed and approved mockup shall become part of the finished work and shall serve to define the workmanship and material performance standards for the remainder of the project.
- C. Provide access, equipment, and labor to assist the Architect in water testing the completed window rehabilitation as described in this Section.
- D. Should the mockup test indicate water penetration to an extent unacceptable to the Architect and Owner, reconstruct as directed until the mockup meets the desired performance standards.

1. Record revisions made to the reconstructed window/wall assembly and submit revised construction procedures.

- E. Do not begin full production until the mockup has been approved by the Architect and Owner.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions.
- B. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with installation of joint sealants when ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.
- B. Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed.
- C. Protect window/wall assembly from rain while sealants are curing. Do not install sealants if rain is imminent.
- D. Comply with the project conditions of the other Sections referenced herein.

1.9 PROTECTION

- A. Schedule and execute all work without exposing the building interior to the effects of inclement weather. Protect the existing building and its contents against all risks associated with this work and repair all damage to restore the original conditions.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Refer to Specification Section 08 81 00 – Glazing and plan schedules for all glass requirements.
- B. Refer to Specification Section 09 96 00 – High Performance Coatings and plan schedules for all primer and paint requirements.

2.2 MATERIALS

- A. Steel Frame Putty Filler

1. Two-Part Epoxy: 3M Panel Bond Adhesive – Part No. 38315
 - a. To be used with manufacturer approved material applicator.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine window frames for defects that would affect repainting, glazing, weatherstripping, and sealant work.
- B. Verify removal of flat glass for reglazing, rivets, screws, bolts, welding fillets, or other projections from clearances in glazing rabbets.

3.2 PREPARATION

- A. Remove built-up paint, corrosion, glazing putty and stops using chemical and mechanical means.
- B. Remove old sealant (including perimeter sealant), debris, and all other foreign material.
- C. Remove any corrosion and loose and flaky paint from fixed frame and movable sash in accordance with paint manufacturer's instructions and required SSPC-SP-7 surface preparation level
- D. Patch or fill deteriorated or pitted steel to match clean existing surface free of visible defects with specified panel bond adhesive.
 1. Follow manufacturer's instructions for mixing, application and curing of adhesive.
 2. Upon full strength cure, sand and or shape adhesive to match existing steel frame surface or profile.
- E. Replace designated missing or severely damaged metal sash or frame components (e.g. muntin, rail, or stile) with new components to match. New components shall be solidly welded and spliced into existing components so that they are aligned with the existing component to form smooth and watertight seams.
- F. Prime and paint fixed frames and sash according to paint manufacturer's instructions.
- G. Do not paint brass or bronze hardware.
- H. Where sealant comes into contact with frame, apply primer to comply with sealant manufacturer's instructions.
- I. Where required for reglazing: Ensure glazing surfaces are clean and dry. Prevent formation of condensation.

- J. Remove dust and oil from glass and frames by wiping clean immediately before installation.
- K. Prime glazing surfaces where recommended by sealant manufacturer. Apply primer to comply with sealant manufacturer's instructions. Confine primers to areas of sealant bond; do not allow spillage or migration onto adjoining surfaces.
- L. 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 putty and sealant. Remove tape immediately after glazing without disturbing joint seal. Install new perimeter sealant joint around all windows.

3.3 GLAZING

A. General Requirements:

- 1. Comply with the provisions of Specification Section 08 81 00 – Glazing.
- 2. Conform to the glazing standards of the GANA (Glass Association of North America) Glazing Manual and the FGMA (Flat Glass Marketing Association) Sealant Manual.
- 3. Provide convenient access to the Architect for observation. In addition, comply with the following:
 - a. Do not glaze units when ambient air temperature is below 40°F.
 - b. Keep the glazing pocket clean and dry during installation of glass.
 - c. Use suction cups to move lites of glass.
 - d. Use a "rolling block" to rotate glass.
- 4. Watertight installation of each piece of glass exposed to the weather is required. Each installation must withstand normal temperature changes, wind loading, and impact loading with no failure of any kind, including loss or breakage of glass and failure of glazing compound or sealant.
- 5. Immediately prior to installation of flat glass, inspect all edges for chips or other irregularities that would interfere with glazing. Lites with such blemishes shall be replaced with new matching glass.

B. Installation:

- 1. Provide a continuous bed of sealant in the glazing pockets for setting the lites. Ensure that the exterior side and all corners of the glazing pockets are fully covered with glazing sealant and are watertight.
- 2. Install glazing compound to match original or existing conditions..
- 3. Clean all excess sealant from the glass and movable sash.

4. At new and existing glazing, install cap bead of sealant on the exterior joint between the glass and steel muntin(s) as shown on the drawings.

3.4 CLEANING AND PROTECTION

- A. Inspect all completed work. Remove all dirt, grease, putty, and foreign matter from the glass and window frames.
- B. Keep work areas free of accumulating debris. Upon completion of daily work, leave areas of work in broom-clean condition.
- C. Remove debris related to window restoration work from project site per applicable regulations for waste disposal.
- D. Protect completed work from damage due to subsequent construction activities.
- E. Repair any damage caused by window restoration operations to the building and surrounding areas at no cost to the Owner.

END OF SECTION

SECTION 08 51 13**ALUMINUM WINDOWS**

PART 1 - GENERAL**1.1 SUMMARY**

- A. Section Includes: Provide simulated steel thermally-broken aluminum windows with glazing, and accessories as required for complete weather-tight installation.
 - 1. Window installation shall be installed into the following substrates:
 - a. Existing steel window frames,
as prepared under Specification Section 08 51 00.
 - b. Existing or new wood-framed rough openings.
 - 2. Scope of work includes special emergency egress windows; comply with applicable California Building Code requirements.
- B. Related Work:
 - 1. Section 07 90 00: Joint Sealers
 - 2. Section 08 51 00: Steel Window Renovation
 - 3. Section 08 81 00: Glazing.

1.2 REFERENCES

- A. American Architectural Manufacturers Association (AAMA) and Window and Door Manufacturers Association (WDMA), AAMA/WDMA 101/I.S. 2, Voluntary Specifications for Aluminum, Vinyl (PVC), and Wood Window and Glass Doors.
- B. Glass Association of North America (GANA): Glazing Manual.
- C. National Association of Architectural Metal Manuf. (NAAMM): Metal Finishes Manual.

1.3 SYSTEM DESCRIPTION

- A. Performance Requirements: Comply with applicable codes and AAMA 101 for each type of window specified, but no less than following.
 - 1. Structural: Withstand code required wind loads on exterior and on interior when tested in accordance with ASTM E330, without breakage, failure of any part, or malfunction of operation.
 - 2. Air Infiltration: Construct and weather-seal in accordance with ASTM E283; air infiltration shall not exceed 0.37 cfm/sf of overall frame area.
 - a. Fixed Windows: Maximum 0.15 cfm/sf.

3. Water Resistance: Construct and weather-seal in accordance with ASTM E547 test; pressure equal to 3.00 psf; no uncontrolled water penetration.
4. Forced Entry: Provide systems conforming to ASTM F588, Performance Level 10 or AAMA 1302.5 where at ground floor and at areas accessible from decks and accessible rooftops.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturers' literature including test results indicating compliance with design criteria.
- B. Shop Drawings: Indicate pertinent dimensioning, general construction, component connections and locations, anchor methods and locations.
- C. Samples: Furnish samples of metal finish and glass.

1.5 QUALITY ASSURANCE

- A. Manufacturer: Provide each type of window by single manufacturer. Provide all windows by single manufacturer where all types are available from approved manufacturer.
- B. Standards: Conform to ANSI/AAMA 101 for window types indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack units on edge on wood strips above ground.

1.7 WARRANTY

- A. Provide for correcting failure of aluminum window frames and assemblies. Failure includes signs of moisture on interior surfaces of all aluminum window components.
- B. Warranty Period: Two years.

PART 2 - PRODUCTS**2.1 MANUFACTURERS****A. Basis of Design:**

1. Winco Window Company – Series 3250 Steel Replica
 - a. 3-1/4" Architectural Grade – Thermally Broken
 - 1) With SR-71 divided lite grid profile, center spacer, and #11 Bar
2. Winco Window Company – Series 1150S
 - a. 2" Architectural Grade – Thermally Broken
 - 1) With DB-416 divided lite grid profile, center spacer, and #11 Bar

B. Substitutions: Refer to Section 01 63 00.**2.2 MATERIALS****A. Aluminum Windows: Provide units meeting requirements of Architectural Aluminum Manufacturers Association (AAMA) Certification Program.**

1. Grade: Not less than Commercial "-C" or "-CW" grade or better for each type of window indicated for Project.
2. Performance Class: Provide AAMA/WDMA 101/I.S.2 performance class as required to comply with California Building Code wind loads as listed in Chapter 16.
3. Egress Windows: Provide windows meeting California Building Code requirements as egress windows from sleeping rooms.

B. Aluminum: Of sizes, shapes and profiles shown; alloys and tempers as recommended by manufacturer and processor to comply with requirements for performance, fabrication, and finish application.**C. Powder Coat Paint Finish: The paint finish on all exterior exposed metal surfaces shall be shop-applied spray-applied Fluorocarbon Resin utilizing 70% Kynar 500 resins.**

1. Number of Coats: 3-coats. The coating shall be shop applied. The coating shall consist of a 0.2 mil prime coat, a 0.70 mil barrier coat, and a 0.70 mil color coat containing 70% Kynar resins.
2. Custom color to match RAL 3003 – Ruby Red.
3. Relevant to the color selected, material to be painted in accordance with either AAMA specification 2605 or 2604.

D. Glass: Preassembled insulated glass units. See Specification Section 08 81 00.

- E. Glazing Materials: Manufacturer standard type to suit locations and applications.
- F. Miscellaneous Materials:
 - 1. Fasteners: Anodized aluminum or non-magnetic stainless steel of type not causing electrolytic action or corrosion; provide flush Phillips flat-head or Allen screws where exposed.
 - 2. Finish exposed aluminum fasteners to match aluminum work.
 - 3. Brackets and Reinforcements: Aluminum wherever possible, where steel units are required for higher strength or other unavoidable necessities, hot-dip galvanize after fabrication; ASTM A123 G-90.
 - 4. Bituminous Paint: Cold applied asphalt mastic complying with SSPC-Paint 12, compounded for 30-mil thickness per coat.
- G. Weatherstripping:
 - 1. Operable and Fixed Panels: Neoprene gaskets complying with ASTM D2000, Designations 2BC415 to 3BC620.
- H. Hardware: Manufacturer's standard secure hardware as approved by Architect; fabricated from aluminum, stainless steel, or corrosion resistant material compatible with aluminum; conform to AAMA 101.
 - 1. Operable Units: Deadlock latch mechanism, constructed to prevent accidental lockout and accidental damage if closed in locked position;
 - a. Include feature to permit locking operable windows in 5" open position.
- I. Screens: Provide manufacturer's standard screens for windows and conforming to ANSI/SMA 2005; frames finished to match windows.

2.3 FABRICATION

- A. Fabricate units only after all rough openings have been determined or verified by the Contractor.
- B. Fabricate units to allow for clearances and shim spacing around perimeter to enable installation; provide for thermal movement and slope and weep sills for drainage.
- C. Provide anchorage devices to securely and rigidly fit windows in place.
- D. Accurately fit together joints and corners; match components that ensure continuity of line and design; ensure joints and connections are flush, hairline and weatherproof.
- E. Apply coat of bituminous paint on concealed aluminum surfaces to be in contact with cementitious or dissimilar materials.

- F. Glass Installation: Conform to requirements in GANA "Glazing Manual"; glass shall not touch metal.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine surfaces of openings and verify dimensions.
- B. Installation of units constitutes acceptance of existing conditions.

3.2 INSTALLATION

- A. Assemble and anchor various components to allow for expansion and contraction, maintaining weather-tight condition.
- B. Install units in strict compliance with manufacturer's recommendations and installation instructions.
- C. Install work plumb, straight, square, level and in their proper elevation, plane and location, and in proper alignment with other work.
- D. Anchor securely in place, separate aluminum and other corrodible metal surfaces from corrosion and electrolytic action with other materials.
- E. Upon completion of installation, remove protective coatings or coverings and clean aluminum surfaces.
- F. Adjust hardware for proper operation.
- G. Repair or replace damaged metal components, cracked glass, and broken glass.

END OF SECTION

SECTION 08 70 00

HARDWARE

PART 1 - GENERAL**1.1 SUMMARY**

- A. Section Includes: Provide hardware for all doors as scheduled on the drawings.
 - 1. ALL door hardware must match City of Petaluma Standard unless otherwise required by applicable codes and regulations.
 - 2. Provide full size interchangeable cylinder cores.
 - 3. Service all existing door hardware scheduled to remain.
- B. Related Sections:
 - 1. Section 08 11 00: Steel Doors and Frames
 - 2. Section 08 11 16: Aluminum Doors and Frames
 - 3. Section 08 13 76: Bifolding Aluminum Doors and Frames
 - 4. Section 08 21 00: Wood Doors and Frames

1.2 REFERENCES

- A. ANSI A115 and A115W Series: Door and Frame Preparation Standards.
- B. ANSI A156.1 through A156.20: Standards for various hardware items.
- C. California Building Code: 2019 California Code of Regulations, Title 24, Part 2.
- D. Americans with Disabilities Act - 2010 ADA Standards for Accessible Design.

1.3 SYSTEM DESCRIPTION

- A. Products: Provide each type of hardware (hinges, pivots, locksets, latchsets, closers, trim) from single manufacturer unless otherwise indicated in Hardware Schedule.
 - 1. Provide products by manufacturers specified and manufacturers listed in Hardware Schedule, with references to catalog numbers and designations.
- B. Access for Persons with Disabilities: Comply with 2019 California Building Code and Americans with Disabilities Act - 2010 ADA Standards for Accessible Design.

1.4 SUBMITTALS

- A. Product Data: Submit catalog cuts for each type of hardware.
- B. Shop Drawings: Indicate locations and mounting heights of hardware.

1. Supply templates to door and frame manufacturers for proper and accurate sizing and locations of cut-outs for hardware.
- C. Samples: Indicate required style and finish of exposed door hardware.
- D. Keying Schedule: Coordinate directly with Owner's Representative.
- E. Closeout Submittal: Record actual locations of installed cylinders and master key codes on Project Record Documents.

1.5 QUALITY ASSURANCE

- A. Supplier Qualifications: Recognized builder's hardware supplier with minimum five year's successful experience in scheduling and furnishing hardware.
 1. Provide services of architectural hardware consultant to supervise hardware supply.
- B. Pre-Installation Meeting: Convene pre-installation meeting prior to commencing work of this section. Include persons involved with installation of doors, frames, and hardware.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hardware in manufacturer's original packages, marked for intended opening.
- B. Pack complete with necessary screws, bolts, keys, instructions, and installation template, if necessary, for spotting mortising tools.
- C. Upon delivery, furnish complete list of hardware for checking, clearly marked to correspond with marking on each package.
 1. Review list for completeness and accuracy.

1.7 MAINTENANCE

- A. Provide manufacturer's parts list and maintenance instructions for each type of hardware supplied and necessary wrenches and tools required for proper maintenance of hardware.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Review Drawings for hardware group locations and door types; where not fully covered in Hardware Schedule, comply with following general requirements; inform Architect where conflicts occur.
 1. Provide hardware items with accessories complete to function as intended.
- B. Hinges and Butts: ANSI A156.1; comply with following unless otherwise indicated.

1. Manufacturers:
 - a. H. B. Ives
 - b. Substitutions: Refer to Section 01 63 00.
 2. Doors 1-3/4" Thick: 4-1/2" heavy weight, extra heavy weight ball or oilite bearing where over 40" wide.
 - a. Provide widths sufficient to clear trim projection when door swings 180 degrees.
 3. Provide minimum 3 hinges to 90" high, 4 hinges to 120" high for each door leaf, unless otherwise indicated.
 4. Provide nonferrous butts with non-removable pins at exterior and locked outswinging doors, non-rising at interior doors; stainless steel where labeled; steel butts at labeled interior doors.
 5. Provide ball bearing or oilite bearing hinges at doors with closers.
 6. Tips: Flat button tips with matching plug.
- C. Locking Devices: Provide of metal matching specified finish; interior parts of steel and zinc-dichromate plating, to resist rusting and corrosion; do not supply plastic, die-cast or aluminum mechanisms.
1. Manufacturers:
 - a. Schlage by Ingersoll Rand (no exceptions allowed).
 2. Type:
 - a. Mortise Locksets: ANSI A156.13, Series 1000, Grade 1, Mortise Type with 6 or 7 pin tumbler cylinders, except where otherwise indicated in Hardware Schedule.
 - b. Cylindrical Locksets: ANSI A156.2, Series 4000, Grade 1, Bored Type (cylindrical) with 6 or 7 pin tumbler cylinders, except where otherwise indicated in Hardware Schedule.
 - c. All locksets shall be full size interchangeable core (FSIC).
 - d. All locksets shall be Primus XP Security System.
 3. Lockset and Latchset Design: Solid lever with rose, as selected by Architect.
 4. Backset: 2-3/4".
 5. Strikes: Furnish standard strikes with extended lips where required to protect trim from being marred by latch bolt; verify type of cutouts provided in metal frames.

- D. Cylinders, Keys, and Keying: Hardware manufacturers shall provide for grand master, master key alike or key different keying as directed by Owner.
1. Manufacturer: Provide cylinders by lockset manufacturer unless otherwise indicated.
 2. Provide cylinders of extruded brass bar material.
 3. Provide construction cylinders for doors requiring locking during construction; construction cylinders shall be removed and replaced just prior to Owner occupancy.
 4. Submit keys for final use to Owner; provide not less than two keys for each lockset, six of each type and level of masterkey, two grand master keys, and 5% extra blanks.
 5. Hardware manufacturers shall key and register lock cylinders.
- E. Closers: ANSI A156.4, furnish products of one manufacturer; full rack and pinion type with steel spring and non-freezing hydraulic fluid.
1. Manufacturers:
 - a. LCN Closers Division Schlage Lock Co./4000 Series.
 - b. Substitutions: Refer to Section 01 63 00.
 2. Provide controls for regulating closing, latching, speeds and back check.
 3. Arm types shall suit individual conditions, as approved; supply parallel-arm closers at reverse bevel doors and where doors swing full 180 degrees.
 4. Mount closers on room side or pull side unless otherwise indicated.
 5. Sizes: Adjustable to following maximum 5 lbs. door operating pressures:
 6. Design: ANSI Modern Type with Cover, unless otherwise indicated.
 7. Install door closers with thru bolts.
 8. Reinforce door frames for soffit shoe.
- F. Exit Devices: ANSI A156.3, furnish devices of the type and functions as listed. Provide UL label devices at label fire doors. Double doors shall have rim devices with removable keyed mullions. If required, surface mounted vertical rods with guards shall be used. All panic devices shall be capable of being locked and unlocked by a control cylinder or hex-key on the inside of the door.
1. Manufacturers:
 - a. Von Duprin 99 Series

2. Provide rim exit devices on single doors; rim exit devices on pairs of doors with mullions where egress requirements allow.
 - a. All mullions to have a set of #154 stabilizers.
 3. Provide heavy duty exit devices that have quiet return of push bar, heavy chassis mounting design, with one piece removable covers, and interchangeable removable core cylinders of the lockset manufacturer.
 4. Provided cylinder dogging on non-labeled exit devices. Thru-bolted trim to the lock stile chassis. Use the same type of lever on the locksets with the break-a-way feature.
 5. Provide keyed removable mullions with interchangeable removable core cylinders where required.
 6. Install all exit devices with sex bolts.
 7. When provided, electronic exit devices, power supplies and electronic access controls shall be of one manufacturer. Provide manufacturer's complete wiring illustration.
- G. Thresholds, Stops, Trim, and Miscellaneous Hardware: Provide as indicated, as specified, as included in Hardware Schedule, and as required for complete installation.
1. Manufacturers:
 - a. H.B. Ives.
 - b. National Guard Products.
 - c. Substitutions: Refer to Section 01 63 00.
 2. Weather-Stripping: Provide continuous weather-stripping at top and sides of exterior doors.
 3. Kick Plates: Height indicated by 1" less than door width; minimum 0.050" thick.
 4. Pulls: Provide with bolts to secure from opposite door face; provide with pull plates unless otherwise indicated.

2.2 ACCESSORIES

- A. General: Provide complete hardware with accessories as required for doors and applications indicated.
- B. Templates: Furnish templates or physical hardware items to manufacturers concerned sufficiently in advance to avoid delay in Work.
- C. Reinforcing Units: Furnished by door manufacturer, coordinated by hardware manufacturer.

- D. Fasteners: Furnish as recommended by manufacturer and as required to install secure hardware.
 - 1. Finish: Match hardware.
 - 2. Furnish screws for items applied on gypsum board sufficiently long to provide solid connection to framing or backing
- E. Through Bolts: Through bolts and grommet nuts shall be avoided on door faces in highly visible areas, unless no alternative is possible, as directed and approved, and shall not be used for solid wood core doors.
- F. Electrical and Mechanical: Make provisions and coordinate requirements for mechanical and electrical devices in connection with hardware.

2.3 FINISHES

- A. As called for on Hardware Schedule or on Drawings.
- B. Match existing where required.
- C. Other Items: Provide manufacturer's standard finishes matching similar hardware types on same door, and maintain acceptable finish considering anticipated use.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install finish hardware specified under this section; coordinate with manufacturer and installation of doors and frames.
- B. Fit hardware prior to painting. Remove for painting of doors and frames before final installation of hardware.
- C. Install hardware in accordance with manufacturer's instructions.
- D. No extra cost will be allowed because of changes or corrections necessary to facilitate installation of hardware.

3.2 MOUNTING POSITIONS

- A. Typical: Match existing unless otherwise required to comply with applicable codes and regulations.
 - 1. Dead Bolt: Not more than 44" from floor to operating lever.
- B. Comply with recommendations of Builders Hardware Manufacturers Association, subject to approval, for heights of items not indicated.

3.3 ADJUSTING

- A. Qualified hardware supplier's or manufacturer's representatives shall inspect installation and make adjustments.
 - 1. Adjust closers, locks, and critical operational hardware.
 - 2. Deliver instructions for maintenance and future adjustments to Owner's Representative.
- B. Service all existing door hardware scheduled to remain.

3.4 HARDWARE SCHEDULE

- A. The Hardware Schedule establishes a type and standard of quality.
- B. Examine Drawings and Specifications and furnish proper hardware for door openings, whether listed or not.
- C. Bring omissions to attention of Architect prior to bid opening for instructions; otherwise, list will be considered complete; no extras will be allowed.
- D. Hardware Groups: Refer to Hardware Groups and Schedules on Drawings.

END OF SECTION

SECTION 08 81 00**GLAZING**

PART 1 - GENERAL**1.1 SUMMARY****A. Section Includes:**

1. Provide safety and insulated glazing for steel doors and frames, wood doors, steel windows, aluminum windows, bifolding aluminum doors, and sectional aluminum overhead doors including accessories as required for complete installation.

B. Related Sections:

1. Section 08 11 00: Steel Doors and Frames
2. Section 08 11 16: Aluminum Doors and Frames
3. Section 08 13 76: Bifolding Aluminum Doors and Frames
4. Section 08 21 00: Wood Doors and Frames
5. Section 08 36 13: Sectional Aluminum Overhead Doors
6. Section 08 51 00: Steel Window Restoration
7. Section 08 51 13: Aluminum Windows

1.2 REFERENCES

- A. Glass Association of North America (GANA): Glazing Manual and Sealant Manual.

1.3 SYSTEM DESCRIPTION

- A. Safety Glass Standard: CPSC 16 CFR 1201, ANSI Z97.1, and California Building Code Chapter 24.

1.4 WARRANTY

- A. Provide for correcting failure of insulated glass units. Failure includes signs of moisture on any interior glass surface.
- B. Warranty Period: Ten years.

1.5 SUBMITTALS

- A. Product Data: Furnish for each type of glass.

PART 2 - PRODUCTS**2.1 MATERIALS**

- A. Glass Type 1 - Tempered Glass: Select glazing quality, clear float glass, fully tempered, ASTM C1048, Kind FT; nominal thickness 1/4"; safety glass.
 - 1. Locations: See Schedule on Drawings.
- B. Glass Type 1 - Laminated Glass: Select glazing quality, clear float glass, fully tempered, ASTM C1048, Kind FT; nominal thickness 1/4"; safety glass.
 - 1. Locations: Apparatus Bay sectional overhead doors.
- C. Glass Type 3 - Insulated Glass: Preassembled units consisting of organically sealed panes of glass enclosing a hermetically sealed dehydrated air space with -20 degree F dew point.
 - 1. Performance Classification: ASTM E774, Class A.
 - 2. System: Manufacturer's standard dual seal system compatible with glazing system, and including spacers, desiccant, and standard corner construction.
 - 3. Glass: Select glazing quality, clear float glass, fully tempered, ASTM C1048; nominal thickness 1/4"; safety glass.
 - 4. Glass Surfaces:
 - a. Surface 1: Clear, no coating
 - b. Surface 2: Low Emissivity Coating: Provide low e coating comparable to PPG/SolarBan 60.
 - c. Surface 3: Clear, no coating
 - d. Surface 4: Clear, no coating
 - 5. Total Unit Thickness: 1".
 - 6. Locations: See Schedule on Drawings.
- D. Glass Type 4 - Insulated Glass: Preassembled units consisting of organically sealed panes of glass enclosing a hermetically sealed dehydrated air space with -20 degree F dew point.
 - 1. Performance Classification: ASTM E774, Class A.
 - 2. System: Manufacturer's standard dual seal system compatible with glazing system, and including spacers, desiccant, and standard corner construction.
 - 3. Glass: Select glazing quality, clear float glass, fully tempered, ASTM C1048; nominal thickness 1/4"; safety glass.
 - 4. Glass Surfaces:
 - a. Surface 1: Clear, no coating
 - b. Surface 2: Clear, no coating
 - c. Surface 3: Clear, no coating

- d. Surface 4: Clear, no coating
- 5. Total Unit Thickness: 1".
- 6. Locations: See Schedule on Drawings.
- E. Manufacturers:
 - 1. Old Castle.
 - 2. Pilkington.
 - 3. Guardian Industries Corp.
 - 4. PPG Industries, Inc., Glass Group.
 - 5. Substitutions: Refer to Section 01 63 00.
- F. Glazing Accessories: Of type recommended by manufacturer to suit security locations and applications for dry glazing installation.
- G. Setting Blocks: Neoprene or EPDM, 80-90 Shore A durometer hardness; 4" long by 3/8" thick by 1/4" high; ASTM C864.
- H. Spacer Shims: Neoprene or EDPM; 45-55 Shore A durometer hardness; 3" long by 3/32" thick by 1/4" high; ASTM C864.
- I. Edge Blocks: Neoprene or EPDM, 60-70 Shore A durometer hardness; 4" long with minimum two per jamb located at top and bottom edges of glass; ASTM C864.
- J. Glazing Gaskets: Exterior neoprene or EDPM; interior neoprene, EPDM or vinyl; miter corner joints; ASTM C509 or C864.
- K. Spacer Shims: Silicone compatible, 50 durometer hardness; 3" long by 3/32" thick by 1/4" high.
- L. Setting Blocks: 70-90 durometer hardness; 4" long by 3/8" thick by 1/4" high standard setting blocks.
- M. Glazing Sealant: ASTM C920, Type S, Grade NS, elastomeric one-component silicone glazing sealants as recommended by sealant manufacturer for application involved.
 - 1. Manufacturers:
 - a. Dow Corning Corp.
 - b. General Electric Co.
 - c. Pecora Corp.
 - d. Substitutions: Refer to Section 01 63 00.
 - 2. Color: As selected by Architect from manufacturer's full range of available colors.

PART 3 - EXECUTION**3.1 PREPARATION**

- A. Clean glazing channels and framing members to receive glass immediately before glazing; remove coatings not firmly bonded to substrate.
- B. Apply primer to joint surfaces where recommended by sealant manufacturer.

3.2 INSTALLATION

- A. Comply with GANA Glazing Manual and Sealant Manual and glazing manufacturer instructions.
 - 1. Do not allow glass to touch wood or metal surfaces.
- B. Place setting blocks at quarter points in thin course of sealant.
- C. Install removable stops with glass centered in space with spacer shims at 2'-0" intervals on both sides of glass, 1/4" below sightline.
- D. Sealant Glazing: Fill gap between glass and stops with sealant to depth equal to bite of frame on glass but not more than 3/8" below sightline.
 - 1. Apply sealant to uniform and level line, flush with sightline; tool or wipe sealant surface for smooth appearance; at exterior locations tool sealant so water is carried away from glass.

3.3 CLEANING

- A. Mark glass after installation by crossed streamers attached to framing and held away from glass; do not apply markers to surface of glass.
- B. Remove nonpermanent labels immediately after sealant cures; cure sealants for high early strength and durability.
- C. Remove and replace glass which is broken, chipped, cracked, abraded or damaged during construction period, including natural causes, accidents and vandalism.

END OF SECTION

SECTION 09 24 00**PLASTER ASSEMBLIES**

PART 1 - GENERAL**1.1 SUMMARY****A. Section Includes:**

1. Provide three coat Portland cement plaster (stucco) with metal lath and accessories as required for complete finished system over existing or new wall construction.
 - a. Exterior plaster installed over a water resistive barrier applied to plywood veneered wood stud walls and soffits
 - b. Cement plaster is required at both exterior and interior wall locations.
 - c. Finish coat texture and color to match existing plaster wall surfaces as directed by the Architect.
 - 1) The existing 1938 building exterior wall finish is a dashed texture.
 - 2) The existing 1938 building interior wall finish is a smooth trowel texture.
 - 3) The existing 1970 building exterior addition is a sand trowel texture.
 - d. Exposed metal accessories, casing beads, and channel screeds.
2. Provide two coat Portland cement plaster (stucco) with metal lath and accessories as required for complete sub-straight to adhered masonry veneer.
 - a. Exterior plaster installed over a water resistive barrier applied to plywood veneered wood stud walls.
 - b. Exposed metal accessories, casing beads, and channel screeds.
3. Provide three coat Portland cement plaster (stucco) with metal lath and accessories as required for complete finished system at all patch and repair existing plaster wall locations as required to complete the scope of work required.
 - a. Cement plaster patch and repair is required at both exterior and interior wall locations.
 - b. Use means and methods typical of existing plaster patch and repair.

B. Related Sections:

1. Section 07 13 00: Building Envelope Underlayment.
2. Section 07 60 00: Flashing and Sheet Metal.
3. Section 09 91 00: Paints and Coatings.

1.2 REFERENCES

- A. ASTM C926: Application of Portland Cement Based Plaster.
- B. ASTM C1063: Installation of Lathing and Furring for Portland Cement Plaster.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product information for each lathing material and accessory, and for plaster mix materials.
- B. Shop Drawings: Indicate locations of control and expansion joints where not shown on Drawings.

1.4 PROJECT CONDITIONS

- A. Take precautionary measures to ensure plaster is not subjected to excessive sun and wind which could cause uneven and excessive evaporation, premature dehydration, or cracking.
- B. Cold-Weather Requirements: Do not apply plaster unless minimum ambient temperature of 40 degrees F has been and continues to be maintained for minimum 48 hours prior to application and until plaster is cured.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Portland Cement Plaster: Provide either neat or ready-mixed (where applicable) materials, at Contractor's option, complying with ASTM C926.
 - 1. Basecoat Materials for Scratch and Brown Coats:
 - a. Cement: Normal Type 1 or 1A Portland cement, ASTM C150.
 - b. Hydrated Lime: Special finishing hydrated lime, Type S, ASTM C206.
 - c. Aggregate: Natural sand, conforming to ASTM C897 or C144.
 - 2. Brown Coat Water Acrylic Admix: Acrylic polymer specifically manufactured for use in Portland Cement Plaster (Stucco) applications and which will not detrimentally affect finish.
 - a. Manufacturers:
 - 1) Larsen Products Corp./Acrylic Admix 101.
 - 2) Thoro System Products, Inc./Acryl 60.
 - 3) Chem-Masters Corp./Cretelox.
 - 4) Substitutions: Refer to Section 01 63 00.
 - 3. Finish Coat: Same as basecoat with acrylic admix.

- a. Factory premix finish coat is acceptable.
 - b. Color and texture to match existing exterior and interior wall surfaces.
- 4. Water: Clean, fresh and free from injurious amounts of oil, acid, alkali, organic matter or other deleterious substances.
- B. Metal Components: Comply with requirements of ASTM C1063.
 - 1. Manufacturers:
 - a. Unimast Inc.
 - b. Phillips Manufacturing Co. (formerly National Gypsum).
 - c. Alabama Metal Industries Corp.
 - d. Western Metal Lath Co.
 - e. Substitutions: Refer to Section 01 63 00.
 - 2. Exterior Components: Hot-dip galvanized finish; ASTM A924 and A653 minimum G90 for 18 gage and lighter formed metal products, ASTM A123 galvanized after fabrication for 16 gage and heavier products.
 - a. Exposed Components: Zinc accessories unless fully concealed in plaster.
 - 3. Metal Lath: Expanded diamond mesh; minimum 2.5 lbs per square yard at vertical applications, 3.4 lbs per square yard at horizontal applications.
 - a. Backing: Building Paper or Building Envelope Underlayment as specified in Section 07 13 00.
 - b. Self-Furring: Where over solid substrate, provide "V" groove type to hold lath approximately 1/4" from supporting base.
 - c. Tie Wire: ASTM A641, soft temper, Class 1 zinc coated; minimum 16 gage for tying metal lath to furring channels and metal lath to metal lath.
 - 4. Inside Corner Mesh: Minimum 26 gage steel; perforated or expanded flanges or clips shaped to permit complete embedding in plaster; minimum 2" x 2" size.
- C. Accessories: Provide as indicated, as recommended by referenced standards, and as required for complete installation.
 - 1. Manufacturers:
 - a. Keene Products from Metalex, a Division of The Koller Group.
 - b. Delta Star, Inc., Superior Metal Trim.
 - c. Lath manufacturers.
 - d. Substitutions: Refer to Section 01 63 00.
 - 2. Casing Beads and Base Screeds: Minimum 26 gage, square edges at casing beads, drip type base screeds; provide with expanded flanges.
 - 3. Expansion Joints: Two-piece slip type joints; commonly referred to as No. 40.

4. Control Joints: One piece metal joint designed to interlock with plaster similar to Keene/XJ15-3.
5. Aluminum Channel Screeds:
 - a. Extruded 6063 alloy, T5 or T6 temper aluminum, minimum 0.05" thick; with manufacturer's standard baked-on finish. Size and configuration as shown on drawings.
 - b. Manufacturers:
 - 1) Fry Reglet Corp./Plaster Moldings.
 - 2) MM Systems Corp./Dura-Trim.
 - 3) Gordon Inc./Final Forms II.
 - 4) Substitutions: Refer to Section 01 63 00.
 - c. Color: As selected by Architect.
- D. Anchorages: Tie wire, nails, screws and other approved metal supports, of type and size to suit application.

2.2 PLASTER MIXES

- A. Provide plaster mixes in accordance with ASTM C926 as appropriate to the substrate indicated and the approved samples.
- B. Mix only as much plaster as can be used in one hour.
- C. Mix materials dry, to uniform color and consistency, before adding water.
- D. Protect mixes from frost, dust and evaporation.
- E. Do not retemper mixes after initial set has occurred.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate suspended work with structural work to ensure inserts and structural anchorage provisions have been installed to receive hangers.
 1. Coordinate location of hangers with other work.
- B. Prior to application ensure mechanical and electrical services behind surfaces to receive cement plaster have been tested and approved.
- C. Ensure metal framing has been properly installed and rigidly secured.

3.2 INSTALLATION

- A. Erect furring and lath in accordance with ASTM C1063.

- B. Install work true to lines and levels and to provide surface flatness with maximum variation of 1/8" in 10'-0" in any direction.
 - 1. Contractor shall be responsible for planning or shimming existing construction as necessary to meet or exceed these tolerances.
- C. Isolation: Isolate lathing and metal support system where it abuts building structure horizontally, and where partition/wall work abuts overhead structure, to prevent transfer of building loads into plaster.
 - 1. Install slip or cushion type joints to absorb deflections but maintain lateral support.
- D. Frame both sides of expansion joints independently unless otherwise indicated, do not bridge joints with furring and lathing or accessories.
- E. Fixture Support Framing: Install supplementary framing, blocking and bracing where work is indicated to support fixtures, equipment, services and similar work requiring attachment and support.
- F. Coordinate installation of anchors, blocking, electrical and mechanical work which is to be placed in or behind framing; allow such items to be installed after framing is complete.
- G. Install expansion and control joints so plaster areas do not exceed 120 ft², and with area sides having a maximum one to two and a half (1:2-1/2) ratio, unless otherwise approved by Architect.
- H. Metal Lathing: Apply lath taut, with long dimension perpendicular to supports; secure end laps with tie wire where they occur between supports; lap sides minimum 1-1/2"; secure with tie wires.
 - 1. Continuously reinforce internal angles.
 - 2. Place 6" wide x 12" long strips of metal lath diagonally at corners of openings; secure rigidly in place.
 - 3. Place 6" wide strips of metal lath at junctions of dissimilar materials; place parallel with dissimilar materials; secure rigidly in place.
- I. Installation of Metal Accessories:
 - 1. Fasten in place true to line and in correct relation to adjacent materials and as required to prevent dislodging and misalignment by subsequent operations.
 - 2. Fasten at both ends and at maximum 12" on center along sides.
 - 3. Bring grounding edge of accessories to true lines, plumb, level, and straight.
 - 4. Install accessories to provide required depth of plaster and to bring plaster surface to required plane.

5. Install continuous corner reinforcement for full length of external corners.
6. Install sill and drip screeds with paper sheathing and lath installed over attachment flange of screeds.
7. Beads: Use single length of metal beads wherever length of run does not exceed longest standard stock length available; miter or cope corners.
 - a. Provide casing beads where plaster abuts dissimilar construction and at perimeter of openings where edges of plaster will not be concealed by other work.

J. Portland Cement Plaster: Conform to ASTM C926.

1. Apply three coat cement plaster system, scratch, brown, and finish coats.
2. Apply each base coat (scratch and brown) to minimum thickness of 3/8"; allow each coat to moist cure for minimum period of 48 hours;
 - a. Moist cure first base coat (scratch coat) during 48 hour period.
3. Allow base coats to cure for minimum 7 days prior to application of finish coat.
4. Evenly dampen base coat, to ensure uniform suction, and apply finish coat; apply thickness sufficient to secure required texture but in no case less than 1/8".
 - a. Apply pre-mixed finish coat in accordance with manufacturer's recommendations.
5. Maintain surface flatness, with maximum variation of 1/8" in 10'-0".
6. Avoid excessive working of surface, delay trowelling as long as possible to avoid drawing excess fines to surface.

K. Final Finish Coat:

1. Provide finish coat texture to match existing or as selected by Architect.
2. Integral Color as selected by Architect.

3.3 CUTTING AND PATCHING

- A. Cut, patch, point, and repair plaster as necessary to accommodate other work and to restore cracks, dents, and imperfections.
- B. Repair or replace work to eliminate blisters, buckles, crazing, check cracking, dry-outs, efflorescence, sweat-outs, and similar defects.
- C. Finish cutting and patching to match undamaged plaster; patching shall not be visible in finished installation.

3.4 CLEANING

- A. Promptly remove plaster from surfaces not indicated to be plastered.
- B. Repair surfaces stained, marred or otherwise damaged during plastering.

END OF SECTION

SECTION 09 29 00

GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL**1.1 SUMMARY**

- A. Section Includes: Provide gypsum board systems including gypsum sheathing, gypsum board, joint treatment, acoustical accessories, resilient channels, and general accessories for complete installation.
 - 1. Includes gypsum board installations on both interior walls, ceilings, and soffits.
 - 2. Includes mold and moisture resistant gypsum board at all wet areas.
 - 3. Includes skim coating of all existing interior plaster and gypsum board surfaces to achieve required finish.
 - 4. GA Level 5 finish required throughout project.
 - 5. Includes floor to ceiling acoustical batt insulation and accessories around all Restroom and Bedroom or Sleeping Room perimeter walls as scheduled on the drawings.
- B. Related Sections:
 - 1. Section 06 10 00: Rough Carpentry
 - 2. Section 07 21 16: Batt Insulation
 - 3. 09 24 00: Plaster Assemblies
 - 4. Section 09 30 13: Tile

1.2 REFERENCES

- A. ASTM C840: Application and Finishing of Gypsum Board.

1.3 SYSTEM DESCRIPTION

- A. Systems Responsibility: Provide products manufactured by or recommended by manufacturer of gypsum board to maintain single-source responsibility for system.
- B. Openings: Obtain dimensions and locations from other trades and provide openings and enclosures for accessories, specialties, equipment, and ductwork.

1.4 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature for gypsum board and acoustical accessories.
- B. Manufacturer's Certification: Furnish manufacturer's certification indicating products comply with Contract Documents and applicable codes.

1.5 PROJECT CONDITIONS

- A. Do not begin installation of interior gypsum board until space is enclosed, space is not exposed to other sources of water, and space is free of standing water.
- B. Maintain areas to receive gypsum board at minimum 50 degree F for 48 hours prior to application and continuously after application until drying of joint compound is complete; comply with ASTM C840.
- C. Immediately remove from site gypsum board for interior use exposed to water, including gypsum board with water stains, with signs of mold, and gypsum board with mildew.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. National Gypsum Co.
- B. Georgia-Pacific Corp.
- C. United States Gypsum Co., USG Corp.
- D. Substitutions: Refer to Section 01 63 00.

2.2 MATERIALS

- A. Exterior Gypsum Sheathing: Comply with ASTM C840; maximum permissible lengths; ends square cut, tapered edges on boards to be finished.
 - 1. Typical: ASTM C1177, Type X, fire rated gypsum board, unless otherwise indicated.
- B. Interior Gypsum Board: Comply with ASTM C840; maximum permissible lengths; ends square cut, tapered edges on boards to be finished.
 - 1. Typical: ASTM C1396, Type X, fire rated gypsum board, unless otherwise indicated.
 - 2. Tile Substrates: Cementitious backer units specified in Section 09 30 13 - Tile.
- C. Mold and Moisture Resistant Interior Gypsum Board: Comply with ASTM C1396; maximum permissible lengths; ends square cut, tapered edges on boards to be finished
 - 1. Surface paper: 100 percent recycled content moisture/mold/mildew resistant paper on front, back, and long edges
- D. Gypsum Accessories: Comply with ASTM C840.

1. Provide protective coated steel corner beads and edge trim; type designed to be concealed in finished construction by tape and joint compound.
2. Corner Beads: Manufacturer's standard metal beads.
3. Edge Trim: "J", "L", "LK", or "LC" casing beads.
4. Reinforcing Tape, Joint Compound, Adhesive, Water, Fasteners: Types recommended by system manufacturer and conforming to ASTM C475.
 - a. Typical Joint Compound: Chemical hardening type for bedding and filling, ready-mixed or powder vinyl type for topping.
5. Control Joints: Back to back casing beads.
 - a. Back control joints with 4 mil thick polyethylene air seal.

E. Acoustical Accessories:

1. Acoustical Batt Insulation: Preformed mineral fiber, ASTM C665, Type I; friction fit type without integral vapor barrier; as required to meet STC ratings indicated, or of thickness indicated.
2. Acoustical Sealant: ASTM C919, type recommended for use in conjunction with gypsum board.
 - a. Type: Paintable, non-shrinking and non-cracking where exposed, nondrying, nonskinning, nonstaining, and nonbleeding where concealed.
 - b. Install acoustical sealant at all floor, wall, and ceiling intersections with dissimilar materials.
3. Electrical Box Pads: Provide at all outlet, switch, and communications boxes in all walls scheduled to receive acoustical batt insulation.
 - a. Manufacturers for Non-Fire Rated Partitions:
 - 1) Harry A. Lowry & Associates (800.772.2521)/Lowry's Electrical Box Pads.
 - 2) Tremco Sheet Caulking (650.572.1656).
 - 3) Hevi-Duty Nelson (800.331.7325)/Putty Pads.
 - 4) Specified Technologies, Inc. (800.992.1180)/Putty Pads.
 - 5) Substitutions: Refer to Section 01 63 00.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Gypsum Board Installation: Install in accordance with ASTM C840, ASTM C1396 and manufacturer's recommendations.

1. Installation of Exterior Gypsum Sheathing shall also comply with Gypsum Association (GA) technical document GA-253 "Application of Gypsum Sheathing".
2. Use screws when fastening gypsum board to furring and to framing.
3. Erect gypsum board with ends and edges occurring over firm bearing.
 - a. Ensure joints of second layer do not occur over joints of first layer in double layer applications.
4. Place control joints to be consistent with lines of building spaces and as directed by Architect.
 - a. Provide where system abuts structural elements.
 - b. Provide at dissimilar materials.
 - c. Lengths exceeding 30'-0" in partitions.
 - d. Ceiling areas exceeding 50'-0" or 2500 square feet.
 - e. Wings of "L", "U" and "T" shaped ceilings.
5. Place corner beads at external corners; use longest practical lengths.
6. Place edge trim where gypsum board abuts dissimilar materials.
7. Tape, fill, and sand exposed joints, edges, corners and openings to produce surface ready to receive finishes; feather coats onto adjoining surfaces.
8. Finishing: Comply with Gypsum Association (GA) "Levels of Gypsum Board Finish".
 - a. GA Level 5, three coat finishing and sanding is required for all wall and ceiling surfaces indicated to be painted. Provide flush, smooth joints and surfaces ready for applied paint finishes.
9. Remove and replace defective work.

B. Acoustical Accessories Installation:

1. Place acoustical insulation tight within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
2. Place acoustical sealant within partitions in accordance with manufacturer's recommendations; install acoustical sealant at gypsum board perimeter at:
 - a. All wood framing or framed partitions:
 - 1) Top Plate: Two beads – one each side.
 - 2) Sill Plate: Two beads – one each side.
 - b. Gypsum board base layer and face layer (if multiple layers required).

- c. Penetrations of gypsum board surfaces or partitions.
- 3. Tolerance: Maximum 1/4" space between gypsum board at floor, ceiling, and any thru penetrations.
- 4. Install electrical box pads with pads molded and pressed on back side of box, closing openings, in accordance with manufacturer's instructions, for complete acoustical barrier. Caulk perimeter.

END OF SECTION

SECTION 09 30 13

TILE

PART 1 - GENERAL**1.1 SUMMARY**

- A. Section Includes: Provide ceramic and porcelain floor and wall tile with all required materials, waterproof membranes, leveling compounds, and accessories as required for complete installation.
 - 1. Provide cementitious backer unit tile substrate at all wall surfaces behind tile.
 - 2. Provide cementitious backer unit wall panel substrate at all wall surfaces behind solid surface wall cladding.
 - a. Coordinate with requirements of Section 06 61 00 – Solid Surface Wall Cladding
 - 3. Provide waterproof membranes and shower pan liners at all showers.
 - 4. Provide stainless steel wall edge trim and floor transitions where called out on the drawings, noted herein, or as required to complete the installation.
- B. Related Sections:
 - 1. Section 06 10 00: Rough Carpentry
 - 2. Section 06 61 00: Solid Surface Wall Cladding
 - 3. 09 24 00: Plaster Assemblies
 - 4. Section 09 29 00: Gypsum Board Assemblies

1.2 REFERENCES

- A. ANSI A108.1: Installation of Tile with Portland Cement Mortar.
- B. ANSI A108.5: Installation of Tile with Latex-Portland Cement Mortar.
- C. ANSI A108.10: Installation of Grout in Tilework.
- D. ANSI A108.11: Interior Installation of Cementitious Backer Units.
- E. Tile Council of North America (TCNA): Handbook for Ceramic Tile Installation.

1.3 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature for each type of material to be provided for Project.

- B. Samples: Furnish each type of tile clearly indicating pattern, coloration and joints.
 - 1. Color Charts: Submit actual tile sections showing full range of colors, textures and patterns available for each type of tile.

1.4 PROJECT CONDITIONS

- A. Ensure floor surfaces are smooth and flat with maximum variation of 1/8" in 10'-0".
- B. Ensure concrete floors are dry and exhibit negative alkalinity, carbonizing and dusting.
- C. Maintain minimum 70 degree F air temperature at flooring installation area for 3 days prior to, during, and for 24 hours after installation.
- D. Provide sufficient heat and ventilation in areas where tile work is being performed, so as to allow tile to properly set.
- E. Take precautionary measures necessary to ensure excessive temperature changes do not occur.

1.5 WARRANTY

- A. Special Warranty: Provide for correcting failures of cementitious backer unit and tile or solid wall panel cladding bond and adhesion to sub-straight.
 - 1. Repair and pay for or replace damaged materials and surfaces.
 - 2. Special Warranty Period: Two years.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Tile: Types as indicated; ceramic or porcelain tile that complies with ANSI A137.1 for types, compositions and other characteristics indicated. Provide tile in the locations and of the types colors and pattern indicated on the Drawings and identified in the Tile Schedule. Tile shall also be provided in accordance with the following:
 - 1. Factory Blending: For tile exhibiting color variations within the ranges selected under Submittal of samples, blend tile in the factory and package so tile taken from one package shows the same range of colors as those taken from other packages.
 - 2. Mounting: For factory mounted tile, provide back or edge mounted tile assemblies as standard with the manufacturer, unless otherwise specified.
 - a. Factory Applied Temporary Protective Coatings: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by pre-coating with a continuous film of petroleum paraffin wax applied hot. Do not coat unexposed tile surfaces.
 - 3. Manufacturers:

- a. Crossville Inc.
 - b. Dal-Tile Corporation
 - c. American Olean Tile Company, Inc.
 - d. Substitutions: Refer to Section 01 63 00.
4. Floor and Wall Tile Types: See tile types scheduled on drawings.
5. Floor Tile: Provide non-slip units with minimum wet and dry value 0.60 coefficient of friction when tested in accordance with ASTM C1028.
6. Base and Trim: Provide matching trim pieces, coordinated with sizes and coursing of adjoining flat tile as directed by Architect; types as indicated, as selected by Architect where not indicated.
- B. Portland Cement Setting Bed: Portland cement bed conforming to ANSI A108.1 and TCNA recommendations including separator sheet and reinforcing mesh.
 1. Where over waterproof membrane, separator sheet may be deleted.
- C. Latex Thin Set: Thinset bond coat, consisting of latex-cementitious mortar conforming to ANSI A118.4.
 1. Manufacturers:
 - a. Laticrete International Inc.
 - b. Bostik Construction Products/Hydroment.
 - c. Custom Building Products.
 - d. Mapei Corp.
 - e. Mer-Kote Products, Inc.
 - f. Substitutions: Refer to Section 01 63 00.
- D. Latex-Cement Grout: ANSI A118.7, latex-cementitious type, uniform in color, resistant to shrinkage.
 1. Manufacturers:
 - a. Laticrete International Inc.
 - b. Bostik Construction Products/Hydroment.
 - c. Custom Building Products.
 - d. Mapei Corp.
 - e. Mer-Kote Products, Inc.
 - f. Substitutions: Refer to Section 01 63 00.
 2. Color: Match tile unless otherwise indicated.
- E. Liquid Waterproof Membrane: Manufacturer's standard liquid rubber polymer designed specifically for application under tile in non-immersed applications.
 1. Manufacturers:
 - a. Laticrete International Inc./9235 Waterproof Membrane.

- b. Bostik Construction Products/Hydroment Ultra-Set.
 - c. Mer-Kote Products/BFP Membrane or Hydro-Guard 2000.
 - d. The Nobel Company/NobelSeal TS.
 - e. Substitutions: Refer to Section 01 63 00.
- F. Sheet Waterproofing Membrane at Shower Floors: Membrane in accordance with ANSI A118.10 and as follows:
 - 1. Chlorinated Polyethylene Sheet (CPE) with polyester fabric reinforcing.
 - a. ASTM D 4068, sheet membrane made from an alloy of non-plasticized chlorinated polyethylene (CPE) listed by IAPMO (UPC #4036)
 - b. Sloping Materials: Use a sloped fill or a composite made from expanded polystyrene with reinforced fiber cutting template on one side, tapered to 1/4 inch per foot (20.8 mm/m) slope with weep hole protector.
 - 2. Manufacturers:
 - a. CPE: The Noble Company/Chloraloy
 - b. Slope: The Noble Company/Pro-Slope
 - c. Substitutions: Refer to Section 01 63 00.
- G. Membrane at Walls: 4 mil (0.1 mm) thick polyethylene film, ASTM D4397.
- H. Cementitious Backer Units: ANSI A118.9 aggregated Portland cement with woven glass-fiber mesh on both faces; thickness as required; UL fire rated as required to maintain integrity of fire rated assemblies.
 - 1. Manufacturers:
 - a. USG Industries, Durabond Division/Durock.
 - b. National Gypsum Co./PermaBase Cement Board.
 - c. Custom Building Products/Wonderboard.
 - d. James Hardie Building Products/Hardibacker.
 - e. Substitutions: Refer to Section 01 63 00.
- I. Cleaning and Sealing Materials: As recommended by tile and grout manufacturers, such as Bostik Construction Products/Hydroment CeramaSeal.
- J. Leveling compound - Latex or cementitious type as recommended by tile manufacturer.
- K. Accessories:
 - 1. Stainless steel edge trim
 - a. Mfr.: Schluter
 - b. Style: SCHIENE or QUADDEC as detailed.
 - c. Finish: Stainless Steel – 304
 - 2. Stainless steel floor finish transition

- a. Mfr.: Schluter
- b. Style: RENO-U as detailed.
- c. Finish: Stainless Steel – 304

2.2 MIXES

- A. Mix and proportion cementitious materials for site-made leveling coats, setting beds and grout as recommended by the TCNA Handbook for Ceramic Tile Installation.
- B. Mix and proportion pre-mixed setting beds and grout materials in accordance with manufacturer's recommendations.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prior to installing tile, ensure surfaces are level.
 - 1. Bed Set Tile Tolerance: Maximum surface variation of 1/8" in 10'-0".
 - 2. Thin Set Tile Tolerance: Maximum surface variation of 1/8" in 10'-0".
- B. Use leveling material to patch cracks, small holes, and leveling to requirements.
- C. Ensure surfaces are clean and well cured.
 - 1. Drains: Where indicated, ensure surfaces are properly sloped to drains.
- D. Do not commence work until surface conditions are within tolerances required for proper installation; apply latex leveling material where necessary to meet required tolerances.
- E. Waterproof Membrane: Install waterproof membrane at tile areas located above grade, in accordance with manufacturer's recommendations; extend membrane minimum 6" up walls.
 - 1. Comply with waterproof membrane manufacturer recommendations for installation of tile over waterproof membrane.
- F. Cementitious Backer Units: Install units in accordance with ANSI A108.11, manufacturer's recommendations, and as required to provide fire ratings indicated on Drawings.

3.2 INSTALLATION

- A. Install tile in accordance with referenced ANSI Standards and TCNA recommendations for type of substrate and indicated setting method.
 - 1. Bed Set Floors over Concrete: TCNA F111, with latex cement bond coat.

2. Latex-Cement Thin Set Floors over Concrete: TCNA F113.
 3. Latex-Cement Thin Set Wall Tile over Cementitious Backer Units: TCNA W244.
 4. Showers: TCNA B415 latex bond coat over reinforced mortar bed floor with latex cement thin set over cementitious backer unit walls, with shower pan liners and waterproofing at walls.
- B. Place tile in accordance with patterns indicated on Drawings or as directed by Architect; carefully plan tile layouts, ensure pattern is uninterrupted from one surface to the next and through doorways.
1. Apply latex thin set to back of tile where necessary to ensure 100% bond between bond coat and substrate; replace tiles which break due to voids between tile and substrate.
- C. Neatly cut tile around fixtures and drains; accurately form corners, base, intersections and returns.
1. Base, Coves: Flush cove type with base grout joint on wall, cove tile on floor, unless otherwise indicated.
 2. Corners and Edges: Bullnose tile unless otherwise indicated.
- D. Locate expansion joints, control joints, contraction joints, and isolation joints where indicated; where not indicated, provide as recommended by TCNA Handbook and as approved by Architect.
1. Install special trim pieces as indicated on Drawings and in accordance with manufacturer recommendations and installation instructions, true to lines and levels indicated and in correct relationship with tile and adjacent materials.
- E. Ensure tile joints are uniform in width, subject to normal variance in tolerance allowed in tile size; ensure joints are watertight, without voids, cracks, excess mortar or grout.
- F. Sound tile after setting, remove and replace hollow sounding units.
- G. Allow tile to set for a minimum 48 hours prior to grouting.
- H. Grout tile to comply with recommendations of TCNA and as specified.
- I. Leave completed installation free of broken, damaged and faulty tile.

3.3 CLEANING AND SEALING

- A. Clean tile surfaces free of foreign matter upon completion of grouting.
- B. Seal tile and grout surfaces where recommended by manufacturer for materials and applications involved; comply with manufacturer's recommendations.

END OF SECTION

SECTION 09 51 00**SUSPENDED ACOUSTICAL CEILINGS**

PART 1 - GENERAL**1.1 SUMMARY**

- A. Section Includes: Provide acoustical ceiling systems with exposed suspended metal grid system, acoustical panels, trim, and accessories as required for complete finished installation.
- B. Related Sections:
 - 1. Section 09 26 00: Gypsum Board Assemblies
 - 2. Section 09 51 53: Acoustical Ceiling Tile
 - 3. Divisions 15 and 16: Mechanical and electrical ceiling penetrations.

1.2 SYSTEM DESCRIPTION

- A. Seismic Design Requirements: Comply with California Building Code requirements for seismic bracing of ceiling suspension system, and with ASTM E580.
 - 1. Ceiling Struts: Provide struts as detailed on Drawings and as required by code, placed maximum 12'-0" on center in both directions and within 6'-0" of each wall.
 - 2. Slack Wires: Provide safety slack wires, two per fluorescent fixture on diagonally opposite corners and a single wire for each recessed down light.
- B. Fire Performance Characteristics: Provide products listed by Underwriters Laboratories (UL) or other independent testing laboratory acceptable to applicable authorities.
 - 1. Flame Spread/Smoke Density: Provide products meeting code requirements for maximum 25 flame spread and maximum 25 smoke density.

1.3 REFERENCES

- A. ASTM C635: Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
- B. ASTM C636: Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
- C. ASTM E580: Application of Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels in Areas Requiring Seismic Restraint.
- D. ASTM E 1264 Classification for Acoustical Ceiling Products.

1.4 SUBMITTALS

- A. Product Data: Furnish manufacturers' literature.

- B. Shop Drawings: Clearly indicate grid layout and related dimensioning, junctions with other work and ceiling finishes, and inter-relation of mechanical and electrical items related to system.
- C. Samples: Furnish samples of exposed grid finish and each type of ceiling unit.

1.5 QUALITY ASSURANCE

- A. Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer.
- B. Installer Qualifications: Firm with minimum three years successful experience in projects of similar type and scope; acceptable to manufacturer of acoustical units.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
 - 1. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.
 - 2. Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.7 SITE CONDITIONS

- A. Do not install ceilings until building is enclosed, sufficient heat is provided, dust generating activities have terminated and overhead mechanical work is completed, tested and approved.
 - 1. Do not allow acoustical ceiling units to be exposed to moisture; immediately remove acoustical ceiling units with stains, units with signs of mold, and units with mildew.
- B. Allow wet work to dry prior to commencement of installation.
- C. Installation of the products shall be carried out where the temperature is between 32°F (0° C) and 120°F (49° C). It is not necessary for the area to be enclosed or for HVAC systems to be functioning. All wet work (plastering, concrete, etc) must be complete and dry.
- D. The ceilings must be maintained to avoid excessive dirt or dust buildup that would provide a medium for microbial growth on ceiling panels.

1.8 WARRANTY

- A. Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace acoustical panels that fail within the warranty period. Failures include, but are not limited to:

1. Acoustical Panels: Sagging and warping as a result of defects in materials or factory workmanship.
2. Grid System: Rusting and manufacturer's defects
3. Acoustical Panels designated as inherently resistive to the growth of micro-organisms: Visible sag and will resist the growth of mold/mildew and gram positive and gram negative odor and stain causing bacteria.

B. Warranty Period:

1. Acoustical panels: Ten (10) years from date of substantial completion.
2. Grid: Ten (10) years from date of substantial completion.

C. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

1.9 MAINTENANCE

- A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.
1. Acoustical Ceiling Units: Furnish quality of full-size units equal to 5.0 percent of amount installed.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Suspension System: Comply with ASTM C635, as applicable to type of suspension system required for type of ceiling units indicated.
1. Exposed Grid System: Tee System with 9/16" face.
 - a. Design Basis: Armstrong World Industries – Suprafine XL
 - b. Acceptable Manufacturers subject to physical and visual compliance:
 - 1) Armstrong World Industries, Inc.
 - 2) Chicago Metallic Corp.
 - 3) USG, Interiors, Inc./Donn.
 - 4) Substitutions: Refer to Section 01 63 00.
 2. Attachment Devices: Size for 5 times design load indicated in ASTM C635, Table 1, Direct Hung.

3. Hanger Wires: Galvanized carbon steel, ASTM A641, soft temper, pre-stretched, yield-stress load of at least three times design load, but not less than 12 gage.
 4. Straps, Tubes and Angles: Provide galvanized steel as required to meet state and local requirements for seismic design loads.
 5. Structural Class: Minimum intermediate-duty system.
 6. Edge Molding: Manufacturer's standard angle molding for edges and penetrations of ceiling, with single flange of molding exposed.
 7. Finish of Exposed Items: Manufacturer's standard full-color range as selected by the Architect from product submittal samples.
 8. Maximum Allowable Deflection: $L/360$.
- B. Acoustical Panels: ASTM E1264 type and form as indicated.
1. Panels: Mineral composition lay-in ceiling panels
 - a. Beveled Tegular Edge designed to be compatible with specified suspension system.
 2. Texture: Medium Texture panels unless otherwise indicated on Drawings.
 3. Size: 24" by 24", except where otherwise indicated on Drawings.
 4. Finish: Manufacturer's White or Ivory painted finish as selected by Architect.
 5. Design Basis: Armstrong World Industries - Cirrus 9/16" Beveled Tegular
 6. Acceptable Manufacturers subject to physical and visual compliance:
 - a. Armstrong World Industries, Inc.
 - b. Celotex Corp.
 - c. USG Interiors, Inc.
 - d. Substitutions: Refer to Section 01 63 00.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Furnish layouts for inserts, clips and other supports required to be installed by other trades for support of acoustical ceilings.
1. Install inserts, clips, and supports where not previously installed and where additional supports are required for complete installation.
- B. Measure ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling; do not use less than half width units at borders.

- C. Coordinate with other work supported by or penetrating through ceilings, including light fixtures, HVAC equipment and partition systems.

3.2 INSTALLATION

- A. Install acoustical ceiling systems in accordance with manufacturer's recommendations and ASTM C636.
 - 1. Finished Ceilings: True to lines and levels and free from warped, soiled or damaged grid or acoustical units.
- B. Install ceiling systems in a manner capable of supporting superimposed loads, with maximum permissible deflection of 1/8" in 10'-0".
- C. Install after major above-ceiling work is complete; coordinate location of hangers with other work.
 - 1. Ensure suspension system is located to accommodate fittings and units of equipment which is to be placed after installation of ceiling grid.
- D. Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest adjacent hangers and related carrying channels as required to span required distance.
- E. Install ceiling suspension system to resist seismic loads as required by state and local codes, including extra hanger wires and compression supports for ceilings and light fixtures.
- F. Hang system independently of walls, columns, ducts, pipes and conduit. Where suspension system members are spliced, avoid visible displacement of the longitudinal axis or face plane of adjacent members.
- G. Do not support lighting fixtures from or on main runners or cross runners if weight of fixture causes total dead load to exceed deflection capability.
 - 1. Support fixture loads independently or provide supplementary hangers located within 6" of each corner.
- H. Do not install fixtures so main runners and cross runners are eccentrically loaded; where fixture installation would produce rotation of runners, provide stabilizer bars.
- I. Install edge moldings at intersection of ceiling and vertical surfaces, using maximum lengths, straight, true to line and level; miter corners.
 - 1. Provide edge moldings at junctions with other ceiling finishes.
- J. Where required form expansion joints to accommodate movement and maintain visual closure without distorting system.

- K. Fit acoustic units in place, free from damaged edges or defects detrimental to appearance and function.
 - 1. Lay directionally patterned units one way with pattern as directed.
 - 2. Fit border units neatly against abutting surfaces.
- L. Install system level, in uniform plane and free from twist, warp and dents.
- M. Install hold-down clips where required by applicable codes and where ceiling is within 20'-0" of an exterior door.
- N. Adjustment: Adjust sags or twists which develop in ceiling system and replace any part which is damaged or faulty.

END OF SECTION

SECTION 09 61 00**STAINED CONCRETE FINISH**

PART 1 - GENERAL**1.1 SUMMARY****A. Section includes:**

1. Chemically stained concrete floor finish including a combination of colors and dilution mixes as selected by the Architect at locations noted on the Finish Schedule.
2. Low-gloss, Low-VOC sealer as recommended by stain manufacturer.
3. Architect shall provide Contractor with one or two field installations for inspection to illustrate desired finish.

B. Related Sections:

1. Section 03 30 00 Cast-In-Place Concrete for general concrete applications.

1.2 REFERENCES**A. ASTM International (ASTM):**

1. ASTM C 171: Standard Specification for Sheet Materials for Curing Concrete.
2. ASTM C 309: Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
3. ASTM F 1869: Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's technical data, including Material Safety Data Sheet (MSDS) and installation instructions, for each product specified.
- B. Samples for Initial Selection: Manufacturer's color charts showing full range of colors available.
- C. Qualification Data: For manufacturer and Installer.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum 10 years of documented experience producing the specified products.
- B. Installer Qualifications: Minimum 5 years of documented experience with work of similar scope and complexity required by this Project and acceptable to, or certified by, concrete stain manufacturer.

C. Regulatory Requirements:

1. Code of Federal Regulations 40 CFR 59, Subpart D and EPA Test Method 24 establish VOC emissions standards and test protocols for architectural coatings.
2. Products to comply with United States Clean Air Act for maximum Volatile Organic compound (VOC) content as specified in this Section.

D. Material Source: Obtain each specified material from the same source.

E. Concrete Stain Mockups:

1. Construct up to four (4) - 2 foot by 2 foot stain and sealer mockups at location selected by Architect.
2. Construct mockup using materials, processes, and techniques required for the work, including curing procedures. Incorporate representative control, construction, and expansion joints according to Project requirements. Installer for the work to construct mockup.
3. Mockup to be stained and sealed by the Installer who will actually perform the work for the Project. Record the amount of chemical stain needed per square foot of application to establish coverage rates for the work.
4. Notify Architect and Owner a minimum of seven calendar days in advance of the date scheduled for each mockup construction.
5. Obtain the Architect's and Owner's acceptance of each mockup prior to commencement of the work.
6. Each mockup to remain until completion of the work to serve as a quality control standard for the work. Provide suitable protections to preclude damage to mockup.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in original factory unopened, undamaged packaging bearing identification of product, manufacturer, batch number, and expiration date as applicable.
- B. Store products in a location protected from damage, construction activity, and adverse environmental conditions, and away from combustible materials and sources of heat, according to manufacturer's printed instructions and current recommendations.
- C. Handle products according to manufacturer's printed instructions.

1.6 PROJECT CONDITIONS

- A. Environmental Conditions: Maintain an ambient temperature between 50 deg F and 90 deg F during application and at least 48 hours after application.

1.7 PREINSTALLATION CONFERENCE

- A. Seven calendar days prior to scheduled date of installation, conduct a meeting at Project site to discuss requirements, including application methods. Attendees to include Architect, Owner, Contractor, Installer, and manufacturers authorized field representative (if necessary).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. L. M. Scofield Company, LITHOCHROME Chemstain Classic
- B. Kemiko Concrete Products, Stone Tone Stain
- C. Butterfield Color, Perma-Cast or Elements
- D. Substitutions: Refer to Section 01 63 00.

2.2 MATERIALS

- A. Reactive Chemical Concrete Stain: Reactive, water-based solution of metallic salts which react with calcium hydroxide in cured concrete substrates to produce permanent variegated or translucent color effects. Zero or low VOC content.
- B. Color(s): Installation Contractor to combine or dilute up to three colors from the manufacturer's standard color range as necessary to achieve desired color and variegation.
 - 1. Final color and required mix design shall be approved by the Architect
- C. Select sealing compound from available choices in following four paragraphs, and to suit Project requirements.
 - 1. Acrylic-Polyurethane Sealer: One-component clear acrylic-polyurethane sealer. Low VOC formulation. VOC content less than 100 g/L. Low Gloss, Low Sheen.
 - a. Manufacturers:
 - 1) Scofield Selectseal-W.
 - 2) Butterfield Clear Guard Pro 350.
 - 3) Substitutions: Refer to Section 01 63 00.
 - 2. Waterborne Sealer: Low VOC waterborne modified acrylic formulation. Complies with ASTM C 309. VOC content less than 100 g/L. Low Gloss, Low Sheen.

a. Manufacturers:

- 1) Scofield Cureseal-W.
- 2) Kemiko Stone Tone Sealer II.
- 3) Butterfield Clear Guard H2O Cure and Seal.
- 4) Substitutions: Refer to Section 01 63 00.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which the concrete stain work will be performed and identify conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.
- B. Interior Applications: Concrete substrates must have a moisture vapor emission rate of less than 5 lbs./1000 sq. ft. per 24 hour based on a 72 hour test period according to ASTM F 1869.

3.2 PREPARATION

A. New Concrete: Comply with the following:

1. Newly placed concrete to sufficiently cure for concrete to become reactive. Minimum cure time is 14 days.
2. Interior Applications: Minimum cure time of concrete is 30 to 60 days, or longer if necessary to meet the specified water vapor transmission requirements.
3. Do not use liquid curing materials. Cure concrete flatwork with new, unwrinkled, non-staining, high quality curing paper complying with ASTM C 171. Do not overlap curing paper.
4. Cure surfaces using the same method and different sections (pours) chemically stained when concrete is the same age.
5. Immediately prior to chemically staining, thoroughly clean concrete to remove any contaminants deleterious to subsequent chemical stain application. Sweep surfaces, then pressure wash or scrub using a rotary floor machine with a Mal-Grit Brush from the Malish Corporation. Use suitable, non-acidic, high quality commercial detergents to facilitate cleaning. Rinse surfaces after cleaning until rinse water is completely clean. Allow floor to dry completely prior to application of concrete stain.
6. Pressure Washing: Use a pressure washer equipped with a fan tip and rated for a minimum pressure capability of 4000 psi.

B. Existing Concrete:

1. Clean concrete surfaces until completely penetrable before receiving the initial application of chemical stain. Test surfaces to receive stain by spotting with water. Water should immediately darken the substrate and be readily absorbed. If water beads and does not penetrate or only penetrates in some areas, perform additional surface preparation and testing. On denser concrete floors, sand lightly to open up surfaces. Retest and continue surface preparation until water spots immediately darken and uniformly penetrate concrete surfaces.
 2. Cleaning method used depends on the condition of the concrete surface. To remove dirt and other contaminants, detergents and other commercial grade cleaners may be suitable subject to testing. Pressure washing or scrubbing with a rotary floor machine with a Mal-Grit Brush from the Malish Corporation is required, unless otherwise recommended by chemical stain manufacturer.
 3. Pressure Washing: Use a pressure washer equipped with a fan tip and rated for a minimum pressure capability of 4000 psi.
 4. Rinse concrete substrates until rinse water is completely clean.
- C. Scoring: Score decorative jointing in concrete surfaces 1/8 inch deep with diamond blades. Rinse until water is completely clean.
1. Single Color Stain Applications: Score after staining.
 2. Multiple Color Stain Applications: Score before staining.

3.3 CHEMICAL STAIN APPLICATION

- A. General: Comply with chemical stain manufacturer's printed instructions and current recommendations.
- B. Do not mix the specified chemical stain with highly alkaline chemical stain materials. Doing so will result in a dangerous chemical reaction.
- C. Protect surrounding areas and adjacent surfaces from overspray, runoff, and tracking. Divide surfaces into small work sections using walls, joint lines, or other stationary breaks as natural stopping points.
- D. Apply chemical stains at the coverage rate recommended by the manufacturer and use application equipment according to the chemical stain manufacturer's printed instructions. Note the color of the liquid chemical stain will not be the final color produced on the concrete substrate.
- E. Transfer chemical stain to the substrate by brush or spray and immediate scrub into surface. Reaction time depends on wind conditions, temperatures, and humidity levels.
- F. When multiple coats of one or more colors are required, washing and drying between colors is desirable to evaluate the color prior to the next coat.

- G. Rinsing: After the final coat of chemical stain has remained on the surface for a minimum of four hours, neutralize unreacted chemical stain residue and then remove completely prior to sealing. After neutralization, thoroughly rinse surface with clean water several times to remove soluble salts. While rinsing, lightly abrade surface using a low-speed floor machine and red pad to remove residue and weakened surface material. Runoff may stain the adjacent areas or harm plants. Collect rinse water by wet vacuuming or absorbing with an inert material.
- H. Failure to completely remove all residue prior to sealing the surface will cause appearance defects, adhesion loss or peeling, reduced durability, and possible bonding failure and delamination of sealer.
- I. All stain residue, runoff liquid, and rinse water must be collected and disposed of according to applicable Federal regulations and governing authorities having jurisdiction.

3.4 SEALING APPLICATION

- A. Concrete substrate must be completely dry. Test surface for proper pH prior to applying sealer. A pH value of 7 or higher indicates all acid has been neutralized. If the tested pH value is less than 7, repeat neutralization step until the required pH value is achieved.
- B. Conduct a moisture vapor emission test prior to applying any sealer. Refer to the specific sealer's Technical-Data Bulletin for acceptable MVER.
- C. Apply sealer according the sealer manufacturer's printed instructions at a rate of 300 to 500 square feet per gallon per coat. Maintain a wet edge at all times.
- D. Allow sealer to completely dry before applying additional coats.
- E. Apply second coat of sealer at 90 degrees to the direction of the first coat using the same application method and rates.
- F. Seal horizontal joints in areas subject to pedestrian or vehicular traffic.

3.5 PROTECTION

- A. The General Contractor is responsible for using Temporary Floor Protection throughout the project to safeguard the surface quality of concrete slabs before and after application of decorative finishes or installations of other materials.
- B. All concrete floors that will be not be covered by other materials will be protected throughout the project. The concrete slab must be treated as a finished floor at all times during construction.
- C. Temporary Floor Protection will be removed only while finish work to the concrete is being performed and will be replaced after the final finish has cured sufficiently.

D. Temporary Floor Protection will be installed following the manufacturer's published installation procedures.

1. Do not apply heavy duty seaming tape to bare or finished floors or wall surfaces at any time.

3.6 MAINTENANCE

A. Maintain chemically stained and sealed floors by sweeping. Clean spills when they occur and rinse dirt off with water. Wet-clean heavily soiled areas by mopping or by scrubbing with a rotary floor machine equipped with a scrubbing brush and a suitable, high quality commercial detergent. Maintain interior floors that require polishing by using a compatible, premium-grade, emulsion-type, commercial floor polish, according to manufacturer's printed instructions and safety requirements.

END OF SECTION

SECTION 09 64 29**WOOD STRIP AND PLANK FLOORING**

PART 1 - GENERAL**1.1 SUMMARY****A. Section Includes:**

1. Provide all labor and material for installing new hardwood strip and plank floors.
 - a. New strip and plank flooring to match existing strip and plank flooring in species, grain, dimension, and finish.

B. Related Sections:

1. Section 09 93 00: Hardwood Floor Finish

1.2 REFERENCES

- A. American Forest Foundation (AFF)
- B. American Tree Farm Systems Standards (2021) - American Tree Farm System Standards of Sustainability
- C. CSA Group (CSA) - CSA Z809-16 (R2021) Sustainable Forest Management
- D. Forest Stewardship Council (FSC) - FSC STD 01 001 (2015) Principles and Criteria for Forest Stewardship
- E. Maple Flooring Manufacturers Association (MFMA) - MFMA GS (1999) Guide Specifications for Maple Flooring Systems
- F. National Wood Flooring Association (NWFA) (formerly NOFMA)
 1. NOFMA Grading Rules (1999) - Official Flooring Grading Rules

1.3 QUALITY ASSURANCE

- A. Comply with the requirements of the National Wood Flooring Association – Sanding and Finishing Guidelines and Methods.
- B. Manufacturer Qualification: Use an experienced hardwood floor installer with at least ten (10) years of experience.
- C. Use a single manufacturing source to produce all finish products ready for installation.

1.4 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature and indicate each for materials, finishes, and equipment including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- B. Verification Samples: For finish product specified, provide two samples, minimum size 6 inches square, representing actual product, color, and patterns.
 - 1. Samples to match existing floor finish.

1.5 PRE-INSTALLATION CONFERENCE

- A. A pre-installation meeting will be held with the Contractor, Architect, and Owner to address the project details prior to the commencement of work.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver all materials in original, unopened packaging and store them under appropriate environmental conditions to prevent damage.

PART 2 – PRODUCTS**2.1 MATERIALS**

- A. Strip and plank flooring must be 3/4" inch thick by 2-1/4 inch face width (minimum) (field verify thickness and width), kiln dried, continuous tongue and groove and of standard lengths.
- B. Field verify wood species.
 - 1. Beech and birch must be second grade in accordance with NOFMA Grading Rules.
 - 2. Hard maple must be second and better in accordance with MFMA GS.
 - 3. Red and white oak must be select grade in accordance with NOFMA Grading Rules.
- C. Provide wood products with no added urea-formaldehyde resins. Strip flooring must be marked with the trademark of the grading agency.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of work.

3.2 PREPARATION

- A. Prepare substrates to ensure proper installation of hardwood plank flooring.
 - 1. After installation of subfloor as detailed, use a trowelable leveling and patching compound to fill any remaining cracks, holes, and depressions in subfloor that would cause new plank flooring to be installed outside of the tolerances noted below..
 - 2. Contractor responsibility to prepare all subfloors so that the following tolerances are achieved:

Level 1/8" in 10'-0" in any direction

- B. Do not open wood floor packaging until ready for installation.
- C. Sweep and vacuum clean substrates to be covered by wood flooring products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. General: Comply with plank flooring manufacturer's written instructions, as applicable to flooring type.
- B. Pattern: Install hardwood plank flooring in pattern indicated on Drawings or, if not indicated, as directed by Architect to match existing conditions.
- C. Expansion Space: Provide expansion space at walls and other obstructions and terminations of flooring of not less than 3/16" and no greater than 1/2". Insure that new wood base, as detailed, will cover and conceal all expansion spaces.
- D. Underlayment: Install appropriate manufacturer approved underlayment in accordance with manufacturer's installation guide.

3.4 FINISHING

- A. Upon installation, follow specification requirements for sanding and finishing hardwood floors.
 - 1. Refer to Section 09 93 00: Hardwood Floor Finish

3.5 CLEANING AND PROTECTION

- A. Perform the following operations immediately after completing installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
- B. Protect wood flooring products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- C. Cover installed wood flooring to protect it from damage or deterioration, during remainder of construction period until Substantial Completion. Use heavy kraft-paper or other suitable covering.
 - 1. Do not use plastic sheet or film that could cause condensation.
- D. Do not tape protection material to wood flooring.
- E. Do not move heavy and sharp objects directly over surfaces. Place hardboard or plywood panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION

SECTION 09 65 70

RUBBER BASE

PART 1 - GENERAL**1.1 SUMMARY****A. Section Includes:**

1. Provide resilient base and accessories as required for complete installation.

1.2 SYSTEM DESCRIPTION

- A. Performance Requirements: Provide materials tested under ASTM E648, Flooring Radiant Panel Test, with results of 0.45 watts/cm² or higher.

1.3 SUBMITTALS

- A. Product Data: Furnish manufacturer's product literature.
- B. Samples: Furnish samples of each base color and type.

1.4 PROJECT CONDITIONS

- A. Maintain minimum 70 degree F air temperature at installation area for 3 days prior to, during, and for 24 hours after installation.
- B. Store materials in area of application; allow three days for material to reach same temperature as area.

PART 2 - PRODUCTS**2.1 MATERIALS**

- A. Resilient Rubber Base: Conform to ASTM F1861, with premolded end stops and external corners; 1/8" gage; provide coved base at hard floor surfaces, straight base at carpet unless otherwise indicated.
1. Type: Extruded rubber, available in 100' or 120' rolls.
 2. Manufacturers:
 - a. Flexco Co.
 - b. Burke-Mercer Flooring Products.
 - c. Johnsonite, Inc.
 - d. Substitutions: Refer to Section 01 63 00.
 3. Height: 4" or 6" as per the Finish Schedule unless otherwise indicated.

4. Color: As selected by Architect from manufacturer's full range of available colors.
- B. Primers and Adhesives: Water-resistant nontoxic types recommended by base manufacturer for specified material and application.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Rubber Base: Apply to walls, columns, pilasters, casework, and other permanent fixtures in rooms and areas where base is required.
 1. Fit base joints tight and vertical; maintain minimum measurement of 18" between joints.
 2. Miter internal corners; use molded sections for external corners and exposed ends.
 3. Install base on solid backing, adhere tightly to wall and floor surfaces; fill voids along top edge of base with manufacturer's recommended adhesive filler.
 4. Scribe and fit to door frames and other obstructions.
 5. Install straight and level to variation of plus or minus 1/8" over 10'-0".

3.2 CLEAN-UP

- A. Remove excess adhesive from floor, base and wall surfaces without causing damage.
- B. Clean surfaces in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 09 67 50**EPOXY FLOORING**

PART 1 - GENERAL**1.1 SUMMARY**

- A. Section Includes: Provide Roller-applied 100% solids, penetrating epoxy primer, midcoat, and a chemical, abrasion, and slip resistant, multi-component moisture cure urethane topcoat.
 - 1. Epoxy flooring shall be placed on both existing and new concrete surface.
 - 2. Include all surface preparation of existing surface in accordance with manufacturer's recommendations or as noted on the drawings.
 - a. Existing surface is epoxy flooring that exhibits substantial wear over a fully-cured concrete slab-on-grade.
 - 3. Include all base and accessories as required for complete finished installation.
- B. Related Sections:
 - 1. Section 03 30 00: Cast-In-Place Concrete

1.2 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature and maintenance instructions.
- B. Samples: Submit membrane applied to 1/4" plywood, or similar backing.
- C. Certifications:
 - 1. Project List: List minimum five projects of similar nature installed by applicator.
 - 2. Installer Acceptance: Submit manufacturer's certification installer is acceptable for this Project.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum of five years successful experience in application of flooring systems of type specified and acceptable to manufacturer of flooring system.
- B. Supervision: Manufacturer's representative shall supervise installation of system.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original manufacturer's sealed containers, identified with material name, date of manufacture and lot number.
- B. Store materials to prevent damage to containers.

1.5 PROJECT CONDITIONS

- A. Slab Temperature: Comply with manufacturer recommendations; minimum 50 degrees F at time of installation.
- B. Optimum air and substrate temperature for product application is between 55° F (13° C) and 95° F (35° C). For temperatures outside of this range, consult the manufacturer for product application suggestions.

1.6 WARRANTY

- A. Special Warranty: Provide for correcting failure of epoxy flooring.
 - 1. Special Warranty Period: Two years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Dexotex
- B. BASF, MasterTop Products
- C. Florock, Florothane Products
- D. PPG Industries, Megaseal or Amercoat Products
- E. Substitutions: Refer to Section 01 63 00.

2.2 MATERIALS

- A. Epoxy Flooring: Roller-applied 100% solids, epoxy primer followed by a multi-component moisture cure urethane topcoat providing an easily maintainable, wear-resistant flooring surface.
- B. Primer Coat: The primer shall be a 100% reactive, epoxy-based, penetrating primer that exhibits chemical resistance.
- C. Midcoat: The Midcoat shall consist of chemical resistant, self-leveling 100% solids epoxy.
- D. Topcoats: The topcoat shall be satin finish, color-stable, aliphatic moisture cure urethane, exhibiting excellent chemical resistance properties.
- E. Number of Topcoats: 2
- F. Basis of Design: Dexotex
 - 1. 1/8" Quartz Flake
 - 2. Color: Discovery
 - 3. HPT Topcoat
 - 4. #220 Aluminum Oxide Broadcast

PART 3 - EXECUTION**3.1 PREPARATION**

- A. Examine surfaces to receive epoxy flooring.
 - 1. Application constitutes acceptance of substrate and conditions.
- B. Prepare surface for epoxy flooring in accordance with flooring manufacturer recommendations but not less than following.
 - 1. Clean floor and apply, trowel and float filler to leave smooth, flat hard surface; prohibit traffic until filler is cured.
- C. Apply vapor retarding floor sealer in accordance with or if required by manufacturer recommendations and installation instructions.

3.2 INSTALLATION

- A. Comply with manufacturer's recommendations and instructions for application and quantities of materials.
 - 1. Mix and apply epoxy in accordance with directions, minimum two coat system, two coats plus primer where recommended by manufacturer.
- B. Aggregate spread rate and slip resistance shall be selected by Owner based on field conditions present. Consult with Owner or Owner's representative prior to proceeding with the work.
- C. Provide 1" radius coved base at all wall intersections.
- D. Height of coved base shall be determined in field by the Architect based on existing conditions.
 - 1. Minimum base height: 6"
 - 2. Maximum base height: 12"

3.3 PROTECTION

- A. Protect completed epoxy floor surface as required from stains and damage by covering with reinforced construction paper or covering recommended by flooring manufacturer.
- B. Protect walls and surfaces of finished work of others against damage or soiling resulting from epoxy flooring work.
- C. Repair damage caused by epoxy flooring work; clean using methods and materials recommended by manufacturers of damaged surfaces; replace materials that cannot be repaired to match adjacent undamaged materials.

END OF SECTION

SECTION 09 68 00**CARPET**

PART 1 - GENERAL**1.1 SUMMARY**

- A. Provide modular carpet tile where scheduled with required accessories, including edge strips where carpeting terminates at other floor finishes, as required for complete finished installation.

1.2 RELATED SECTIONS:

- A. Section 06 20 00: Finished Carpentry

1.3 SYSTEM DESCRIPTION

- A. Flammability: Provide carpet having passed following tests.
 - 1. DOC-FF-1-70: Pass.
 - 2. NFPA 258 (Smoke Density): 450 or less.
 - 3. ASTM E648 (Flooring Radiant Panel Test): 0.45 or higher.
- B. Static: Carpet shall develop less than 3.0 kilovolts of static at 70 degrees F and 20 percent relative humidity.
- C. Indoor Air Quality Standards: Provide carpet materials that bear Carpet and Rug Institute "Green Label Plus".

1.4 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature for carpet and accessories.
- B. Samples: Furnish each type, color and pattern of carpet and edge strip.
- C. Maintenance Recommendations: Prior to final acceptance of carpet installation, furnish carpet manufacturer's detailed maintenance recommendations for care, cleaning and repair of carpets installed.
- D. Certificate of Compliance: Furnish manufacturer's certificate of compliance stating each material delivered conforms to Specifications.

1.5 QUALITY ASSURANCE

- A. Manufacturer: The carpet manufacturer shall have no less than fifteen years of production experience with modular carpet similar to type specified. Published product literature of carpet manufacturer must clearly indicate compliance of products with requirements of this section.

- B. Commitment to Quality: Carpet manufacturer must provide verification of its registration to the ISO 9001/9002 Quality Management System.
- C. Commitment to sustainability: Carpet manufacturer must demonstrate environmental responsibility through programs of source reduction, recycling, reuse and conservation and registration to the ISO 14001 Environmental Management System.
- D. Installer Qualifications: The carpet installer shall be directly responsible for the quality of the completed floorcovering installation, including both the quality of the materials and labor used in the installation. The carpet installer must directly warrant to owner that all products, materials and services related to the floorcovering installation (including any floorcovering(s), adhesive(s) and/or other products or materials used in the installation) will meet specifications set forth herein. The product warranty required herein must be provided directly by the carpet manufacturer.
 - 1. The carpet installer must have successful carpet installation experience similar to the work of this Section.
 - 2. The carpet installer shall be pre-approved by carpet manufacturer. Upon request, submit letter from carpet manufacturer stating installer is acceptable.

1.6 PROJECT CONDITIONS

- A. Do not commence carpet installation until painting and finishing work is complete and ceiling and other overhead work has been tested, approved and completed, unless specifically approved.
- B. Maintain room temperature at minimum 60 degrees F for at least 24 hours prior to installation; relative humidity shall be approximately that at which the area is to be maintained.
- C. Schedule, receive and place carpet on floors indicated; protect from soiling and damage during transit, storage, and installation.

1.7 WARRANTY

- A. Manufacturer: Provide the following written warranties by carpet manufacturer for a period of not less than 15 years:
 - 1. Wear: Surface fiber wear shall not be more than 10% by weight in 15 years.
 - 2. Static - Static generation at less than 3.0 kV at 70° F, and 20% R.H.
 - 3. No delamination
 - 4. No edge ravel
 - 5. No dimensional instability (i.e., shrinkage, curling and doming) which adversely affect the ability of the tile to lay flat.
- B. Special Installation Warranty: Provide for promptly repairing or replacing, at no cost to Owner, carpet which exhibits evidence of defective materials or workmanship.
 - 1. Repairs: Make repairs within ten days of Owner's written notification.
 - 2. Special Warranty Period: Two years.

1.8 MAINTENANCE

A. Extra Materials:

1. Provide carpet tile for each type, size, and color installed equivalent to 5% of tiles installed.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Modular Carpet Tile Performance Standards. Modular carpet tile shall meet the following performance standards:

1. Carpet Flammability

a.	Pill Test (ASTM D2859 or CPSC FF-1-70)	Passes
b.	Radiant Panel Test (ASTM E648)	> 0.45 watts/cm2,
c.	Smoke Density (ASTM E662)	< 450 Flaming Mode
d.	Dimensional Stability (Aachen Method Din 54318)	< 0.1% change
e.	Static Generation at 70° F (AATCC 134 w/ neolite)	< 2.5 kV at 20% R.H.
f.	Lightfastness (AATCC 16E)	4.0 after 60 hours
g.	Gas Fade (AATCC 23)	4
h.	Ozone Fade (AATCC 109)	4
i.	Fungicidal (AATCC 174, Part III)	No growth
j.	Soil/Stain Protection (AATCC 175-1991)	> 8.0 on the Red 40 Stain Scale
k.	California 01350	Passes

B. Carpet Type C-1: Product Specification. Modular carpet tile shall meet the following specifications:

1. Basis of Design:

- a. Yarn System: Premium branded type 6 nylon.
- b. Dye Method: Minimum 81% Solution Dyed, 19% Yarn Dyed
- c. Mergeability: Carpet that is of the same style/color, but from different dyelots and/or manufacturing dates, may be merged and used interchangeably, both at initial installation and at later selective replacement, to create a continuous carpeted surface with no tile appearing out of place
- d. Construction: Tufted
- e. Patterning: Integrated (topical application or wet patterning not allowed)
- f. Texture: Textured Loop
- g. Gauge/Stitch: Minimum 1/10
- h. Texture Appearance Retention Rating: TARR 3.0 or greater

- i. Pile Face Weight: Maximum 20 oz. per yard (lower face weights are preferable if equal or superior performance can be substantiated by Appearance Retention Testing, TARR 3.0 or greater).
 - j. Primary Backing: Must be non-woven. Woven primary backings not allowed.
 - k. Secondary Backing: Fiberglass Reinforced Thermoplastic Composite containing not less than 39% post-consumer and/or post-industrial material content. Secondary backing must be 100% recyclable at the end of its useful life.
 - l. Soil/Stain Resistance: Application by fiber producer and manufacturer required.
 - m. Random Installation Method: All product must be designed for random installation, meaning that each and every tile can be installed in any of the four possible directions without regard to pile direction, pattern or orientation of any adjacent tiles while still creating a finished carpet tile assembly that appears to be a visually continuous carpeted surface with no tile appearing out of place or improperly positioned.
 - n. Color and Pattern: As selected from full range of manufacturer options meeting above specification.
2. Manufacturers:
- a. Patcraft Commercial Carpet
 - b. Shaw Carpet
 - c. Substitutions: Refer to Section 01 63 00.

2.4 RELATED CARPET MATERIALS

- A. Leveling compound - Latex type as recommended by carpet manufacturer. Must be compatible with carpet adhesive and curing/sealing compound on concrete.
- B. Releasable pressure sensitive type adhesive – Adhesive must be water-based and allow for removal of carpet tile at any time without damage to carpet or substrate.
- C. Adhesive must contain antimicrobial preservative and have “zero” calculated VOC’s.
- D. Carpet edge guard, non-metallic - Extruded or molded heavy duty vinyl or rubber carpet edge guard of size and profile indicated, and with minimum two inch wide anchorage flange; colors selected by architect/designer from among standard colors available within the industry.
- E. Miscellaneous materials - As recommended by manufacturer of carpet. Other carpeting products selected by installation provider to meet project requirements.

PART 3 - EXECUTION**3.1 PREPARATION**

- A. Clean floors of dust, dirt, solvents, oil, grease, paint, plaster and other substances detrimental to proper performance of adhesive and carpet; allow floors to thoroughly dry.
- B. Ensure floors are level, with maximum surface variation of 1/4" in 10 feet.
- C. Ensure concrete floors are free from scaling and irregularities and exhibit neutrality relative to acidity and alkalinity.
- D. Use leveling and ramping material to patch cracks, small holes, leveling and for ramping to provide finished carpet within 1/2" of adjacent flooring materials.

3.2 INSTALLATION

- A. General: Comply with manufacturer's instructions and recommendations. A "No-Glue Grid" method of installation is preferred if feasible.
 - 1. Install carpet under open-bottom obstructions and under removable flanges and furnishings, and into alcoves and closets of each space.
 - 2. Provide cut outs where required. Conceal cut edges with protective edge guards or overlapping flanges.
 - 3. Run carpet under open bottom items such as heating convectors and install tight against walls, columns and cabinets so that the entire floor area is covered with carpet. Cover over all floor type door closures.
 - 4. Install edging guard at all openings and doors wherever carpet terminates, unless indicated otherwise.
 - 5. Cutting shall be done in accordance with the manufacturer's recommendation, using the tools designed for the carpet being installed. Use leveling compound where necessary. Any floor filling or leveling shall have a minimum of 4'0" of feather.
 - 6. Expansion joints - Do not bridge building expansion joints with continuous carpeting.
- B. Installation: Install carpet according to carpet manufacturer's printed instructions and in accordance with the Carpet and Rug Institute's Installation Standard.
 - 1. "Chair Pads" shall not be recommended or required within installation instructions.

3.3 CLEANING AND PROTECTION

- A. Upon completion of the installation in each area, all dirt, carpet scraps, etc. must be removed from the surface of the carpet.
- B. Remove debris, and sort pieces to be saved from scraps to be redirected and recycled.
- C. Protect carpeting against damage during construction.
- D. At the completion of the work vacuum carpet using commercial dual motor vacuum of type recommended by carpet manufacturer. Remove spots and replace carpet where spots cannot be removed. Remove rejected carpeting and replace with new carpeting. Remove any protruding yarns with shears or sharp scissors.

3.4 INSPECTION

- A. Upon completion of the installation, verify that work is complete, properly installed and acceptable.
- B. Preliminary Acceptance - Upon completion of the carpet installation of each floor, it shall be inspected by the Architect, Owner, Construction Manager, and installer.

END OF SECTION

SECTION 09 77 30

FIBERGLASS REINFORCED PANELS

PART 1 - GENERAL**1.1 SUMMARY**

- A. This Section includes the following:
 - 1. Fiberglass Reinforced Plastic (FRP) panels for adhesive mounting.
 - 2. Moldings, adhesive, and joint sealants.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM D2583 Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
 - 2. ASTM D5319 Standard Specification for Glass-Fiber Reinforced Plastic Wall and Ceiling Panels.
 - 3. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 SYSTEM DESCRIPTION

- A. Performance Requirements: Provide fiberglass reinforced panels that have been manufactured and installed to maintain performance criteria stated by manufacturer without defects, damage or failure.

1.4 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used.
- B. Selection Samples:
 - 1. For each finish specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- C. Maintenance Instructions: For inclusion in Operating and Maintenance Data.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed installation of fiberglass reinforced panels 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.

- B. Manufacturer Qualifications: A firm experienced in manufacturing fiberglass reinforced panels similar to those required for this Project and with a record of successful in-service performance.
- C. Source Limitations: Obtain each color, grade, finish, and type of fiberglass reinforced panels from a single source with resources to provide components of consistent quality in appearance and physical properties.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact. Package sheets on skids or pallets for shipment to project site.
- B. Store wall surface-protection materials in original undamaged packages and containers inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
 - 1. Store products indoors and protect from moisture, construction traffic and damage.
 - 2. Store panels flat on clean, dry surface. Do not stand on edge or stack on fresh concrete or other surfaces that emit moisture.
 - 3. Store panels at least 24 hours with temperature and humidity conditions approximating the average environment of the finished room.
- C. Handling: Remove foreign matter from face of panel by use of a soft bristle brush, avoiding abrasive action.

1.7 PROJECT CONDITIONS

- A. Environmental Requirements:
 - 1. During installation and for not less than 48 hours before, maintain an ambient temperature and relative humidity within limits required by type of adhesive used and recommendation of adhesive manufacturer.
 - 2. Provide ventilation to disperse fumes during application of adhesive as recommended by adhesive manufacturer.
- B. Field Measurements: Verify actual measurements and openings by field measurements before fabrication. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.8 WARRANTY

- A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.
- B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. Available Manufacturers: Subject to compliance with requirements, provide the following:

Crane Composites, Channahon, Illinois
Marlite, Dover, Ohio
Nudo Products, Springfield, Illinois
Substitutions: Refer to Section 01 63 00.

2.2 MATERIALS

- A. Panels:

1. Fiberglass reinforced panels "Pebbled Surface" Panels.

- B. Panel Size:

1. Wall Panel Width: 48 inches.
2. Wall Panel Length: 96 inches, 120 inches or 144 inches, as required to conform to wall height indicated on the drawings. Provide full-height panels from floor to ceiling.

- C. Thickness:

1. Standard Panels: 0.09 inch thick.

- D. Dimensional Tolerances:

1. Width and Length: 1/8 inch.
2. Thickness: +/- 10%.
3. Squareness: Not more than 1/8 inch out of square.

- E. Panel Finish:

1. Exposed Surface: Pebble-like embossed finish.
2. Back Surface: Smooth. Imperfections that do not affect functional properties are not cause for rejection.
3. Color: Uniform throughout. As selected by the Architect from manufacturer's standard range of colors.

- F. Panel Physical Properties: Provide products with the following properties:

1. Surface Burning Classification: Class A; flame spread (ASTM E84): 25 or less; smoke developed (ASTM E84): 450 or less.

- G. Trim: Provide panel manufacturer's standard vinyl moldings to meet project conditions. Provide division bar, inside corner, outside corner and end cap.
 - 1. 0.09 inch Contractor Trim: Match panel color.
- H. Fasteners: Nonstaining nylon drive rivets; match panel colors and length to suit project conditions.
- I. Adhesives as recommended by fiberglass reinforced panels manufacturer:
 - 1. Porous Surfaces: A high-quality, low-odor, non-flammable latex-based fiberglass reinforced panels adhesive for application over approved porous surfaces such as drywall or plywood. The adhesive VOC limit shall be 50 or less. Provide Marlite Brand C-551 Fiberglass Reinforced Panel Adhesive (Latex based) adhesive, Henry's or approved alternate adhesives.
 - 2. Non-Porous Surfaces: A strong, flexible, moisture-resistant, all-purpose adhesive formulated for fast, easy application over many non-porous surfaces. Synthetic rubber base remains pliable to compensate for movement of structural surfaces up to 1/8". The adhesive VOC limit shall be 50 or less. Provide adhesive recommended by manufacturer.
- J. Sealant as recommended by fiberglass reinforced panels manufacturer:
- K. Source Quality: Obtain fiberglass reinforced panels from a single manufacturer. Provide panels and molding only from manufacturer specified to ensure warranty and color harmonization of accessories.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Take panels out of cartons and allow to acclimatize to room conditions for at least 48 hours prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions
- C. Clean surfaces thoroughly prior to installation.
- D. Protect existing surfaces from damage due to installation.

3.3 INSTALLATION

- A. Fiberglass Reinforced Plastic Panel Installation:
 - 1. Cut and drill panels with carbide tipped saw blades or drill bits, or cut with snips.
 - 2. Install panels with manufacturer's recommended gap for panel field and corner joints.
 - 3. Pre-drill fastener holes in panels with 1/8 inch oversize.
 - 4. For trowel type and application of adhesive, follow adhesive manufacturer's recommendations.
 - 5. Using products acceptable to panel manufacturer, install fiberglass reinforced panels in accordance with panel manufacturer's printed instructions. Comply with panel manufacturer's Installation Guide.
- B. Install in accordance with manufacturer's instructions.
- C. Use the adhesives recommended by the panel manufacturer unless prohibited by local regulations; obtain manufacturer's approval of alternative adhesives.
- D. Install continuous bead of silicone sealant in each joint and trim groove and between trim and adjacent construction, maintaining 1/8 inch expansion space.
- E. Avoid contamination of panel faces with adhesives, solvents, or cleaners; clean as necessary and replace if not possible to repair to original condition.
- F. Protect installed products until completion of project.
- G. Touch-up, repair or replace damaged products after Substantial Completion.

END OF SECTION

SECTION 09 91 00**PAINTS AND COATINGS**

PART 1 - GENERAL**1.1 SUMMARY****A. Section Includes:**

1. Provide painting and finishing of exposed items and surfaces.
 - a. Specified surface preparation, priming and coats of paint are in addition to shop-priming and surface treatment specified under other sections of work.
 - b. Painting and finishing includes field finishing of exterior and interior items not listed as "Surfaces not to be Painted" unless clearly indicated otherwise.
 - c. Painting and finishing includes field finishing of select shop finished items where indicated as required to match adjacent surfaces.

B. Surfaces Not To Be Painted:

1. Finished items including finished metal surfaces.
2. Walls and ceilings in concealed areas and generally inaccessible areas.
3. Moving parts of operating mechanical and electrical units.
4. Labels: Keep equipment identification and fire rating labels free of paint.
5. Plastic smoke stops and weather-stripping at doors.

1.2 RELATED SECTIONS:

- A. Section 09 96 00 – High Performance Coatings

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's technical information, including paint label analysis and application instructions for each material.
- B. Samples: Submit samples for review of color and texture; provide list of material and application for each coat of each finish sample.
1. Brush-Outs: Submit samples of each color and material with texture to simulate actual conditions, on hardboard.

- a. Submit 8" by 10" samples of wood finishes on actual wood surfaces; label and identify each as to location and application.
- 2. Field Samples: Duplicate painted finishes of approved samples on actual wall surfaces and components for approval prior to commencing work.
 - a. Size: Minimum 100 sf located where approved.
 - b. Components: One full component as directed.
 - c. Simulate finished lighting conditions for review.
- C. Certificates: Furnish certificates from each manufacturer stating materials are top quality lines and suitable for intended use on this Project.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Furnish materials approved for use by applicable air quality management district for limitations of volatile organic compounds for architectural or special coatings as applicable.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to job site in original, new and unopened packages and containers bearing manufacturer's name and label, with:
 - 1. Name of material, color and sheen.
 - 2. Manufacturer's name, stock number and date of manufacture.
 - 3. Contents by volume, for major pigment and vehicle constituents.
 - 4. Thinning and application instructions.

1.6 SITE CONDITIONS

- A. Apply water-base paints when temperature of surfaces and surrounding air are between 50 and 90 degrees F.
- B. Do not apply paint in rain, fog or mist; or when relative humidity exceeds 85 percent; or to damp or wet surfaces.
- C. Painting may be continued during inclement weather if areas to be painted are enclosed and heated within temperature limits specified.
- D. Provide additional temporary ventilation during interior application of paints to eliminate volatile organic compound (VOC) emissions from interior spaces as quickly as possible.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Benjamin Moore & Co.

- B. Sherwin Williams.
- C. Dunn-Edwards Corp.
- D. P.P.G. Industries, Inc., Coatings and Resins Division.
- E. Devoe & Reynolds Co.
- F. Substitutions: Refer to Section 01 63 00.

2.2 MATERIALS

- A. Definition: "Paint" as used herein means coating systems including primers, emulsions, enamels, stains, sealers and fillers, whether used as prime, intermediate or finish coats.
- B. Material Quality: Provide top line quality commercial grade (professional painter) paints; materials not bearing manufacturer's identification as a best-grade product shall not be acceptable.
 - 1. Primers: Provide premium grade primers recommended by paint manufacturer for substrates indicated and for finish systems specified.
 - 2. Undercoats and Barrier Coats: Provide undercoat paints produced by same manufacturer as finish coats; use only thinners approved by paint manufacturer, and use only within recommended limits.
 - 3. Finish Coats: Provide finish coats capable of being washed with mild detergent without loss of color, sheen, or pigments.
 - a. Color pigments: Pure, non-fading, applicable types to suit substrates and service indicated; no lead content permitted.
 - 4. Finish Coat Coordination: Provide finish coats which are compatible with prime paints, undercoats, and barrier coats used.
 - a. Review other Specification sections in which prime paints are provided; ensure compatibility of total coatings systems.
 - b. Upon request from other trades furnish information on characteristics of finish materials proposed for use.
 - c. Provide barrier coats over incompatible primers or remove and prime as required.
 - d. Notify Architect in writing of any anticipated problems in use of specified coating systems with substrates primed by others.

- C. Colors and Finishes: Prior to commencement of painting work, Architect will furnish color chips for surfaces to be painted.
 - 1. Use of proprietary names in color selection is not intended to imply exclusion of equivalent products of other manufacturers.
 - 2. Final acceptance of colors will be from samples applied on site.
- D. Volatile Organic Compound (VOC) Emissions: Select materials that generate least amount of pollution; consider pollution and volatile organic compound (VOC) emissions generated during manufacturing, transport, installation, use, and disposal.
 - 1. Avoid materials that contain ozone depleting chemicals and that emit potentially harmful volatile organic compound (VOC) emissions.
 - 2. Avoid materials that can leach harmful chemicals into ground water; do not allow potentially harmful chemicals to enter sewers nor storm drains.
 - 3. Select materials that can be reused or recycled and materials with significant percentage of recycled content; set specific recycled content percentages for individual materials; avoid materials difficult to recycle.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Inspection: Examine areas and conditions under which painting work is to be applied.
 - 1. Start of painting work indicates acceptance of surfaces and conditions of surfaces and conditions within any particular area.
 - 2. Where exposed items or surfaces are not specifically mentioned in Schedules, paint same as adjacent similar materials or areas.
 - 3. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to a durable paint film.
- B. Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as specified for substrate condition.
 - 1. Existing Painted Finishes:
 - a. Clean existing painted surfaces and remove oil, grease, dust, stains, scale, efflorescence, mildew, mold, algae, blisters, and non-adhering paint.
 - b. Measure adhesion of existing paints using ASTM D3359 tape test; remove existing coatings where poor adhesion is indicated.
 - c. Feather edges of severely deteriorated paint where several coats are removed as part of cleaning, to provide smooth transition for new paint.

- d. Fill holes, cracks, and defects and fill and sand smooth, ready for new paint finish.
- C. Remove hardware, accessories, and items in place and not to be painted, or provide protection prior to surface preparation and painting; after painting reinstall removed items.
- D. Clean surfaces before applying paint; remove oil and grease prior to mechanical cleaning; program cleaning so contaminants from cleaning process do not fall onto wet, newly painted surfaces.
- E. Cementitious Materials: Prepare by removing efflorescence, chalk, dirt, grease, oils, and by roughening as required to remove glaze.
 - 1. Determine alkalinity and moisture content of surfaces to be painted.
 - 2. If surfaces are found to be sufficiently alkaline to cause blistering and burning of finish paint, neutralize before application of paint.
 - 3. Do not paint over surfaces where moisture content exceeds manufacturer's printed directions.
- F. Wood: Clean wood surfaces of dirt, oil, and other foreign substances; sandpaper smooth surfaces exposed to view, and dust off.
 - 1. Scrape and clean seasoned knots and apply thin coat of recommended knot sealer, before application of priming coat.
 - 2. Prime, stain, or seal wood required to be job-painted immediately upon delivery to job; prime edges, ends, faces, undersides, and backsides of wood.
 - 3. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler; sandpaper smooth when dry.
- G. Ferrous Metals: Touch up shop-applied prime coats wherever damaged using same type of primer as applied in shop or barrier coat compatible with finish paint.
 - 1. Bare Surfaces: Clean surfaces that are not galvanized or shop-coated, of oil, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning.
 - 2. Galvanized Surfaces: Clean free of oil and surface contaminants, using non-petroleum based solvent; primer and touch-up primer to be zinc-rich primer.
- H. Mix painting materials in accordance with manufacturer's directions.
- I. Store materials in tightly covered containers; maintain containers used in storage, mixing and application of paint in a clean condition, free of foreign materials and residue.
- J. Stir materials before application to produce mixture of uniform density, and stir as required during application; do not stir surface film into material, if necessary, strain material before using.

3.2 APPLICATION

- A. Apply paint in accordance with manufacturer's directions; use applicators and techniques best suited for substrate and type of material being applied.
 - 1. Apply additional coats when stains or blemishes show through final coat, until paint is a uniform finish, color and appearance.
 - 2. Provide extra attention to assure dry film thickness at corners and crevices is equivalent to that of flat surfaces.
 - 3. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces; paint surfaces behind permanently-fixed equipment and furniture with prime coat only.
 - 4. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.
 - 5. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
 - 6. Finish doors on tops, bottoms and side edges same as faces.
 - 7. Sand lightly between each succeeding enamel coat and each varnish coat.
- B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated or prepared for painting as soon as practicable after preparation.
 - 1. Allow time between successive coatings to permit proper drying.
 - 2. Do not recoat until paint feels firm and does not deform or feel sticky under moderate thumb pressure.
- C. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry film thickness as recommended by coating manufacturer.
- D. Prime Coats: Apply to items not previously primed; recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat.
- E. Finish Coats: Provide even texture; leave no laps, irregularity in texture, skid marks, or other surface imperfections.
 - 1. Opaque Finishes: Provide opaque, uniform finish, color and coverage; cloudiness, spotting, holidays, brush marks, runs, sags, ropiness, and other surface imperfections are not acceptable.
 - 2. Transparent and Stained Finishes: Produce glass smooth surface film of even luster; provide with no cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, and other surface imperfections.

- F. Completed Work: Match approved samples for color, texture and coverage; remove, refinish or repaint work not accepted.

3.3 PAINTING SCHEDULE

A. Exterior Work: Provide the following paint systems:

1. Plaster Surfaces: Flat sheen.
 - a. 1st Coat: Heavy body waterproof elastomeric acrylic coating.
 - b. 2nd Coat: Heavy body waterproof elastomeric acrylic coating.
2. Metal: Semigloss sheen.
 - a. 1st Coat: Touch-up primer, prime if none.
 - b. 2nd Coat: Exterior alkyd or 100% acrylic enamel.
 - c. 3rd Coat: Exterior alkyd or 100% acrylic enamel.
3. Opaque Finished Wood: Semigloss sheen.
 - a. 1st Coat: Primer undercoat.
 - b. 2nd Coat: Exterior alkyd or 100% acrylic enamel.
 - c. 3rd Coat: Exterior alkyd or 100% acrylic enamel.

B. Interior Work: Provide following paint systems.

1. Gypsum Board Systems: Eggshell sheen at walls, Flat sheen at ceilings.
 - a. 1st Coat: Universal primer.
 - b. 2nd and 3rd Coat: Interior latex or acrylic latex emulsion.
2. Gypsum Board Systems at Wet Areas: Satin sheen at walls, Satin sheen at ceilings.
 - a. 1st Coat: Universal primer.
 - b. 2nd and 3rd Coat: Interior latex or acrylic latex emulsion.
3. Metal: Semigloss sheen.
 - a. 1st Coat: Touch-up primer, prime if none.
 - b. 2nd and 3rd Coat: Alkyd or 100% acrylic enamel.
4. Opaque Finished Wood: Semigloss sheen.
 - a. 1st Coat: Primer undercoat.
 - b. 2nd and 3rd Coat: Alkyd or 100% acrylic enamel.

C. Sheens: Comply with ASTM D523, reflectance of paint.

1. Flat: 1-10.
2. Satin: 15-30.
3. Eggshell: 30-45.
4. Semigloss: 45-75.
5. Gloss: 75-100.

3.4 CLEAN-UP, PROTECTION, AND REPAIR

A. Clean-Up: During progress of work, remove discarded paint materials, rubbish, cans and rags from site at end of each work day.

1. Clean glass and paint-spattered surfaces immediately by proper methods of washing and scraping, using care not to scratch or damage finished surfaces.

B. Protection: Protect work of other trades, whether to be painted or not; correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.

1. Provide "Wet Paint" signs to protect newly-painted finishes.
2. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.

C. Repair: At completion of work of other trades, touch-up and restore damaged surfaces or defaced painted surfaces.

END OF SECTION

SECTION 09 93 00**HARDWOOD FLOOR FINISH**

PART 1 - GENERAL**1.1 SUMMARY****A. Section Includes:**

1. Provide all labor and material for refinishing existing hardwood plank floors and finishing new hardwood plank floors so that all hardwood plank flooring matches in terms of wood species, grain, dimension, color and sheen.
 - a. Hardwood floor adhesives, finishing and maintenance of the following types:
 - 1) Stains.
 - 2) Waterborne finishes
 - b. This work includes hardwood plank sanding of both existing and new finishes.
 - c. Coordinate refinishing hardwood with other finish trades including, but not limited to, removal of existing wood base prior to start of work. New wood base as scheduled should be installed after hardwood floor finish has been completed.
 - 1) Field verify construction sequence with General Contractor.
 - d. Work shall be completed in strict accordance with National Wood Flooring Association Guidelines. A copy of these guidelines are available from the Architect upon request.

1.2 REFERENCES**A. ASTM International (ASTM):**

1. ASTM D2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.
2. ASTM E492 - Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine.
3. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

- B. National Wood Flooring Association (NWFA) – Sanding and Finishing Guidelines and Methods.

1.3 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature and indicate each for materials, finishes, and equipment including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- B. Verification Samples: For finish product specified, provide two samples, minimum size 6 inches square, representing actual product, color, and patterns.
 - 1. Samples to match existing floor finish.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualification: Use an experienced hardwood floor refinisher with at least ten (10) years of experience.
- B. Use a single manufacturing source to produce all finish products ready for installation.

1.5 PRE-INSTALLATION CONFERENCE

- A. A pre-installation meeting will be held with the Contractor, Architect, and Owner to address the project details prior to the commencement of work.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver all materials in original, unopened packaging and store them under appropriate environmental conditions to prevent damage.
- B. Store and dispose of all solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Sandpaper: Per NWFA Guidelines, use 80, 100, 120, 150 grit sandpaper for various sanding stages, compatible with machine sanding and hand sanding.

- B. Wood Filler: Select a suitable wood filler that matches the wood species and finish to be applied.

- C. STAINS

- 1. Fast Drying Stain:
 - a. Solids: 35 to 47 percent.
 - b. Low VOC as per California CalGreen Regulations
 - c. Odor: Mild solvent.
 - d. Stability: 2-year shelf life in unopened container.
 - e. Flashpoint: 116.6 degrees F (47 degrees C).
 - f. Clarity: Semi-transparent (dry).

- D. WATERBORNE FINISHES

- a. Ingredients: Water, Polymeric resins, and amorphous silica.
 - b. Color: Milky white (wet).
 - c. Clarity: Clear and colorless when dry.
 - d. pH: 7.9.
 - e. Solids: 34 percent (with hardener).
 - f. Density: 8.70 lbs per gal (1.04 s.g.).
 - g. Low VOC as per California CalGreen Regulations
 - h. Coefficient of Friction: Greater than or equal to 0.5.
 - i. Gloss Level (60 degrees):
 - j. Commercial Extra Matte: 7 to 10 percent.
 - k. Commercial Satin: 15 to 20 percent.
 - l. Commercial Semi-Gloss: 40 to 45 percent.
 - m. Odor: Very slight non-offensive odor.
 - n. Stability: 1-year shelf life in unopened container.
 - o. Cure Time: 100 percent after 3 days
 - p. Certification: GREENGUARD Certified Gold for indoor air quality.

2.1 EQUIPMENT

- A. Sanding Machines: Per NFWA Guidelines, use belt sanders, orbital sanders, or edge sanders where appropriate for the project.
- B. Hand Sanders: Specify the type of hand sanders (e.g., palm sanders, scrapers).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of work.
- B. Do not begin installation until substrates have been properly prepared.

- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- D. Building climate control system shall be functioning with a temperature of 65 to 80 degrees and maximum relative humidity of 70 percent for 72 hours before flooring is installed, during installation, and for 72 hours after installation. Acclimate flooring according to manufacturer's instructions.

3.2 PREPARATION – EXISTING WOOD FLOORING

- A. Surface Preparation: Remove any loose flooring elements or hardware. Securely protect doorways and any surrounding areas from damage.
- B. Environmental Conditions: Maintain appropriate room temperature and humidity levels during the refinishing process.
- C. Removal of Existing Finish: Carefully remove the existing floor finish to allow for the appropriate sanding and refinishing as required by NWFA Guidelines.
- D. For moisture content and quality of substrates, the guidelines of the wood floor manufacturer shall be followed.
 - 1. Wood Subfloor Moisture Content: 20 percent maximum.
- E. Do not open wood floor packaging until ready for installation.
- F. Sweep and vacuum clean substrates to be covered by wood flooring products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 SANDING

- A. Sand all existing and new wood flooring together in one continuous operation.
- B. Sanding Procedure: Sand all wood flooring in the direction of the wood grain. Follow appropriate NWFA Guidelines.
- C. Grit Selection: Use appropriate grits for each sanding stage to ensure a smooth, even surface as per NWFA Guidelines.
 - 1. Stained Floors: Make final cut with 80 to 100 grit paper. Then multidisc with 80 to 120 grit paper.
 - 2. Unstained Floors: Make final cut with 80 to 120 grit paper. Then multidisc with 120 to 150 grit paper. This burnishing will reduce the amount of grain raise.
- D. Clean the surface after each sanding stage to remove dust and debris

1. Use a Tampico Brush on a buffer and vacuum thoroughly.
2. Tack with a dry Microfiber Tacking Pad or cloth to remove dust.

3.4 STAIN APPLICATIONS

- A. Shake or stir well before applying. Do not thin.
- B. After Surface Preparation: Apply stain with brush, cut-in pad, cloth or carpet disc driven by a buffer in the direction of the grain.
 1. Coverage Rate: As per manufacturer's recommendations.
 2. Penetration Time: Allow 1 to 3 minutes.
 3. Remove excess by hand wiping or buffing with an absorbent, non-abrasive material.
- C. Allow Stain to Dry Thoroughly:
 1. Wood Tones: 2 hours minimum.
 2. Ideal Drying Conditions: 60 to 80 degrees F with 35 to 75 percent relative humidity.
 - a. High humidity and/or low temperature conditions extend dry time.
 3. Increased ventilation and airflow reduces dry time.
- D. Sealer or Finish Application: Within 48 hours after stain application.

3.5 WATERBORNE FINISH APPLICATIONS

- A. Application:
 1. Apply finish going with grain of wood.
 2. Feather out each stroke to avoid applicator marks.
 3. Use manufacturer's recommended coverage rate of sq ft per gallon.
 4. Allow each coat to dry thoroughly. Recommended conditions of 65 to 80 degrees, and 40 to 60 percent relative humidity.
 5. Waterborne Finishes: 2 to 3 hours.
 - a. High humidity and/or low temperature conditions extend dry time.
 - b. Increased ventilation and airflow reduces dry time.

- B. For Smoothest Results: Abrade between coats as necessary. Use multidisc Bona Diamond 180 to 240 grit abrasives with Bona Intermediate Pads.
- C. Thoroughly clean abraded floor using vacuum and tack with microfiber tacking cloth.

3.6 CLEANING AND PROTECTION

- A. Perform the following operations immediately after completing installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
- B. Protect wood flooring products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- C. Cover installed wood flooring to protect it from damage or deterioration, during remainder of construction period until Substantial Completion. Use heavy kraft-paper or other suitable covering.
 - 1. Do not use plastic sheet or film that could cause condensation.
- D. Do not tape protection material to wood flooring.
- E. Do not move heavy and sharp objects directly over surfaces. Place hardboard or plywood panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION

SECTION 09 96 00**HIGH PERFORMANCE COATINGS**

PART 1 - GENERAL**1.1 SUMMARY**

- A. Section Includes: Provide high performance coating system of urethane over epoxy primer as indicated, including surface preparation, priming and high-performance coating application. High-performance coating requires a minimum of three coats as specified. Items requiring high performance coating include:
1. Existing steel window frames, mullions, and divided lites scheduled for renovation.
 2. Existing steel trusses above apparatus bays.
 3. Existing steel bollards at all apparatus bay door openings.
 4. Existing tower handrails and pickets.
 5. Brackets, braces, channels, and connectors including bolts, nuts, and washers.
 6. All exposed ferrous metal or galvanized surface painted gate posts, frames, mounting plates, and components.

1.2 SUBMITTALS

- A. Product Data: Manufacturer's technical information, including coating label analysis and application instructions for each material.
1. Provide certificate from each manufacturer stating material is top quality line and suitable for intended use on this Project.
- B. Samples: Submit samples for review of color and texture; provide list of material and application for each coat of each finish sample.
1. Provide samples of each color and material with texture to simulate actual conditions.

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements: Provide materials complying with applicable air quality management requirements for volatile organic compound (VOC) emissions limitations.
1. Materials: Approved for use by applicable air quality management district for limitations of volatile organic compound (VOC) emissions for special coatings.
- B. Mock-Up: Duplicate finish of approved samples in field at location as approved by Architect, one complete component or approximately 100 square feet, for approval prior to commencing work.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to job site in original, new and unopened packages and containers bearing manufacturer's name and label, with:
 - 1. Name of material, color and sheen.
 - 2. Manufacturer's name, stock number and date of manufacture.
 - 3. Contents by volume, for major pigment and vehicle constituents.
 - 4. Thinning and application instructions.

1.5 PROJECT CONDITIONS

- A. Apply high performance coating when temperature of surfaces and surrounding air are between manufacturer recommended temperatures.
- B. Do not apply high performance coating in rain, fog or mist; or when relative humidity exceeds 85 percent; or to damp or wet surfaces.

1.6 WARRANTY

- A. Special Warranty: Provide for correcting failure of high performance coating including peeling, chipping, rusting of substrate, cracking, delamination, chalking, and loss of color and sheen.
 - 1. Special Warranty Period: Two years.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Special Coating: High build acrylic polyurethane or aliphatic polyurethane over compatible epoxy primer as recommended by coating manufacturer and suitable for applications indicated and based on quality of following products.
 - 1. Manufacturers:
 - a. DuPont Co. Maintenance Finishes/Imron with 25P primer.
 - b. Tnemec Company, Inc./Endura-Shield with Epoxoline primer.
 - c. Ameron Protective Coatings Div./450 HS with Amerlock 400 primer.
 - d. Substitutions: Refer to Section 01 25 13 and General Conditions 00 7202.2.
 - 2. Special Coating System: Provide specific primer and coating as recommended by manufacturer for applications indicated, conforming to specified requirements.
 - a. Touch-Up: Apply zinc-rich primer to welds and to surfaces either not previously galvanized or where galvanized coating has been damaged; entire steel surface to have either galvanized or zinc-rich coating.
 - b. 1st Coat: Epoxy primer.
 - c. 2nd Coat: High-build acrylic polyurethane or high-build polyurethane.

- d. 3rd Coat: High-build acrylic polyurethane or high-build polyurethane.
 - e. Clear Coat: Provide additional clear coat where recommended by coating manufacturer representative based on color, sheen, or location.
3. System Requirements:
- a. Abrasion: ASTM D4060, CS-17 Wheel, 1,000 grams load, no more than 95 mg. loss after 1000 cycles.
 - b. Adhesion: ASTM D3359 Method B (Crosshatch Adhesion), coating applied to sandblasted steel and cured 30 days at 77° F, minimum rating of 5 on average of three tests.
 - c. Humidity: ASTM D4585, no blistering, cracking or delamination of film after 1000 hours exposure.
 - d. Salt Spray (Fog): ASTM B117, no blistering, rusting, cracking, or delamination of film; maximum 1/8" rust creepage at scribe after 1000 hours exposure.
 - e. UV: ASTM G154, no blistering, cracking or chalking, less than 35% gloss loss and less than 3.5 MacAdam unit color change after 1500 hours exposure.
4. Coordination: Provide special coating system compatible with prime paints, undercoats, and barrier coats used.
- a. Review other Specification sections in which prime paints and zinc-rich touch-coatings up are provided; ensure compatibility of total coatings systems.
 - b. Upon request from other trades furnish information on characteristics of finish materials proposed for use.
 - c. Provide barrier coats over incompatible primers or remove and reprime as required. Reprime with zinc-rich primer where galvanized.
 - d. Notify Architect in writing of any anticipated problems in use of specified coating systems with substrates primed by others.
- B. Colors and Finishes:
- 1. Prior to commencement of coating work, Architect will furnish color chips for surfaces to be coated; custom colors, premium colors, or colors to match existing finishes may be required.
 - 2. Final acceptance of colors will be from samples applied on site or on suitable material representing final product.
 - 3. Color pigments: Pure, non-fading, applicable types to suit substrates and service indicated; no lead content permitted.
 - 4. Sheen: Gloss; comply with ASTM D523, reflectance of coating, 75-100.

- C. Material Quality: Provide primers produced by same manufacturer as finish coats; use only thinners approved by coating manufacturer, and use only within limits.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Inspection: Examine areas and conditions under which high performance coating work is to be applied.
 - 1. Start of high performance coating work indicates acceptance of surfaces and conditions of surfaces and conditions within any particular area.
 - 2. Do not apply coating over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to a durable coating.
- B. Perform preparation and cleaning procedures in accordance with coating manufacturer's instructions and as specified for substrate condition.
- C. Remove items in place and not to be coated, or provide protection prior to application of high performance coating; after application of coating reinstall removed items.
- D. Clean surfaces before applying high performance coating; remove oil and grease prior to mechanical cleaning; program cleaning so contaminants from cleaning process do not fall onto wet, newly coated surfaces.
- E. Metal Preparation: Comply with coating manufacturer recommendations, but not less than following requirements.
 - 1. Bare Surfaces: Clean surfaces which are not galvanized or shop-coated, of oil, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning to an SSPC-SP3 or SSPC-SP7 surface preparation unless otherwise noted.
 - 2. Galvanized Surfaces: Clean free of oil and surface contaminants, using non-petroleum based solvent.
 - 3. Painted Surfaces: Clean surfaces of loose paint, dirt, and foreign substances by solvent or mechanical cleaning to an SSPC-SP3 or SSPC-SP7 surface preparation unless otherwise noted; feather remaining edges of existing paint to provide smooth, even substrate for high performance coating.
- F. Mix materials in accordance with manufacturer's directions.
- G. Store materials in tightly covered containers; maintain containers used in storage, mixing and application of coating in a clean condition, free of foreign material/residue.
- H. Stir materials before application to produce mixture of uniform density, and stir as required during application; do not stir surface film into material, if necessary, strain material before using.

3.2 APPLICATION

- A. Apply high performance coating in accordance with manufacturer's directions; use applicators and techniques best suited for substrate and coating material being applied.
 - 1. Apply additional coats when stains or blemishes show through final coat, until coating is a uniform finish, color and appearance.
 - 2. Provide extra attention to assure dry film thickness at corners and crevices is equivalent to that of flat surfaces.
- B. Scheduling: Apply first coat to surfaces that have been cleaned, pretreated or prepared for high performance coating as soon as practicable after preparation.
 - 1. Allow time between successive coatings to permit proper drying.
 - 2. Do not recoat until coating feels firm and does not deform or feel sticky under moderate thumb pressure.
- C. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry film thickness as recommended by coating manufacturer.
- D. Prime Coats: Apply to items not previously primed; recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat.
- E. Finish Coats: Provide even texture; leave no laps, irregularity in texture, skid marks, or other surface imperfections; edges clean and sharp where work joins other materials and colors.
 - 1. Provide opaque, uniform finish, color and coverage; cloudiness, spotting, holidays, brush marks, runs, sags, ropiness and other surface imperfections are not acceptable.
- F. Completed Work: Match approved samples and mock-up for color, texture and coverage. Remove, refinish or recoat work not accepted.

3.3 CLEAN-UP, PROTECTION AND REPAIR

- A. Clean-Up: During progress of work, remove discarded coating materials, rubbish, cans and rags from site at end of each work day.
- B. Protection: Protect work of other trades, whether to be coated or not; correct damage by cleaning, repairing or replacing, and refinishing, as acceptable to Architect.
 - 1. Provide "Wet Coating" or "Wet Paint" signs to protect newly-coated surfaces.
 - 2. Remove temporary protective wrappings provided by others for protection of their work, after completion of coating operations.
- C. Repair: At completion of work of other trades, touch-up and restore damaged surfaces and defaced coated surfaces.

END OF SECTION

SECTION 10 12 00**DISPLAY CASES**

PART 1 - GENERAL**1.1 SUMMARY**

- A. Section Includes: Provide floor-mounted and premanufactured display case.

1.2 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature.

PART 2 - PRODUCTS**2.1 MATERIALS**

- A. Basis of Design:

- 1. Ghent Manufacturing, GMI Company, Lebanon, Ohio
 - a. Spirit Floor Case Collection, Model 3176
 - 2. Substitutions: Refer to Section 01 63 00.

- B. Shelving:

- 1. 4 Half-Size Shelves
 - 2. Shelf Dimensions: 35 ½" x 14" x ¼"
 - 3. Shelf Adjustment: 1" increments.
 - 4. Shelf Capacity: 25 lbs.

- C. Doors:

- 1. Sliding doors operable from both sides. Door handles to match case finish.
 - 2. Lock mechanism: Selby-033 cam lock
 - a. 2 keys.

- D. Lighting:

- 1. Lighted units come with LED strip lights with a 10' cord and case-mounted on/off switch.

- E. Materials:

- 1. Case frame: Anodized aluminum
 - 2. Color: As selected by Architect from full range of color options

F. Assembly/Weight/Shipping:

1. Case may arrive semi-assembled.
2. Contractor shall be responsible for all field assembly and installation required.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine substrates and conditions under which display cabinets are to be installed.
- B. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install cabinets in locations to comply with requirements of governing authorities; prepare recesses in walls as required.
- B. Securely fasten to structure, square and plumb, in accordance with manufacturer's instructions.
 1. Wherever exact location of units is not shown, locate as directed by Architect to avoid conflicts with other building components.
 2. Connect to electrical outlet. Check for proper operation.
- C. Upon completion of installation, remove protective coatings or coverings and clean all surfaces.
- D. Adjust hardware for proper operation.
- E. Repair or replace damaged metal components, cracked glass, and broken glass.

END OF SECTION

SECTION 10 16 50**PLASTIC LAMINATE TOILET COMPARTMENTS**

PART 1 - GENERAL**1.1 SUMMARY**

- A. Provide floor-mounted overhead-braced plastic laminate compartments for toilet cubicles, including hardware, attachment devices, and compartment accessories as required for complete finished installation.
- B. Related Sections:
 - 1. Section 10 28 00: Restroom Accessories.

1.2 REFERENCES

- A. Americans with Disabilities Act, 2010 Standards for Accessible Design
- B. California Building Code: California Code of Regulations, Title 24, Part 2, requirements for providing accessibility for persons with disabilities.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's literature.
- B. Shop Drawings: Clearly indicate compartment layouts, swing of doors, elevations, anchorage and mounting details, panel construction, hardware, finishes and relevant dimensions.
- C. Samples: Furnish samples of each plastic laminate.

1.4 QUALITY ASSURANCE

- A. Access for Persons with Disabilities: Provide signs for assuring access for persons with disabilities in accordance with state and federal regulations.
 - 1. California Regulations: Comply with 2019 California Building Code.
 - 2. Federal Regulations: Comply with Americans with Disabilities Act - 2010 Standards for Accessible Design
 - 3. Door Width: Provide minimum 32" clear door openings when front entry, minimum 34" clear door openings when side entry.
 - 4. Reinforcing: Provide reinforcing for grab bars indicated to be compartment mounted.
 - 5. Urinal Screens: Provide minimum 30" clear space at accessible urinal.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. Bobrick Washroom Equipment, Inc.
- B. Laminating Technologies
- C. ASI Global Partitons
- D. Substitutions: Refer to Section 01 63 00.

2.2 MATERIALS

- A. Plastic Laminate: NEMA Standard LD-3, minimum 0.050" thick.
 - 1. Colors: Architect reserves right to select colors from manufacturer of plastic laminate beyond those considered stock with toilet compartment manufacturer.
 - a. Architect reserves right to select separate colors for each room requiring compartments.
- B. Floor-mount pilasters with overhead bracing as shown on the drawings.
- C. Core Material: Manufacturer's standard particleboard or plywood; thickness to provide specified finished dimensions.
- D. Pilaster Shoes: 3" high; ASTM A666, Type 302/304, No. 4 polished finish; stainless steel.
- E. Attachments, Screws and Bolts: Stainless steel; tamper proof type; heavy duty extruded aluminum brackets.
- F. Hardware: Manufacturer's standard chrome plated or similar finish.
 - 1. Hinges: Non-ferrous cast pivot hinges, gravity type, adjustable for door close positioning; nylon bearings.
 - 2. Latch: Slide latch; door strike and keeper with rubber bumper.
 - 3. Coat Hook/Bumper: Cast alloy chrome plated combination unit.
 - 4. Wall Bumper: Cast alloy wall mounted rubber bumper for outswinging doors.
 - 5. Pulls: Provide as required, including pulls required at interior of accessible compartments.

2.3 FABRICATION

- A. Pressure-laminate one-piece face sheets to core material with no splices or joints; edges straight and sealed.

1. Seal core material at cutouts to protect against moisture.
- B. Doors and Panels: 1" thick by minimum 24" wide by minimum 58" high plastic laminate pressure bonded to sound deadening core.
 1. Provide wider doors where required for accessibility for persons with disabilities.
- C. Pilasters: 1" thick internally reinforced pilasters, with full height internal steel plate reinforcing, finished to appear same as doors, of sizes required to suit cubicle widths and spacing.
- D. Panel Edges: Plastic laminate edges for doors, panels and pilasters.
- E. Internal Reinforcement: Concealed type as required for attached hardware, fittings, and accessories; mark locations of reinforcement for compartment mounted washroom accessories.
 1. Coordinate location of accessories with Section 10 28 00.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine site conditions to which work is to be applied.
- B. Take site dimensions affecting this work.
- C. Ensure correct spacing and size of plumbing fixtures; take special note of fixtures in compartments indicated to be designed for persons with disabilities to assure clearances complying with access regulations.
- D. Ensure correct location of built-in framing, anchorage, and bracing, where required.

3.2 INSTALLATION

- A. Install units in accordance with manufacturer recommendations and installation instructions, secure, plumb, level, and square.
- B. Leave 1/2" space between wall, panels and end pilasters.
- C. Attach panel brackets securely to walls using anchor devices.
- D. Attach panels and pilasters to bracket with through sleeve tamper proof bolts and nuts.
- E. Provide for adjustment of floor variations with screw jack through steel saddles integral with pilaster; conceal floor fastenings with stainless steel shoes.
- F. Equip each door with hinges, latch, and coat hook/bumper combination.

- G. Install door strike keeper and door bumper on each pilaster in alignment with door latch.
- H. Adjust and align hardware to uniform clearance at vertical edges of doors not exceeding 3/16".
- I. Adjust hinges to locate doors in partial open position when unlatched, except adjust hinges to return doors to closed position at stalls designed for use by persons with disabilities.
- J. Anchor urinal screen panels to walls with continuous angle brackets both sides.

3.3 CLEANING

- A. Remove protective masking.
- B. Clean surfaces free of adhesives and imperfections.
- C. Field touch-up of scratches and of defaced plastic laminate finish will not be permitted; replace damaged, scratched and marred defective materials with new, undamaged materials.

END OF SECTION

SECTION 10 28 00**RESTROOM ACCESSORIES**

PART 1 - GENERAL**1.1 SUMMARY****A. Section Includes:**

1. Provide toilet accessories with attachment hardware and rough-in frames as required for complete, operational installation.
 - a. Backlite mirrors included in this section.
 - b. Framed mirrors included in this section.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's product data illustrating each accessory at large scale.

1.3 QUALITY ASSURANCE

- A. Access for Persons with Disabilities: Provide accessories for assuring access for persons with disabilities in accordance with state and federal regulations.
 1. California Regulations: Comply with 2019 California Building Code.
 2. Federal Regulations: Comply with Americans with Disabilities Act - 2010 Standards for Accessible Design

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver inserts and rough-in frames to jobsite at appropriate time for building in.
- B. Do not deliver accessories to site until rooms in which they are to be installed are ready to receive them.
- C. Pack accessories individually, protect each item and its finish.

1.5 PROJECT CONDITIONS

- A. Protect adjacent or adjoining finished surfaces from damage during installation of work of this section.
- B. Before starting work notify Architect in writing of conditions detrimental to installation or operation of units.
- C. Verify with Architect exact location of accessories.

1.6 WARRANTY

A. Special Warranty: Replace mirrors which exhibit signs of desilvering or distortion.

1. Special Warranty Period: Two years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Bobrick Washroom Equipment, Inc.

B. Bradley Corporation

C. American Specialties, Inc.

D. Substitutions: Refer to Section 01 63 00.

2.2 RESTROOM ACCESSORIES

A. Materials

1. General: Provide manufacturer's standard materials and finishes for accessories listed; where more than one material or finish is available and not otherwise indicated provide as selected by Architect from manufacturer's standard materials and finishes.
2. Stainless Steel Sheet: ASTM A666, commercial grade, Type 304, gages as standard with manufacturer of specified items.
3. Stainless Steel Tubing: ASTM A269, commercial grade, seamless welded.
4. Sheet Steel: ASTM A1008, cold rolled stretcher leveled; minimum G90 galvanized coating, ASTM A924 and A653.
5. Adhesive: Epoxy type contact cement as recommended by accessory manufacturer.
6. Fasteners, Screws, and Bolts: Hot dip galvanized; as recommended by accessory manufacturer for component and substrate.
7. Keys: Provide universal keys for access to toilet accessory units requiring internal access for servicing and supply.
 - a. Provide minimum six keys to Owner representative.
8. Metal Framed Mirror Glass: ASTM C1036, q1 mirror select clear float glass with full silver coating, copper coating and organic coating; minimum 1/4" thick.

B. Fabrication

1. Weld and grind smooth joints of fabricated components.
2. Form exposed surfaces from one sheet of stock, free of joints.
3. Fabricate units with tight seams and joints, exposed edges rolled; hang doors and access panels with continuous piano hinges; provide concealed anchorage where possible.
4. Provide steel anchor plates and anchor components for installation on building finishes.
5. Form surfaces flat without distortion; maintain flat surfaces without scratches and without dents; finish exposed edges eased, free of sharp edges where potential exists for physical contact.
6. Hot dip galvanize ferrous metal anchors and fastening devices.
7. Assemble components in shop; package complete with anchors and fittings.

C. Finishes

1. Exposed Finishes: Stainless steel, number 4, satin finish; satin chrome finish acceptable where stainless steel not available for accessory item listed or scheduled.
2. Concealed Surfaces: Treat and clean, spray-apply one coat primer and baked enamel finish.

PART 3 - EXECUTION**3.1 PREPARATION**

- A. Provide templates and rough-in measurements.

3.2 INSTALLATION

- A. Install accessories in accordance with manufacturer's printed instructions using fasteners appropriate to substrate.
- B. Install true, plumb and level, securely and rigidly anchored to substrate.
- C. Use tamper-proof, security type fasteners.
- D. Adjust accessories for proper operation and verify mechanisms function smoothly.
- E. Replace damaged and defective items.
- F. Clean and polish exposed surfaces after removing temporary labels.

3.3 ACCESSORIES SCHEDULE

- A. Refer to schedules and symbol references on the Drawings.

END OF SECTION

SECTION 10 44 00**SIGNAGE**

PART 1 - GENERAL**1.1 SUMMARY****A. Section Includes:**

1. Provide room and exit signage as indicated complete with attachment devices and accessories as required for complete installation.

1.2 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature and indicate each sign type, style, color, and method of attachment.
- B. Shop Drawings: Furnish listing of sign types, lettering and locations, along with overall dimension of each sign.

1.3 QUALITY ASSURANCE

- A. Access for Persons with Disabilities: Provide signs for assuring access for persons with disabilities in accordance with state and federal regulations.
 1. California Regulations: Comply with 2019 California Building Code.
 2. Federal Regulations: Comply with Americans with Disabilities Act - 2010 Standards for Accessible Design
- B. Manufacturer Qualification: Use a tactile sign manufacturer with at least ten years of experience in the fabrication of architectural and ADA signs.
- C. Use a single manufacturing source to produce tactile signage that is finished and ready for installation.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Package separately or in like groups of names, labeled as to names enclosed; include installation template, attachment system and installation instructions.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Permanent Room and Exit Signs: Provide colored plastic signs, conforming with ADA and CBC requirements for signs for permanent rooms, exit access, and exits, with inset symbols and with raised and Braille characters; concealed mounting system.
 - 1. Comply with ADA and CBC requirements for raised and Braille characters, pictorial symbols, finish, and contrasts requirements.
 - 2. Size: See sign schedules on the drawings
 - 3. Style: See sign elevations on the drawings.
 - 4. Colors: As selected by Architect, from full color range and as indicated on the drawings..
 - 5. Manufacturers:
 - a. ASI Modulex.
 - b. Mohawk Sign Systems.
 - c. Vomar Products, Inc.
 - d. Kroy Sign Systems
 - e. Substitutions: Refer to Section 01 63 00.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install signs in accordance with manufacturer recommendations and installation instructions, free from distortions and defects.
- B. Permanent Signs: Install signs on walls after surfaces on which they are to be mounted are painted and finished.
 - 1. Location: Mount signs centered at 60" maximum above finished floor to baseline of highest row of tactile text on strike side of door.
 - 2. Install level, in line, in accordance with the manufacturer's recommendations and ADA and CBC requirements to allow a person to approach within 3" of signs without being within a door swing.
 - 3. Clean and polish, remove excess adhesive.

END OF SECTION

SECTION 10 44 13**FIRE EXTINGUISHER CABINETS**

PART 1 - GENERAL**1.1 SUMMARY**

- A. Section Includes: Provide surface-mounted and semi-recess mounted special corrosion resistant aluminum cabinets for portable fire extinguishers with glass panel and accessories as required for complete installation.
 - 1. Fire Extinguishers: Contractor furnished and installed.

1.2 SUBMITTALS

- A. Product Data: Furnish manufacturer's literature.

PART 2 - PRODUCTS**2.1 MATERIALS**

- A. Fire Extinguishers: Multi-Purpose Dry Chemical Type.
 - 1. UL rated 2A-10BC in nominal 5lb. capacity.
 - 2. Manufacturers:
 - a. J.L Industries
 - b. Larsen's Mfg. Co.
 - c. Potter-Roemer
- B. Fire Extinguisher Cabinets: Provide special corrosion resistant aluminum cabinets for installation required.
 - 1. Provide semi-recessed with 2-1/2" exposed box/frame where indicated or scheduled on the drawings.
 - 2. Provide surface-mounted with fully exposed box/frame where indicated or scheduled on the drawings.
 - 3. Cabinet Depth: Provide cabinets of sufficient depth to house multi-purpose dry chemical type fire extinguisher unless otherwise indicated.
 - 4. Materials: Aluminum: ASTM B 221 (ASTM B 221M), with strength and durability characteristics of not less than Alloy 6063-T5 for aluminum sheet. ASTM B 221 (ASTM B 221M) for extruded shapes.
 - a. Finish: Clear Anodic or white painted as selected by the Architect.
 - 5. Construction: Mitered and welded one-piece tubular door frames; weld joints and grind smooth.

- a. Doors: Aluminum with break-glass type secured access, with inside latch and lock.
 - b. Door Hardware: Continuous hinge permitting door to open 180 degrees.
 - c. Door Style: Horizontal Duo with window.
- C. Manufacturers:
- 1. J.L. Industries/Ambassador Series.
 - 2. Larsen's Mfg. Co./Architectural Series.
 - 3. Potter-Roemer/Alta Series.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine substrates and conditions under which fire extinguisher cabinets are to be installed.
- B. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install cabinets in locations and at mounting height to comply with requirements of governing authorities; prepare recesses in walls as required.
- B. Securely fasten to structure, square and plumb, in accordance with manufacturer's instructions.
 - 1. Wherever exact location of units is not shown, locate as directed by Architect to avoid conflicts with other building components.

3.3 IDENTIFICATION

- A. After installation and finishing is completed, silk screen or apply decal letters spelling "FIRE EXTINGUISHER" as applicable.
- B. Letter size, style and location as selected by Architect.

END OF SECTION

SECTION 11 20 00**LAUNDRY EQUIPMENT AND GEAR STORAGE**

PART 1 - GENERAL**1.1 SUMMARY**

- A. Section Includes: Provide laundry equipment and turnout gear storage with accessories as required for complete installation.

1. Washer and Dryer
2. Extractor
3. Turnout Gear Storage
4. Turnout Gear Drying Cabinet
5. Wire Shelving Systems

- B. Related Sections:

1. Section 06 10 00: Rough Carpentry (blocking)
2. Section 26 27 00: Basic Electrical Materials and Methods

1.2 SUBMITTALS

- A. Product Data: Submit literature for manufactured items.
- B. Shop Drawings: Indicate materials, options, component profiles, fastening, joining details, finishes, and accessories.

1.3 WARRANTIES:

- A. Laundry Room Appliances: 1 Year from Date of Substantial Completion
- B. Extractor: 5 Years from Date of Substantial Completion

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver materials until site conditions are adequate to receive work; protect items from weather while in transit.
- B. Store materials indoors, in ventilated areas with constant but minimum temperature of 60 degrees F and maximum relative humidity of 25% to 55%.
- C. Do not begin installation until space is fully enclosed and mechanical systems are fully operational.

1. Maintain interior installation areas at 70 degrees F and 50% to 55% relative humidity.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Laundry Room Appliances:

1. Clothes Washer: LG, Model WM4000HWA 4.5 cu.ft. Large Capacity Front-Load Washer.
 - a. Energy Star
 - b. Color: White
 - c. Provide matching ADA Compliant pedestal base Model No. WDPS1W in Decontamination 126.
 - d. Provide matching regular height pedestal base Model No. WDP4W in Laundry 207.
2. Clothes Dryer:: LG, Model DLEX4000W 7.4 cu.ft. Large Capacity Front-Load Dryer.
 - a. Energy Star
 - b. Color: White
 - c. Provide matching ADA Compliant pedestal base Model No. WDPS1W in Decontamination 126.
 - d. Provide matching regular height pedestal base Model No. WDP4W in Laundry 207.
3. Where laundry room appliances are available with options and options are not specifically indicated provide best quality options offered with appliance number indicated unless otherwise directed by Architect.

B. Extractor:

1. Pellerin Milnor Corporation, Model 300 15 T6X – Rigid Mount
 - a. Maximum capacity-lbs. 40
 - b. Cylinder diameter x depth-ins. 30 X 15
 - c. Gross cylinder volume-cu. Ft. 6.14
 - d. Overall width 34.5
 - e. Overall depth 48.62
 - f. Overall height 56.44
 - g. Approx. gross weight-lbs. 1,010
 - h. No. of full sets of gear 2 to 3
 - i. Controls Specifications:
 - 1) E-P Plus Controls
 - 2) NFPA 1851-Compliant Features
 - 3) 10-30 Programmable Cycles
 - 4) 6 Chemical Injection Ports
 - 5) Still Fill (water level before start)
 - 6) Programmable Spin Speeds

- 7) Soak Option
- 8) Multiple Agitation Options
- 9) Water Level Control
- 10) Temperature Control
- 11) Control Comparison

C. Turnout Gear Storage:

1. Floor-Mounted Lockers: GearGrid Corporation, Forest Lake, MN.
 - a. Size: 24"x24"x74.5" tall.
 - b. Custom fabricate to gang multiple lockers into one assembly as shown on Drawings.
 - c. Construction: Units shall be welded at all applicable joints. Forming of metal shall be completed by standard cold-forming operations. Use of fasteners will only be required to allow for knock-down shipping, securing units to mounting surface and on applicable accessories.
 - 1) Vertical Dividers:
 - a) Outer Frames: 1.25" O.D. x 16 gauge wall thickness ASTM A513 steel tubing.
 - 2) Inner and Back Panel Grid: .25" diameter ASTM 510 cold drawn steel wire resistance welded to a 3" square pattern.
 - a) Inner Grid wires must be full length and width of inside vertical divider frame. Wires not running full length or width, thus creating exposed wire ends will not be acceptable.
 - b) Inner Grid wires must run horizontally and vertically creating a square or rectangular grid pattern only. Grid wires not creating a square or rectangular grid pattern will not be acceptable.
 - c) Inner Grid wires shall intersect and cross all perpendicular wires, and shall be welded at all intersections.
 - d. Shelves: (1) Upper, (1) Lower. .25" diameter ASTM 510 cold drawn steel wire resistance welded and cold formed. Upper shelf shall include an integrated 20 gauge steel bracket to accept a 2" x 16" name placard(not included), unless doors are selected as an option, in which case the name placard holder will be integrated into the door.
 - e. Apparel Hooks: (3) per locker opening. .192" diameter ASTM 510 cold drawn steel wire resistance welded, cold formed and powder coated. Apparel hooks must securely engage and snap onto side or back grid, to prevent unintentional disengagement of hook.
 - f. Accessories:
 - 1) Heavy Hanger: .25" diameter 304 stainless steel wire cold formed and resistance welded.
 - 2) Black vinyl coating on hook end.
 - g. Helmet Holder: .25" diameter ASTM 510 cold drawn steel wire resistance welded. Powder coated finish in specified color.
 - h. Top Side Storage: Shelf spanning across the top of the lockers for additional gear storage above lockers. .25" diameter ASTM 510 cold drawn steel wire

resistance welded to a 3" square pattern. Powder coated finish in specified color.

- i. Finish: All system components excluding assembly and mounting hardware and stainless steel components are to receive the standard finish.
 - 1) Standard Finish: Components to be cleaned using a phosphatized bath, clear water rinse and electro-statically coated with a durable and UV-stable TGIC powder coating process. Thickness of applied finish shall be 3 – 4 mm for added protection.
 - 2) Color: Red
- 2. Wall-Mounted Storage Panels: GearGrid Corporation, Forest Lake, MN.
 - a. Size: 24"x60"
60"x36"
 - b. Construction:
 - 1) Frame: Heavy-duty 1-1/4" steel tubing
 - 2) Grid: High-strength 1/4" steel wire, 3" x 3" grid pattern
 - 3) Mounting: Heavy-duty 11-gauge wall mount brackets
 - 4) Finish: Super Durable TGIC powder coat
 - c. Color: Red
 - d. Accessories: Fire & EMS Dive Hangers Hangers as shown on the Drawings.
- 3. Fixed Wall Mount Shelf: GearGrid Corporation, Forest Lake, MN.
 - a. Length: As shown on the Drawings
 - b. Construction:
 - 1) Shelf: Heavy-duty steel tube frame with high-strength 1/4" steel wire
 - 2) Brackets: Heavy-duty tubular angle bracket with gusseted support wire
 - 3) Capacity: 150 lbs. per shelf
 - 4) Finish: Super Durable TGIC powder coat
 - c. Color: Red
- D. Turnout Gear Drying Cabinet

1. Model No.

- E. Wire Shelving Systems: Provide coated steel wire shelf system with integral pole, including connections, supports, and accessories as required for complete installation in configurations indicated on Drawings; with 12" shelf depth.
 - 1. Manufacturers:
 - a. Clairson International/Closetmaid SuperSlide Shelving with Hang Bar.
 - b. Newell Rubbermaid/Freeslide Ventilated Wire Shelving.
 - c. LeeRowan/FreeSlide Ventilated Wire Shelving.
 - d. Substitutions: Refer to Section 01630.
 - 2. Type: Provide fixed mount hardware system.

- F. Anchors, Nails and Screws: Select the material, type, size and finish required by each substrate for secure anchorage; provide toothed steel or lead expansion bolt screws for drilled-in-place anchors.

2.2 FABRICATION

- A. Fabricate finish carpentry items in accordance with specified quality standard.
- B. Use exposed fastening devices or nails only when approved and unavoidable; arrange neatly.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication where possible; do not delay job progress, allow for trimming and fitting.
- B. Verify surfaces are ready to receive work and field measurements are as shown on shop drawings.
 - 1. Beginning installation signifies acceptance of conditions.
- C. Ensure mechanical and electrical items affecting work are properly placed, complete, and have been inspected by applicable authorities prior to commencement of installation.
- D. Inspect each product for damage during shipping, handling, and storage. Promptly replace all damaged products prior to installation.

3.2 INSTALLATION

- A. Secure wall-mounted turnout gear panels to blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation.
- B. Install appliances in accordance with manufacturer's instructions.
 - 1. Coordinate with mechanical and electrical trades as necessary for proper service connections.
 - 2. Ensure operating parts work freely and fit neatly.
- C. Accessories: Install accessories in accordance with manufacturer's recommendations in locations indicated or as directed by Architect.
- D. Acceptable Tolerances:
 - 1. Variation from True Position: Maximum 1/16" at any position and maximum 1/8" in any 10'-0" length.
 - 2. Adjoining Surfaces of Same Material: No variation permitted.

3. Offset with Abutting Materials: Maximum 1/32".

3.3 ADJUSTING

A. Adjust laundry and gear storage products and moving parts as necessary.

3.4 PROTECTION

A. Protect laundry equipment and gear storage products until Substantial Completion.

B. Repair or replace damaged parts, dents, buckles, abrasions, or other defects affecting appearance or serviceability, so appliances and gear storage products are undamaged at time of Substantial Completion.

END OF SECTION

SECTION 11 31 70**APPLIANCES**

PART 1 - GENERAL**1.1 SUMMARY**

- A. Section Includes: Provide appliances with options and accessories as required for complete finished operational installation.
- B. Related Sections:
 - 1. Section 06 41 00: Architectural Woodwork and Countertops.
 - 2. Section 12 36 00: Stainless Steel Countertops
 - 3. Division 22: Plumbing connections.
 - 4. Division 26: Electrical connections.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's literature for each type of appliance, including data indicating compliance with requirements and color selection.

1.3 QUALITY ASSURANCE

- A. Certification Labels: Provide appliances which bear appropriate labels as follows:
 - 1. Energy Ratings: Provide energy guide labels with energy cost analysis (annual operating costs) and efficiency information as required by Federal Trade Commission.
 - 2. UL Standards: UL labels required.
 - 3. ADA Compliant.
 - 4. ANSI Z-21: AGA seal of approval required for units with gas-burning appliances.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver appliances in manufacturer's undamaged protective containers, after spaces are ready to receive them.

PART 2 – PRODUCTS**2.1 MANUFACTURERS**

- A. General Electric Co., Major Appliances Division.
- B. BSH Home Appliance Corporation
- C. Viking Range LLC.

D. LG Appliance Division

A. Substitutions: Refer to Section 01 63 00.

2.2 MATERIALS

A. Kitchen 114 and Pantry 115 Appliances:

1. Refrigerator:

a. Stainless Steel

2. Dishwasher: Bosch SGX78B55UC - 800 Series Dishwasher.

a. ADA Compliant

b. Stainless Steel

3. Double Oven:**4. Cooktop:**

a. Stainless Steel

5. Exhaust Hood:

a. Stainless Steel

6. Disposal: General Electric GFC720N 3/4hp Continuous Feed

7. Options: Where appliances are available with options and options are not specifically indicated provide best quality options offered with appliance number indicated unless otherwise directed by Architect.

PART 3 - EXECUTION**3.1 EXAMINATION**

A. Examine substrates and conditions under which appliances are to be installed.

3.2 INSTALLATION

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

B. Coordinate with mechanical and electrical trades as necessary for proper service connections.

C. Ensure operating parts work freely and fit neatly.

3.3 ADJUSTING

A. Adjust hardware and moving parts as necessary.

3.4 PROTECTION

- A. Protect appliances until Substantial Completion.
- B. Repair or replace damaged parts, dents, buckles, abrasions, or other defects affecting appearance or serviceability, so appliances are undamaged at time of Substantial Completion.

END OF SECTION

SECTION 12 36 00

STAINLESS STEEL COUNTERTOPS

PART 1 - GENERAL**1.1 SUMMARY****A. Section Includes:**

1. Stainless steel countertops including plywood substrate.
 - a. Stainless steel countertops occur at both architectural woodwork cabinets and at manufactured metal cabinets.
 - 1) Reference Kitchen 114 and Apparatus Bay 127.
2. Full height stainless steel backsplashes.
 - a. Stainless steel backsplashes occur at both architectural woodwork cabinets and at manufactured metal cabinets.
 - 1) Reference Kitchen 114 and Apparatus Bay 127.

B. Related Sections:

1. Section 06 40 10: Architectural Woodwork and Solid Countertops
2. Section 12 31 00: Manufactured Metal Casework
3. Division 22: Plumbing
4. Division 26: Electrical

1.2 QUALITY ASSURANCE**A. Manufacturer's Qualifications:**

1. Manufacturer is regularly engaged in design and manufacture of metal of scope and type similar to requirements of this project for a period of not less than five (5) years.
2. Manufacturer has successfully completed at least three (3) projects of scope and type similar to requirements of this project.
3. Submit manufacturer's qualifications and list of projects.

B. Installer Qualifications:

1. Installer has completed at least three (3) projects in least five (5) years in which these products were installed.
2. Submit installer qualifications.

1.3 SUBMITTALS**A. Certificates:**

1. Manufacturer's Certificate of qualifications specified.
2. Certificate of installer's qualifications specified.

B. Manufacturer's Literature and Data:

1. Brochures showing name and address of manufacturer, and catalog or model number of each item incorporated into the work.
2. Manufacturer's illustration and detailed description.

C. Shop Drawings:

1. Showing details of stainless steel construction, including kinds of materials and finish, hardware, accessories and relation to finish of adjacent construction, including specially fabricated items or components.
2. Fastenings and method of installation.
3. Location of service connections and access.

D. Manufacturer's warranty.**1.4 WARRANTY**

- A. Manufacturer Warranty: Manufacturer shall warranty their stainless steel countertops and backsplashes for a minimum of five (5) years from date of installation and final acceptance.

1.5 REFERENCES**A. American Society for Testing and Materials (ASTM):**

1. A167-99 – Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. Basis of Design: For purposes of designating type and quality of work under this Section, Drawings and Specifications are based on products manufactured by:

1. Baldhead Cabinets, Bend, Oregon
2. Substitutions: Refer to Section 01 63 00.

- B. When two (2) or more units are required, use products of one (1) manufacturer.

- C. Manufacturer of casework assemblies in Specification Section 12 31 00 is to assume complete responsibility for the final assembled stainless steel countertops and backsplashes.

- D. Provide products of a single manufacturer for parts which are alike.

2.2 MATERIALS

A. Stainless Steel: ASTM A167

- 1. Stainless Steel shall be Type 304; 16 gauge U.S. Standard.
- 2. Stainless steel shall be supplied with a #4 finish free of burrs, weld marks, or other imperfections.

B. Plywood:

- 1. Prod. Std. PS 1, five ply, exterior.
- 2. Grade AC

C. Fasteners:

- 1. Exposed to View: Stainless steel, or finished to match adjacent surface.

1.2 FABRICATION

A. General:

- 1. Welding: Comply with AWS Standards D1.1/D1.1M and D1.3/D1.3M.
- 2. Reinforce with angles, channels, and gussets to support intended loads, notch tightly, fit and weld joints.
- 3. Fabricate up to 12 feet long in one piece, including nosing, backs and ends.
- 4. When counter tops exceed 12 feet in length, or turn 90 degrees, accurately fitted field joints are acceptable.
- 5. Reinforced with minimum 0.0598 inch thick hat channel stiffeners, minimum of two stiffeners for units without sinks and three stiffeners for units with sinks welded or soldered to underside of top full length, except at sink openings.
- 6. Grind welds smooth and finished on exposed surfaces to match finish specified.

B. Stainless Steel Countertops:

- 1. Depth: 25"
- 2. Edge Configuration:
 - a. 1-5/8" Marine No-Drip with a 1/2" return at Kitchen 117
 - b. 1-5/8" Square or Box with a 1/2" return at Apparatus Bay 127

3. Mount on 2 layers of specified plywood.
- C. Backsplash:
 1. Backsplash to be contiguous and integral with countertop (no visible seams).
 2. Height of backsplash and backsplash ends as noted on Drawings.
 - a. Where backsplash does not extend full height, backsplash shall project from the adjacent wall surface 3/4".
 3. Edge Treatment: Hemmed
 4. Turned down at least 1/2 inch against wall.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Begin only after work of other trades is complete, including wall and floor finish completed, ceilings installed, light fixtures and diffusers installed and connected, and area free of trash and debris.
- B. Verify location and size of mechanical and electrical services as required and perform cutting of components of work installed by other trades.
- C. Verify reinforcement of walls and partitions for support and anchorage of countertops.
- D. Coordinate with other Divisions and Sections of the specification for work related to installation of casework systems to avoid interference and completion of service connections.

3.2 INSTALLATION

- A. Secure countertops to supporting rails of cabinets with metal fastening devices, or screws through pierced slots in rails.
 1. Where type, size or spacing of fastenings is not shown or specified, submit shop drawings showing proposed fastenings and method of installation.
 2. Use round head bolts or screws.
- B. Install stainless steel countertops and backsplashes in accordance with manufacturer's or fabricator's written instructions.

3.3 CLEANING

- A. Immediately following installation, clean each item, removing finger marks, soil and foreign matter resulting from work of this section.

- B. Remove from job site trash, debris and packing materials resulting from work of this section.
- C. Leave installed areas clean of dust and debris resulting from work of this section.

3.4 INSTRUCTIONS

- A. Provide operational and cleaning manuals and verbal instructions for Owner use.

END OF SECTION

SECTION 21 13 00**FIRE PROTECTION**

PART 1 - GENERAL**1.1 SUMMARY****A. Section Includes:**

1. Provide a new, deferred approval, fire protection system and monitoring panel for Petaluma Fire Station No. 1.

- a. Furnish and install a complete wet-pipe fire sprinkler system as specified.

- 1) The system shall be installed in conformance with the 2022 Edition of NFPA 13 - Standard for Installation of Sprinkler Systems, as amended in California Building Code, Chapter 35.
- 2) All materials utilized shall be UL Listed and FM approved.
- 3) All materials installed shall adhere to the manufacturer's installation guidelines.

- B. Fire protection scope includes all labor, equipment, materials, tools, transportation, excavation and backfill, supervision, and services required to furnish and install a complete and properly operating wet-pipe fire protection system in all rooms of the fire station.

- C. Provide all necessary escutcheons, drains, test valves and accessories, hose connections for flow test, spare parts, tools, and signs that are required for the work of this Section.

- D. The Contractor shall determine all pipe lengths and sprinkler spacing and make any and such length and offset adjustments as may be necessary to complete the installation at no change in the contract price. The Drawings are not intended to relieve the Contractor of responsibility for avoiding conflicts or obstructions or for installing the number of sprinklers and supply piping as required to provide complete protection of the designated areas in accordance with the requirements of the referenced standards and these Specifications.

- E. The Contractor shall be responsible for obtaining and payment for all permits, licenses, and inspection certificates required in accordance with the provisions of the Contract Documents.

1. Refer to differed submittal general notes on Sheet T0.1.

- F. Seismic Performance: All sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE 7.

1.2 REFERENCES

A. American Society for Testing and Materials

1. ASTM A 53, "Standard Specification for Pipe, Steel and Hot-Dipped, Zinc-Coated, Welded and Seamless"
2. ASTM A135, "Standard Specification for Electro-Resistance Steel Pipe"
3. ASTM A795, "Standard Specification for Black & Hot Dipped Zinc Coated Welded & Seamless Steel Pipe for Fire Protection".
4. ASTM A234, Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service

B. American National Standards Institute / American Society of Mechanical Engineers

1. ANSI / ASME B 16.1, "Cast Iron Pipe Flanges and Pipe Flanged Fittings"
2. ANSI / ASME B 16.4, "Cast Iron Threaded Fittings, Class 125 and Class 250"

C. American National Standards Institute / National Fire Protection Association

1. ANSI / NFPA 13-2022, "Installation of Sprinkler Systems" as amended in chapter 35, 2022 CBC.
2. ANSI / NFPA 25, 2013 California Edition – "Standard for Inspection, Testing, and Maintenance of Water Based Fire Protection Systems"

1.3 CERTIFICATION

- ### A. All fire sprinkler system pipefitters responsible for installing, altering, or repairing water-based fire protection systems shall require certification by the State Fire Marshal's office. For more information, refer to the State Fire Marshal's Information Bulletin 17-002: NEW Automatic Fire Extinguishing Systems Certification (Water-Based Fire Protection)

1.4 WET-PIPE SPRINKLER SYSTEM DESIGN

A. Occupancy Classifications

1. The wet-pipe sprinkler system design for sleeping quarters, offices, restrooms, etc. shall be for a light hazard occupancy classification.
2. The wet-pipe sprinkler system design for kitchen, all storage rooms, and apparatus bay vehicle storage areas shall be for an ordinary hazard, group 2 occupancy classification.

B. Occupancy classifications noted above shall be verified with the State Fire Marshal.

C. Sprinkler spacing shall not exceed the limits allowed in NFPA 13.

1.5 SUBMITTALS

A. All submittals shall be submitted under the provisions of Division 01 and as follows:

1. Product Data

- a. Submit manufacturer's product data for all fire sprinkler system components, in compliance with specifications. Data sheets shall include capacities, RPM, BHP, pressure drop, design and operating pressures, temperatures, and similar data.
- b. Sprinklers shall be referred to on drawings, submittals, and other documentation, by the sprinkler identification or Model number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations shall not be allowed.

2. Shop Drawings.

- a. Prepare shop drawings of fire sprinkler systems and submit to Architect for approval prior to fabrication or installation of any work. Check shop drawings before forwarding to Architect and ascertain that submittals meet all requirements of the Drawings and Specifications and conform to space conditions.
- b. Obtain all necessary information regarding layout of piping, conduit, ductwork, lights and air outlets, etc., and place piping and sprinkler heads to avoid interferences. Head layout shall be symmetrical.
- c. The shop drawings shall have a title block similar to the Contract Drawings and shall identify Architect's Drawing number or any reference drawings. All drawings shall be fully dimensioned including both plan and elevation dimensions. Use of contract documents for shop drawings is not acceptable.

3. Operation And Maintenance Data

- a. Provide master index showing items included.
- b. Provide name, address, and phone number of Architect, Architect's Fire Sprinkler Consultant, General Contractor, and Fire Protection subcontractor.
- c. Provide operating instructions to include general description of fire protection system and step-by-step procedure to follow in putting system into operation.
- d. Maintenance instructions shall include a list of system components used indicating name and model of each item and manufacturer's maintenance instructions for each component installed in Project. Instructions shall include installation instructions, parts numbers and lists, operation instructions of equipment, and maintenance and lubrication instructions.
- e. Include copies of approved shop drawings and copies of required warranties.
- f. Include copies of NFPA 25, "Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems", 2013 California Edition.

4. Record Drawings

- a. Provide record drawings in hard copy and pdf format. Drawings shall include the project-specific title block and notations reflecting the "as built" conditions of any additions to or variations from the Construction Documents.

1.6 QUALITY CONTROL

A. Qualifications:

1. A State of California Licensed C-16 Contractor shall install all fire sprinkler system components, including underground lines and overhead lines. The Contractor shall have at least 5 years of experience in similar size and complexity projects.
2. The Contractor shall furnish a verified list of similar projects installed during past 5 years.

B. Requirements of Regulatory Agencies

1. Unless noted otherwise, system shall conform to:
 - a. ANSI / NFPA 13, 2022 - "Light & Ordinary Hazard Occupancies"
 - b. ANSI / NFPA 24, 2019 - "Private Fire Service Mains and Their Appurtenances"
 - c. Requirements of local water department and local Authority Having Jurisdiction over fire protection.
 - d. Applicable rules, regulations, laws, and ordinances.
2. Comply with backflow prevention requirements.

C. Conform all work and materials to requirements of the local and state codes, fire marshal, the Owner's insurance underwriter and any other Authority Having Jurisdiction, and all federal, state, and other applicable laws and regulations.

D. The work shall be of good quality, free of faults and defects, and in conformance with the Contract Documents.

PART 2 - PRODUCTS

A. GENERAL

1. Only specified materials shall be utilized in the work of this Section unless substitutions have been approved by the State Fire Marshal and the Architect, and in accordance with Division 01 requirements.
2. All products shall be UL listed or FM approved for fire protection service unless specifically allowed otherwise by this specification.
3. All grooved couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

4. All castings used for couplings housings, fittings, or valve and specialty bodies shall be date stamped for quality assurance and traceability.
5. Where two or more units of the same class of equipment are furnished, use products of the same manufacturer. Component parts of the entire system need not be products of the same manufacturer.
6. Equipment scheduled by performance or model number is considered the basis of design. If other specified manufacturer's equipment is provided in lieu of basis of design equipment, the Contractor is responsible for changes and costs that may be necessary to accommodate this equipment, including different sizes and locations for connections, different electrical characteristics, different dimensions, different access requirements, or any other differences that impact the project.
7. Provide all necessary escutcheons, drains, test valves and accessories, hose connections for flow test, spare parts, tools, and signs that are required for the work of this Section.

B. COMPONENTS

1. Steel Pipe

- a. Above Grade: Schedule 10/Schedule 40 sprinkler pipe, with internally lined antibacterial/antimicrobial coating, FM approved, UL Listed, complying with ASTM A135 for Type E, Grade A (Schedule 10); ASTM A795 for Type E, Grade A (Schedule 40, 1-2 NPS); ASTM A53 for Type F, Grade A (Schedule 40, 1-4 NPS) or Type E, Grade B (2-8 NPS), and NFPA 13 standards. Wheatland Tube or equal.
 - 1) 2 inches and smaller: Welded, threaded, flanged, soldered, or roll grooved coupling system. Schedule 40 Type F pipe shall not be used for gasketed mechanical fittings for pipe sizes 2 inches and smaller.
 - 2) 2-½ inches and larger: Welded, flanged, or roll grooved coupling system.
- b. Below Grade:
 - 1) Cast iron, hub or mechanical joint. Install thrust blocks at all fittings.
 - 2) AWWA Ductile Iron- minimum Class 53 grooved in accordance with AWWA C606. Rigid joints shall be utilized where flexibility is neither required nor desired. Pipe ends shall be factory grooved. Couplings & Fittings shall be cast ductile iron [UL, FM], conforming to A-536, Grade 65-45-12.
- c. Piping and fittings used for the installation of underground water mains shall be listed for such service.
- d. Every piece of pipe over 2 feet long shall be identified with manufacturer's name, model designation, or schedule.

2. Steel Pipe Fittings

- a. Malleable or ductile iron unions
- b. Threaded: Cast iron, class 125, meeting dimension requirements of ANSI/ASME B 16.4, and manufactured in accordance with ANSI/ASME B 14.4, Anvil, SPF, or equal.

- c. Flanged: Cast iron meeting requirements of ANSI/ASME B16.1; Anvil, Victaulic, or equal.
 - d. Grooved end pipe: ductile iron conforming to ASTM A536, coated with rust inhibiting paint, SPF/Anvil or equal. Grooved couplings & flanges, SPF model C-4 rigid and model C-3 lightweight flexible coupling, SPF model RC-2 reducing coupling, and SPF model F-3 flange or Victaulic Firelock® roll grooved pipe coupling system.
 - e. Welded: Carbon steel meeting requirements of ASTM A 234.
 - f. Steel welding fittings: ASTM A 234/A 234M and ASME B16.9
3. Flexible Sprinkler Hose Fittings: Victaulic VicFlex series with captured coupling or approved equal.
4. Risers (in-building)
- a. Ames Fire & Waterworks, series IBR or equal, type 304 stainless steel, 6'x6' standard length; UL/FM approved, meets NFPA 24; AWWA C900 inlet/DIP; AWWA C606 outlet. Includes test cap and coupler.
5. Valves
- a. Butterfly Valves
 - 1) UL Listed/FM approved to 300 psi (2065 kPa).
 - 2) Grooved end, ductile iron with stainless steel stem, weatherproof actuator, handwheel, with internal open supervisory tamper switches; Tyco BFV-300, Victaulic Series 705, or equal
 - b. Globe Valves
 - 1) UL Listed/FM approved
 - 2) WWP Bronze, threaded ends, screw over bonnet; NIBCO KT-65-UL or equal
 - c. Gate Valves
 - 1) UL Listed/FM approved
 - 2) Outside Screw and Yoke Type (OS&Y), 250 psi non-shock cold working pressure, raised face flanges, bolted bonnet, solid wedge, bronze trim, NIBCO F-637-31; OS&Y, double-disc, flanged ends, adjustable packing, Mueller A-2073-6; Victaulic Series 771; or equal.
 - d. Ball Valves
 - 1) UL Listed/FM approved
 - 2) 1 inch – 2 inches full port, 2 ½ inches standard port, 300 psi/20.7 Bar non-shock cold water, bronze, tamper-proof screw
 - 3) Threaded ends: NIBCO KT-505-W-8, Milwaukee BBSC, or equal
 - 4) Grooved ends: NIBCO KG-505-W-8, Victaulic Series 728, or equal.
 - e. Check Valves
 - 1) UL Listed/FM approved to 250 psi (1725-kPa).

- 2) Spring-assisted for vertical or horizontal installation.
 - 3) 2 inches – 12 inches, ductile iron conforming to ASTM A536, grade 65-45-12, EDPM seal, aluminum bronze disc with elastomer seal, stainless steel shaft, and carbon steel zinc plated plugs. Victaulic Firelock® series 717, Tyco Model CV-1F, or equal
6. Automatic Sprinklers:
- a. General Notes/Comments
 - 1) Sprinklers shall be UL listed and or FM approved, rated to 175 psi working pressure, shall have die-cast brass frame, and can be connected to the piping system with NPT, BSPT or IGS grooved connections. Victaulic Series Firelock, Tyco, or equal.
 - 2) Corrosive Environments: Body shall be coated with a UL and FM approved anti-corrosion coating.
 - 3) Head guards shall be UL listed and FM approved for use with the sprinkler in which it is attached.
 - 4) Wrenches shall be provided by the sprinkler manufacturer that directly engage the hex-shaped wrench boss integrally cast in the sprinkler body.
 - b. Types | Hazards | Classifications
 - 1) Light hazard applications to have quick response upright, pendent, sidewall, and concealed type sprinklers as required by NFPA 13.
 - 2) Ordinary hazard applications to have standard response upright, pendent, sidewall, and concealed type sprinklers as required by NFPA 13.
 - c. Sprinklers
 - 1) Standard coverage, quick response horizontal sidewall and recessed horizontal sidewall, minimum operating pressure - UL/FM: 7 psi/48 kPa/.5 bar; K5.6.
 - 2) Standard coverage, quick response upright, pendent, and recessed pendent sprinklers, corrosion resistant coating, minimum operating pressure - UL/FM: 7 psi/48 kPa/.5 bar; K5.6.
7. Sprinkler Guards:
- a. Constructed from chrome-plated 13 gauge steel wire welded to steel plates.
8. Sprinkler Box:
- a. Victaulic 'SA' Series Sprinkler Cabinet, Tyco TFP 7856, or equal
9. Pressure Gauges:
- a. Mechanical water pressure gauges:
 - 1) UL Listed/FM approved
 - 2) 0 to 300 psi, plastic case and window, bronze bourdon tube, brass socket, Viking VWATERSF, Reliable, Trerice, or equal.
10. Post Indicator - See Civil Drawings

11. Fire Department Connection - See Civil Drawings.

- a. At the low point near each fire department connection, install a 90-degree elbow with drain connection to allow for localized system drainage. Victaulic or Equal.

12. Hangers and Supports

- a. System piping shall be substantially supported to the building structure. The installation of hangers and supports shall adhere to NFPA 13 requirements. Materials used in the installation or construction of hangers and supports shall be Listed and Approved for such application. Hangers or supports not specifically Listed for service shall be designed by and bear the seal of a Professional Engineer. All hangers and supports shall be manufactured by Tolco/B-Line or approved equal.

13. Test and Drain Valves

- a. UL Listed/FM approved, single handle, tamper resistant, with UL/FM pressure relief valve; AGF Manufacturing model 1011A TestanDrain® valve, Victaulic series UTD universal test & drain assembly with adjustable relief valve, or approved equal.

14. Waterflow Detectors

- a. System Sensor "WFD_N" series vane-type waterflow detectors, or equal, NEMA 4-rated enclosure, UL Listed, tamper-resistant cover screws, two sets of SPDT switches, wire ready terminals, mechanical time delay, sealed retard mechanism, visual and audible switch activation. 450 PSI static pressure rating.

15. Air Vents

- a. Potter PAV automatic float type air vent, or equal, brass construction, 1 inch NPT inlet / outlet to drain, service pressure up to 175 psi.

C. SIGNAGE

1. Valve Identification

- a. All control, drain, vent, and test connection valves shall be provided with permanently marked weather-proof metal or rigid plastic identification signs. The identification sign shall be secured with corrosion-resistant wire, chain, or other approved means. The control valve sign shall identify the portion of building being served.
 - 1) Control valves shall have identification signs indicating valve function and system being controlled at each valve. Signs shall be white, rectangular, with letters reading "CONTROL VALVE".
 - 2) An aluminum sign reading "MAIN DRAIN" in red letters shall identify the main drain valve assembly.
 - 3) Test connections valves shall be identified with a rectangular sign with red text reading "INSPECTORS TEST"

2. General Information Sign

- a. All sprinkler systems require a general information sign. The sign shall be permanently marked, weather proof metal or rigid plastic, and be secured with

corrosion resistant wire, chain, etc. The sign shall detail the system design basis and information relevant to the inspection, testing, and maintenance requirements required by NFPA 25. The sign must be present at the system control riser and auxiliary system control valve.

3. Hydraulic Design Information Sign

- a. A permanently marked weatherproof metal or rigid plastic sign secured with corrosion resistant wire or chain shall identify a hydraulically designed sprinkler system. The sign shall include location of the design area; discharge densities; required flow and pressure of the system at the base of the riser; occupancy classification; sprinkler demand with hose stream allowance included; name of installing contractor; type and number of sprinklers installed with orifice size, temperature rating, orientation, K-factor, SIN when applicable, and response type; minimum discharge flow rate and pressure required from hydraulically most demanding sprinkler; required pressure settings for pressure reducing valves; the protection area per sprinkler; and the NFPA 13 edition used when designed and installed.

4. Fire Department Connections

- a. Adhere to Title 19, Chapter 5, Article 6 requirements for labeling, which requires a label of the self-adhesive type shall be placed on the fire department connection or on the riser for fire sprinkler system and shall include the date of installation and/or service was performed and license number of person performing service work.
- b. NFPA 13 requires that fire department connections (FDC) be identified and include the service design of the FDC, which part of the building an FDC serves, and the "pressure required at the inlets to deliver the greatest system demand" if the system demand pressure is 150 psi or greater. The sign shall have raised or engraved letters at least 1 inch in height and be placed on a plate or fitting.

5. Signaling System Signs

- a. Flow switch shall be connected to a 10 inch outside alarm bell or other audible alarm device at each riser. Approved identification signs shall be provided on the outside alarm bell "SPRINKLER FIRE ALARM - WHEN ALARM SOUNDS CALL 911 / FIRE DEPARTMENT."

6. All sprinklers shall be permanently marked with 1 or 2 uppercase letters to identify manufacturer, followed by 3 or 4 numbers to identify K-factor, pressure rating & thermal sensitivity.

7. Fire Sprinkler Monitoring System

- a. Fire sprinkler monitoring system shall be equipped with a monitoring panel with offsite reporting capabilities. The panel shall be capable of monitoring fire protection equipment. i.e. fire sprinkler flow switch, valves, tamper switches, etc. The installation and setup of this system shall be subject to deferred approval.

D. PIPE LABELS

1. Brady, Seton, Graphic Products, or approved equal pipe labels. Preprinted, color-coded, with lettering indicating service, and showing flow direction.

2. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent adhesive backing.
3. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
4. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as a separate unit on each pipe label to indicate flow direction.
5. Label Sizes (per ANSI A13.1 / ASME A13.1-2020 Standards):
 - a. For pipes or covering with outside diameter $\frac{3}{4}$ to $1\frac{1}{4}$ ", minimum length of the label: 8", minimum height of letters: $\frac{1}{2}$ ".
 - b. For pipes or covering with outside diameter $1\frac{1}{2}$ to 2", minimum length of the label: 8", minimum height of letters: $\frac{3}{4}$ ".
 - c. For pipes or covering with outside diameter $2\frac{1}{2}$ to 6", minimum length of the label: 12", minimum height of letters: $1\frac{1}{4}$ ".
6. Pipe Label Color Schedule: (per ANSI A13.1 / ASME A13.1-2015)
 - a. Potable, Cooling, Boiler Feed, and other Water Piping:
 - 1) Background Color: Green.
 - 2) Letter Color: White.
 - b. Fire Quenching Fluids:
 - 1) Background Color: Red.
 - 2) Letter Color: White.
7. Valves
 - a. For identification and the Owner's maintenance records, all valves shall be numbered and identified with clearly stamped $1\frac{1}{4}$ " diameter brass tags, in accordance with drawings and service performed.
 - b. Control valves shall be also marked whether normally open (N.O.) or normally closed (N.S.).

PART 3 - EXECUTION

A. EXAMINATION

1. Before bidding, verify and become familiar with existing conditions by visiting the site, and include factors that may affect the execution of this work. Include related costs in the initial bid proposal. Coordinate exact requirements governed by actual job conditions. Check information and report any discrepancies before fabricating work. Report changes in time to avoid unnecessary work. Coordinate shutdown and start-up of existing, temporary, and new systems, and utilities. Notify the Owner, City, and utility company.

B. INSTALLATION

1. Before bidding, be familiar with rulings of governing authorities and comply with such requirements.
2. Follow manufacturer's directions where they cover points not specifically indicated. If they conflict with the Drawings and Specifications, obtain clarification before starting the work.
3. Provide all necessary escutcheons, drains, test valves and accessories, hose connections for flow test, spare parts, tools and signs that are required for the work of this Section.
4. Piping
 - a. Locations and Arrangements: Deferred Approval plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 - 1) Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
 - b. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.
 - c. Install unions adjacent to each valve in pipes NPS 2 and smaller.
 - d. Protect unattended openings in piping from dirt and vandalism during construction.
 - e. Ensure that joints do not occur in piping installed in pipe sleeves.
 - f. Install piping system so it will not be exposed to temperatures of 40°F or lower.
 - g. Install sprinkler lines above ceiling and within walls so that no piping is visible within the building. Where possible, pipes shall be concealed and run parallel to buildings lines.
5. Make provisions for the necessary openings in the building to allow for the admittance of equipment. Cutting, patching, and repairing for the proper installation and completion of the work specified in this Division, including plastering, masonry, concrete, carpentry, and painting work, shall be performed by skilled craftsmen of each respective trade, in conformance with the appropriate Division of work. Make additional openings that are required in building construction by drilling or cutting. Use of a jackhammer is specifically prohibited. Beams or columns shall not be pierced without permission of the Architect and only as directed.
6. Fill holes that are cut oversize so that a tight fit is obtained around the sleeves passing through.

7. The entire system and apparatus shall operate at full capacity without objectionable noise or vibration.
8. Underground mains and lead-in connections to system risers shall be completely flushed before connection is made to overhead sprinkler piping. Where underground piping is flushed and not immediately connected to the overhead piping, the riser shall be capped or otherwise protected to prevent debris, dirt, or animals from entering into the underground piping (Witnessed by the Project Inspector).
9. Grooved joints shall be installed in accordance with the manufacturer's latest published instructions. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service. Gaskets shall be molded and produced by the grooved coupling manufacturer. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Grooved coupling manufacturer's factory trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools, application of groove, and installation of grooved piping products. Factory trained representative shall periodically visit the jobsite to ensure best practices in grooved product installation are being followed. Contractor shall remove and replace any improperly installed products.
10. The end sprinkler on each line shall be restrained against excessive vertical and lateral movement.
11. The Inspector's Test Valve location shall be installed within the most hydraulically remote system area. The pipe sized shall be no less than 1 inch, with a smooth bore, corrosion-resistant orifice, providing the equivalent flow of the smallest orifice of the sprinkler types installed within the system. The discharge shall be to the exterior of the building.
12. The sprinkler flow switch shall be tested to confirm that when the Inspector's Test Valve is activated, an alarm will sound no more than 90 seconds after initial flow (Witnessed by the Project Inspector).
13. Connect system to flange. See Civil Plans.
14. Install system to drain. Drain trapped piping in accordance with NFPA 13.
 - a. Install main drain from riser.
 - b. Install auxiliary drains in low points of piping system and inspector's test valve drain to mechanical pad located outside building unless otherwise directed by Architect.
15. Do not use dropped, damaged, or used sprinkler heads.
16. Install sprinkler lines above ceiling and within walls so that no piping is visible within the building. Where possible, pipes shall be concealed and run parallel to buildings lines. Sprinkler heads shall be located in the center of ceiling tile.
17. Install tamper switches and pressure flow detectors where indicated.

18. Brace and support system to meet seismic zone requirements for building site. Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE 7.
19. All concealed spaces shall be protected by sprinklers except areas not required by NFPA 13.
20. All exterior walkways between and adjacent to the buildings shall be sprinkled.
21. Install materials and equipment to allow convenient servicing (e.g., no piping in front of manholes, heaters, controls, electrical equipment, pumps, etc.).
22. Where pipes, etc., pass through roofs or outside wall above grade, provide flashings with weather-tight installation. Where not otherwise specified or shown, flashings shall be 24-gauge minimum thickness galvanized steel, with 8" minimum flange all around and 8" minimum height.
23. Pipe penetrations at finished surfaces shall be covered with chrome plated escutcheon plates with set screws.
24. Exposed sprinkler pipe in stairways shall be bent to suit overhead contours (no offset fittings shall be used for this purpose).
25. Connections from branches or mains to sprinkler heads shall be off of the top of branch or main pipe with return bend or piping for adjustment of location.

C. FIELD QUALITY CONTROL

1. Testing and acceptance of fire sprinklers shall be done in accordance with NFPA Standards, California Fire Code, Local Authority Having Jurisdiction, and State Fire Marshal requirements. The Contractor shall generate all tests required by local, state, and federal laws, codes, ordinances, and regulations having jurisdiction over this work.
2. Contractors shall not allow or cause any work of this Section to be covered or enclosed until it has been inspected, tested, and approved by the Architect and the Authorities Having Jurisdiction over the Work. Certificates of approval shall be furnished to the Owner. Should any of this work be enclosed or covered up before such inspection, testing, and approval, this Contractor shall uncover the work, have the necessary inspections, tests, and approvals made and, at no expense to the Owner, make all repairs necessary to restore both his work and that of other contractors which may have been damaged to be in conformity with the Contract Documents.
3. Should leaks develop while testing, repairs shall be made, and tests shall be repeated until a satisfactory test result is obtained.
4. Site Tests
 - a. Test system according to 'Contractor's Material and Testing Certificate for Above Ground Piping' per NFPA 13.
 - b. All piping and attached appurtenances subjected to system working pressure shall be hydrostatically tested at 200 psi, or 50 psi in excess of the system working pressure, whichever is greater, and shall maintain that pressure without loss for 2 hours (Witnessed by Project Inspector).

- c. Tests shall be witnessed by Architect or Owner's Representative and representative of local jurisdiction over fire prevention.
 - d. Test blanks shall have red painted lugs protruding beyond flange to clearly indicate their presence and be numbered to assure their removal when testing is completed.
- 5. At time of final inspection of the fire sprinkler system, the Contractor shall provide to the school district:
 - a. All literature and instructions provided by the manufacturer describing proper operation and maintenance of any equipment and devices installed.
 - b. A copy of NFPA 25 with California amendments, 2013 edition
 - c. A copy of CCR Title 19, Chapter 5 "Fire Extinguishing Systems"
- 6. The Sprinkler Contractor shall complete and sign Contractor's Material Certificate for the Aboveground Piping. This form shall be given to the Project Inspector who will forward it to DSA for filing in project records.

D. WARRANTY

- 1. Provide a written guarantee covering the work of this Division for one year from the date of acceptance by the Owner. Provide manufacturer's written warranties for material and equipment furnished under this Division.

E. OWNER'S INSTRUCTIONS

- 1. Instruct building maintenance personnel in operation and maintenance of system, utilizing Operation and Maintenance manual when so doing. The minimum instruction period shall be 4 hours.
- 2. Instruction periods shall occur after Substantial Completion inspection, when the system is properly working, and before final payment is made.

F. MAINTENANCE

- 1. Furnish valve wrenches and operating and maintenance instructions to Owner upon completion of work.
- 2. Provide spare sprinkler head cabinet, sprinkler wrench, and no fewer than 6 spare sprinkler heads matching the types and temperature rating in each protected area for systems less than 300 sprinklers (12 spare sprinkler heads for systems 300 to 1,000 sprinklers).
- 3. Furnish valve wrenches and operating and maintenance instructions to Owner upon completion of work.

G. MICROBIOLOGICALLY INFLUENCED CORROSION (M.I.C.)

- 1. All water used to charge or test the fire sprinkler system shall be treated to prevent M.I.C. in accordance with NFPA-13.
- 2. Alternately, piping coated with "MIC Shield" (Wheatland Tube or equal) may be used in lieu of treatment, if acceptable to the local and state Fire Marshal.

END OF SECTION

SECTION 22 00 00

PLUMBING

PART 1 GENERAL**1.1 SECTION INCLUDES**

- A. The Bidding Requirements and Contract Forms, including General Conditions and Supplemental General Conditions, and Division 01 Sections apply to all work herein.
- B. The Contractor shall provide all supervision, labor, materials, transportation, equipment, hauling and services necessary for a complete and operational system, unless otherwise noted. Anything accepted as standard trade practice reasonably incidental to the completion of the plumbing systems, such as offsets, fittings, etc., even though not specifically shown on Drawings or indicated in Specifications, shall be furnished without additional cost to the Owner. The Contractor shall understand that the work herein described shall be complete in every detail, notwithstanding every item necessarily involved is not particularly mentioned, and the Contractor shall be held to provide all labor and material necessary for the entire completion of the work.

1.2 DESCRIPTION OF WORK

- A. Furnishing, fabrication, and installation of complete plumbing systems as indicated on the Drawings. Plumbing work includes, but is not necessarily limited to, the following items:
 - 1. A complete system of soil, waste, vent and sanitary sewer piping and structures, including provisions for mechanical equipment drainage; and connection of same to public sanitary sewers, located as indicated on the Drawings.
 - 2. Cold water distribution system, complete, from points of contact with site domestic water systems (located approximately as indicated on the Drawings) to all plumbing fixtures, mechanical equipment, building specialties, and Owner supplied equipment scheduled for service on the Drawings.
 - 3. Hot water distribution system, complete, from serving water heaters and/or points of contact with site domestic hot water, to all plumbing fixtures, mechanical equipment, building specialties, and Owner supplied equipment scheduled for service on the Drawings.
 - 4. General service compressed air piping
 - 5. All plumbing fixtures and trim as scheduled on the Drawings, inclusive of setting of fixtures and connections to drainage and water supply systems.

6. Flashing of all plumbing pipe penetrations through exterior walls, roofs, and foundations. Sheet metal and lead flashings for pipe penetrations through roofs shall be furnished by the Plumbing Contractor and installed by the appropriate Roofing Contractor.
7. Condensate drainage piping and connections from points of attachment to equipment to indirect waste locations, as indicated on the Drawings.
8. Final connection of water and natural gas to equipment furnished under other Sections.
9. Excavation and backfill as required for the work of this Section
10. Pipe wrapping and insulation.
11. Rough in and connection of all fixtures and equipment furnished by the Owner and/or Tenant.
12. Testing and adjusting of all piping systems and equipment herein specified.
13. Sterilization of domestic water systems.

1.3 RELATED WORK

- A. Sealants and firestopping - Division 07
- B. Finish painting: Division 09.
- C. Electrical work: Division 26.

1.4 CODES AND STANDARDS

- A. Regulatory compliance: All work performed under this Section shall comply with all regulations and requirements of the State of California and any districts having jurisdictional authority.
- B. Conform to the applicable rules and regulations, including but not limited to the following:
- C. California Code of Regulations – Title 24 Building Standards, Parts 1 through 12, including
 1. 2022 California Administrative Code
 2. 2022 California Building Code
 3. 2022 California Energy Code
 4. 2022 California Building Energy Efficiency Standards

5. 2022 California Electrical Code
 6. 2022 California Fire Code
 7. 2022 California Green Building Standards
 8. 2022 California Mechanical Code
 9. 2022 California Plumbing Code
- D. Compliance with
1. Safety Orders issued by Cal-OSHA and any other regulations of the State of California and any districts having jurisdictional authority
 2. Local jurisdiction codes and amendments
 3. Local utility requirements for water and sewer provisions as appropriate
 4. City and State Fire Marshal requirements
 5. Local Health Department requirements
 6. NSF/ANSI 61 Standard, Drinking Water System Components - Health Effects for fixture materials that will be in contact with potable water.
 7. AB 1953, Amendments to Section 116875 of the Health and Safety Code relating to lead plumbing. Products made of or containing lead, asbestos, mercury, or other known toxic or hazardous materials are not acceptable for installation under this Division. Any such products installed as part of the work of the Division shall be removed and replaced and all costs for removal and replacement shall be borne solely by the installing Contractor.
 8. All accessible plumbing work shall comply with the Americans with Disabilities Act (ADA) and local amendments.
- E. Seismic Restraint/Vibration Isolation Requirements
1. Equipment, piping, and all system appurtenances (including weight of normal operating contents) shall be adequately restrained to resist seismic forces. Restraint devices shall be designed and selected to meet seismic requirements as defined in the latest code editions with state amendments, applicable local codes, applicable importance factors, and soil factors
- F. Through-Penetration Firestop Assemblies
1. Through-penetration and membrane penetration of fire-resistance-rated assemblies shall be caulked, sealed, and/or insulated as required to maintain the fire (F) rating and temperature rise (T) rating of the penetrated assembly. Install per manufacturer's installation instructions, conform with ASTM E814 or

UL 1479, and comply with Chapter 7 of the Building Code. Refer to Drawings for additional requirements.

2. Perform all tests required by governing authorities and required under this Section. Provide written reports on all tests.

G. Referenced Standards

1. Provide in accordance with the applicable referenced standards of the following:
 - a. ADA – Americans with Disabilities Act
 - b. ANSI – American National Standards Institute
 - c. ASME – American Society of Mechanical Engineers
 - d. ASSE – American Society of Sanitary Engineers
 - e. ASTM – American Society for Testing Materials
 - f. AWS – American Welding Society
 - g. AWWA – American Water Works Association
 - h. CISPI – Cast Iron Soil Pipe Institute
 - i. IAPMO – International Association of Plumbing and Mechanical Officials
 - j. NEMA – National Electrical Manufacturer's Association
 - k. NFPA – National Fire Protection Association
 - l. PDI – Plumbing and Drainage Institute
 - m. UL – Underwriters Laboratories
- H. When the Contract Documents call for materials or construction of a higher standard than is required by the above, the Contract Document requirements shall take precedence over the requirements of the said laws, rules, and/or regulations, accepting that nothing in the Contract Documents shall be interpreted as permitting work in violation of said laws, rules, and/or regulations. The Contractor for this work shall furnish any additional materials and/or labor as may be required for compliance with these laws, rules, and/or regulations though such materials and/or labor are not specifically set forth in the Contract Documents, with no additional charges to Owner.
- I. Seismic construction and restraints shall be in accordance with the requirements of the California Building Code and Title 17 and Title 24 of the California Code of Regulations. All equipment mounts, isolators, and hanging systems must meet DSA approval requirements.

1.5 SUBMITTALS

- A. All submittals shall be submitted under the provisions of Division 01 and the following.
- B. General
 1. Before any fixtures, materials, or equipment are purchased, the Contractor shall submit to the Architect for approval, a complete list of materials, fixtures, and equipment, giving the manufacturers' names, capacity, size, power

requirements, and other pertinent data. Submittal lists and drawings shall be specifically applicable to this project and shall include identifying marks assigned by Specifications and Drawings and shall not contain extraneous material or optional choices.

2. Submittal of substitutions shall be limited to one (1) proposal for each type or kind of item, unless otherwise permitted by the Architect. If the first proposed product submittal is rejected, the Contractor shall then submit the first named or scheduled product.
3. Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements. Review of drawings and other material submitted shall not be construed as a complete check or constitute a waiver of the requirements of the Drawings and Specifications but will indicate that the material submitted is acceptable in quality and utility. This review shall not relieve the Contractor of the responsibility to fit the proposed materials to the spaces provided, and to effect necessary rearrangement or construction of other work.

C. Product Data (for each type of product)

1. Submit cut sheets for each plumbing fixture. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports and indicate materials and finishes, dimensions, construction details, and flow control rates for each fixture indicated.
2. Submit manufacturer's product data for all plumbing piping, fittings, materials, and equipment.

D. Shop Drawings:

1. Prepare complete consolidated and coordinated layout drawings for all new systems, and for existing systems that are in the same areas. Shop drawings shall be prepared using AutoCAD 2016 or newer and shall be drawn at a minimum $\frac{1}{4}" = 1' - 0"$ scale. Sections, details, and diagrams shall be to required scales for specified areas. Include diagrams for all piping, and power, signal and control wiring.
2. Complete and detailed shop drawings shall be maintained throughout the coordination and construction phase, indicating all equipment and trades' work clearly. All equipment including piping, etc. shall clearly identify both top and bottom elevations as well as distances from equipment to established building lines. Coordinate with other trades and field conditions and show dimensions and details including building construction and access for servicing.
3. Use of contract documents for shop drawings is not acceptable.

4. Submit shop drawings to Architect for approval, prior to fabrication or installation of any work. Do not install equipment or piping until layout drawings have been approved.
5. Any work installed without prior shop drawing approval shall be removed at the Contractor's expense.

E. Welding Procedures & Certificates

1. Before any welding is performed, the contractor shall submit to the Architect, copies of any welding procedure specifications and their supporting procedure qualification records for review and acceptance. Copies of welder qualification records shall be made available for review to the owner or his representative at the construction site.
2. All work shall be performed to meet or exceed the requirements of the American Welding Society AWS B2.1 Specification for Welding Procedure and Performance Qualification and ASME Boiler and Pressure Vessel Code Section IX, "Welding and Brazing Qualifications".
 - a. Certify that each welder has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current

F. As-Built Drawings

1. A complete set of Contract Drawings shall be maintained at the work site, and all changes in the work shall be recorded on this set on a daily basis. In addition to changes made during course of work, show the following:
 - a. Exact location, type and function of concealed valves and controllers.
 - b. Exact size, elevations and location of underground and under floor piping.
2. Submit to Architect for final approval.

G. Operation and Maintenance Data

1. Contractor shall provide all operating and maintenance instructions provided by the manufacturer, describing proper operation and maintenance of any equipment and devices installed. Operating and maintenance instructions shall cover maintenance, adjustment, and operation of each piece of apparatus.
2. Contractor shall also provide a parts list of all equipment and component parts for all equipment under this Section. The equipment list shall include manufacturer's name, model number, and local representative, service facilities and normal channel of supply for each item.
3. Data shall be bound in a hard cover 3-ring binder, with table of contents identifying items therein, and index tabs for each system. Neatly obscure or

cross out inapplicable data from manufacturer's literature. Include the following:

- a. Manufacturer's brochures, ratings, certified shop drawings, lubrication charts and data, and parts list with part numbers. Mark each sheet with equipment identification number and actual installed condition or system and location of installation. Specifically identify which options are provided.
 - b. Description of start-up and operating procedures for each system, including controls diagrams and description of operating sequences.
 - c. Recommend preventative maintenance schedule and procedures.
4. Submit data to the Architect for approval. Final acceptance of the work will not be made until a satisfactory submission of this material is received and approved by the Architect.

1.6 ACCURACY OF DATA

- A. The data given herein and on the Drawings are as exact as could be reasonably secured, but absolute accuracy is not guaranteed. Exact locations, distances, elevations, etc. will be governed by shop drawings, the building itself, and actual field conditions.

1.7 UTILITY CONNECTIONS

- A. Provide all services within the building to a point five feet outside of building. Arrange for all utility connections, determine their exact requirements, and pay all costs incurred unless indicated otherwise.
- B. Send proper notices, make necessary arrangements, and perform other services required for care and maintenance of all utilities and assume all responsibility concerning same. Observe all rules and regulations of the respective utilities in executing the work.

1.8 PRODUCTS CRITERIA

- A. Only specified materials shall be utilized in the work of this Section unless substitutions have been approved in accordance with the General Conditions and Division 01 Sections of these Specifications.
- B. All materials, appliances, and equipment shall be new and best of their respective kinds, free from defects, testing agency labeled or with other identification whenever standards have been established, and of the make, brand or quality specified or as accepted by the Architect.
- C. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
- D. All fixtures, materials, and equipment equal in quality and utility to these herein mentioned will be accepted. When specific names are used in describing fixtures,

materials, and equipment they are mentioned as standards only, but this implies no right on the part of the Contractor to use other fixtures, materials and equipment, or methods, unless approved as equal in quality and utility by the Architect. The decision of the Architect shall govern as to what fixtures, materials, and equipment are equals to those mentioned, but the burden of proof as to the quality of any proposed fixtures, materials, or equipment shall be upon the Contractor. If any tests are necessary to determine the quality of proposed fixtures, materials, or equipment, an unbiased laboratory shall make such tests at the expense of the Contractor. The chosen laboratory shall be satisfactory to the Architect.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Contractor shall be responsible for delivery, storage, protection and placing of all equipment and materials.
- B. Contractor shall protect the work and materials from damage during construction. Equipment stored at the jobsite shall be protected from dust, water or other damage, and be covered if equipment is exposed to weather. Protect interiors of new equipment and piping systems against entry of foreign matter. Clean both inside and outside before painting or placing equipment in operation.
- C. Any items damaged shall be repaired or replaced, at no additional cost to the Owner.
- D. Cleanliness of Piping and Equipment Systems:
 - 1. Exercise care in storage and handling of equipment and piping material to be incorporated in the work. Remove debris arising from cutting, threading and welding of piping.
 - 2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.
 - 3. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.10 COORDINATION

- A. All work shall be coordinated with water, gas, sanitary sewer, and other services on the site. The locations of points of connection to the site services shall be confirmed prior to commencement of work.
- B. Coordinate roughing-in and final plumbing fixture locations and verify that fixtures can be installed to comply with original design and referenced standards.

1.11 COOPERATION WITH OTHER TRADES

- A. Cooperate fully with other trades doing work on the project as may be necessary for the proper completion of the project. Refer to the Structural, Plumbing, and Electrical Drawings for details of the building structure and equipment installation that will tend

to overlap, conflict with, or require coordination with the work of this Section, and schedule this work accordingly.

- B. Priority of right of way in space shall be as follows, in decreasing order of authority:
 - 1. Electrical lights, electrical panels and drain piping.
 - 2. Ductwork.
 - 3. Fire protection piping, domestic hot water, domestic cold water and condenser water piping.
- C. Any work done without regard for other trades shall be moved, replaced, or redone as required, without extra charges to Owner.

1.12 DAMAGE BY LEAKS

- A. Contractor shall be responsible for any damage to work of other Contractors that is caused by leaks in any temporary or permanent piping systems due to pipe rupture, disconnected pipes or fittings, or by overflow of equipment.

1.13 LICENSING REQUIREMENTS

- A. All plumbing systems shall be installed by a C-36 Plumbing Contractor. Plumbing systems include: waste removal and connection of on-site waste disposal systems; piping, storage tanks, and venting for supply of gases and liquids for any purpose; all gas appliances, flues, and gas connections; water and gas piping from the owner's side of utility meter to the structure or fixed works; installation of any type of equipment to heat water or fluids to a suitable temperature; and maintenance and replacement of the items described above, including health and safety devices.

PART 2 PRODUCTS

2.1 PIPE, FITTINGS

- A. General
 - 1. Tracer wire shall be installed with all non-metallic piping below grade. Tracer wire shall be solid core copper, 14 gauge minimum, laid continuously along pipes. Wire shall be "ty-wrapped" to pipe at eight feet on center. Tracer wire shall terminate in concrete access boxes at the beginning and terminal ends of the buried pipe.
 - 2. All accessible pipe 2" and smaller shall be threaded. Fittings for threaded pipe shall be 150-lb. malleable iron, screwed and banded.
 - 3. Vent piping shall have vandal resistant mushroom vent caps.

4. At penetrations through building walls, provide link seal around pipe.
 5. Ferrous water piping installed within a building and in or under a concrete floor slab resting on the ground shall be protected by either a protective coating or field wrapping of equivalent protection.
- B. Soil, Waste, Drain, & Vent Piping and Fittings:
1. Pipe: Standard weight no-hub cast iron soil pipe conforming to the requirements of CISPI Standard 301, ASTM A 888. All pipe and fittings shall be manufactured in the United States and shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute® and listed by NSF® International.
 - a. Approved manufactures: AB&I, Charlotte, Tyler Pipe
 2. Couplings Underground: Super heavy-duty stainless-steel couplings conforming to ASTM C1540 with heavy-duty shield and neoprene sealing sleeve conforming to ASTM C564, CISPI 310 and FM-1680. Minimum 4 stainless steel clamps for pipes up to 4 inches diameter.
 - a. Approved manufacturers: Anaco Husky "SD-4000", Mission "Heavy Weight", Ideal Tridon "HD", or equal.
 3. Couplings Aboveground: Heavy-duty, stainless-steel couplings conforming to ASTM C1540 with heavy-duty shield and neoprene sealing sleeve conforming to ASTM C-564, CISPI 310 and FM-1680.
 - a. Approved manufacturers: Anaco Husky "HD-2000", Mission "HeavyWeight", Ideal Tridon "MD", or equal.
- C. If the native soil at the project site is found to be highly corrosive, no steel or cast iron pipe shall be used below grade.
1. PVC Pipe and Fittings:
 - a. Solid wall PVC schedule 40 DWV, ASTM D2665. All pipe and fittings shall be manufactured in the United States. All systems shall utilize a separate waste and vent system. Pipe and fittings shall conform to NSF International Standard 14. Charlotte pipe or equal.
 - b. PVC socket fittings: ASTM D2665, made to ASTM D3311, drain, waste and vent patterns
 2. Joints shall be made in a two-step process with primer conforming to ASTM F656 and solvent cement conforming to ASTM D2564. Oatey, Rectorseal, Weldon, or equal.
- D. Hot, Cold & Tempered Water Piping:
1. All domestic hot, cold and tempered water piping 3" and smaller shall be Type L, hard temper, copper pipe with wrought copper or cast brass solder joint

fittings. Pipe shall be NSF 61 Certified and bear the NSF Certification mark. All joints shall be made up with lead free solder. A suitable non-corrosive flux shall be used at all joints.

- a. Press fittings shall also be acceptable: Viega "Copper Press" fittings or approved equal. Copper and copper alloy press fittings shall conform to material requirements of ASME B16.18 or ASME B16.22 and performance criteria of IAPMO PS 117. Sealing elements for press fittings shall be EPDM. Sealing elements shall be factory installed or an alternative supplied by fitting manufacturer. Press end shall have SC (Smart Connect) feature design (leakage path).
 2. Pipes below grade inside buildings shall be soft drawn, Type L or K copper with no joints below slabs. Pipes shall be sleeved with 20-mil plastic sheathing.
- E. Compressed air piping:
1. Pipe: ASTM B88, Type L, seamless, drawn temper copper tube with solder joint fittings.
 2. Fittings:
 - a. Cast bronze, solder joint, pressure rated, ANSI B16.22
 - b. Wrought copper or bronze, solder joint, pressure rated, ANSI B16.22.
 3. Joints: Lead free (< 0.2%) solder, Bridgit or Silvabrite, ASTM B32; flux, ASTM B813.
 4. Below ground shall be sleeved with 20 mil plastic sheathing.
- F. Compressed Air Safety Valves: ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels, National Board certified, labeled, and factory sealed; constructed of bronze body with poppet-type safety valve for compressed-air service.
1. Pressure Settings: Higher than discharge pressure and same or lower than receiver pressure rating.
- G. Condensate Drainage and Indirect Waste Piping:
1. 1 ¼" and larger shall be type DWV, drawn temper seamless copper tube, ASTM B306 with wrought copper or cast brass fittings. Wrought copper fittings shall comply with ASME B16.29.
 2. 1" and smaller shall be type M, drawn temper, seamless copper tube, ASTM B88 with standard pressure fittings.
 3. Drainage fittings shall be ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings. 1 ¼" & smaller, standard pressure fittings.

4. Acidic condensate drainage pipe and fittings shall be Schedule 40, NSF-14, ASTM 439, socket fittings, solvent weld CPVC.
5. Joints shall be made with lead free solder.

2.2 UNIONS

- A. Unions or flanges shall be furnished and installed at each threaded connection to all equipment or valves. The unions shall be located so that the piping can be easily disconnected for removal of the equipment, tank, or valve, and shall be of the type specified in the following:
 1. Steel pipe: ASC/Anvil Figure 463 Class 150 union, malleable iron, bronze to iron seat, ground joint, or equal. ASME B16.39, 150lb. wsp, 300lb. wog non-shock
 2. Copper pipe: lead-free bronze, solder pressure union: NIBCO series 733-LF, Mueller Streamline, or equal. MSS SP-123
 3. Dielectric: Watts LF3001A or equal; lead free construction, female iron pipe thread to solder connection, NSF Certified, max. temperature 180° F, max. pressure 250 psi

2.3 DIELECTRIC FITTINGS

- A. Precision Plumbing Products, "Clear Flow" series, threaded dielectric fittings, sizes 19100P thru 19195P.
- B. Dielectric fittings shall have zinc electroplated steel casing, and NSF/FDA listed lining. Fittings shall meet the requirements of ASTM standard F1545 for continuous use at temperatures up to 225°F (- +5°F) and for pressures up to 300 psi and shall achieve a dielectric waterway in all potable water applications.

2.4 VALVES, SPECIALTIES

- A. General Requirements:
 1. All valves, except pressure reducing and control valves, shall be the same size as the pipe to which they are installed.
 2. All valves of a particular type and size range shall be the product of one manufacturer.
 3. Valve body materials shall be compatible with piping system materials.
 4. Provide a union immediately downstream from each valve, unless the valve is flanged.

5. All valves shall be installed with the stem 45 degrees above horizontal, if possible. In no case shall the stem be installed below horizontal.
 6. Where insulation is required, install extended stem valves arranged in proper manner to receive insulation.
 7. Removable insulation jackets shall be provided on all valves.
- B. Ball Valves
1. NIBCO T-685-80-LF, Watts LFB-6080, or KITZ 858; (Threaded) lead-free, bronze alloy, 2-piece body, full port, blowout proof stem; MSS SP-110; NSF/ANSI-61-8 and NSF/ANSI-372; 600 PSI non-shock cold working pressure.
 2. NIBCO S-685-80-LF, Watts LFB-6081, or KITZ 859; (Solder) lead-free, bronze alloy, 2-piece body, full port, blowout proof stem; MSS SP-110; NSF/ANSI-61-8 and NSF/ANSI-372
- C. Gate Valves:
1. 3" and smaller shall be NIBCO T-111-LF, Stockham B-120, KITZ 42T; bronze body, union bonnet, rising stem, solid wedge, 150 lb. with wheel handle.
- D. Lift Check Valves (vertical): NIBCO T-480-Y-LFor KITZ 836; bronze body, inline lift type, Teflon seat, and discs, spring actuated, 125 lb.
- E. Swing Check Valves (horizontal): NIBCO T-413-Y-LF, Stockham B-345, or KITZ 822T; bronze body, Y-pattern swing-type, rated 200 PSI non-shock CWP. Body, bonnet, and disc hanger shall be of lead-free dezincification-resistant material and TFE seat disc. Valve ends shall be threaded type. Valves shall be 3rd party certified to Annex G of NSF/ANSI 61.
- F. Flow Control/Balancing Valves: Griswold Controls "ISOLATOR Y"; forged or cast brass body, accessible Type 304 stainless steel cartridge; nickel plated brass ball valve, dual Teflon seals and EDPM o-ring stem, 2 ports.
- G. Thermostatic Mixing Valves: Point-of-Use Valves (for lavatories & sinks)
1. Chicago 122-ABNF or equal, bronze body, adjustment cap with locking features, double throttling, inlet filter washers, integral inlet check, hydraulic principal thermostat that controls hot and cold water.
- H. Water Pressure Regulating Valves: Zurn Wilkins 500XLYSBR series or approved equal. Cast bronze valve body, stem and & plunger, stainless steel fasteners, strainer screen and seat. Meets NSF61. Install where pressure to building exceeds 70 psi.
- I. Backflow Preventers (Where shown on the Drawings or required by local code):

1. Reduced Pressure type: (main cold water line):
 - a. 3/4 to 2": Watts LF909-FS small with 909 series air gap fitting, Zurn 975-XL series, or equal
- J. Air-Main Pressure Regulators: Bronze body, pilot-operated, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 250-psig inlet pressure, unless otherwise indicated.
- K. Air-Line Pressure Regulators: Diaphragm or pilot operated, bronze body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 200-psig minimum inlet pressure, unless otherwise indicated.

2.5 HOSE BIBBS

- A. HB-1: (Exterior Hose Bibb) Zurn Z1320-EZ, Encased, "Ecolotrol" "anti-siphon" automatic draining; integral backflow preventer, stainless steel box and hinged cover with operating key lock and "WATER" stamped on cover.

2.6 FLOOR DRAINS

- A. Drains in membrane dampproofed floors shall have flashing flange and membrane clamp.
 1. FD: Jay R Smith 2005Y(B); Duco cast iron body with flashing collar, and adjustable strainer head, nickel bronze square top, trap primer connection.
 2. FD-1 (shower): Jay R Smith 2005Y(A); Duco cast iron body with flashing collar, and adjustable strainer head, nickel bronze round top, trap primer connection.
 3. FD-2 (basin drain): ZURN #Z1189, size 100, acid resistant coated interior and exterior, fabricated steel oil/sediment interceptor, bronze cleanout plug, visible double wall trap seal, removable sediment bucket, horizontal baffle, internal vent connection, with Dura-Coated heavy-duty cast iron grate.

2.7 FLOOR SINK

- A. Drains in membrane dampproofed floors shall have flashing flange and membrane clamp.
- B. Where shown on the Drawings, floor sinks shall be as follows:
 1. Zurn Z1901-P-2, or equal, floor receptor 12" x 12" x 8" deep, cast-iron body and square light duty 1/2" grate with 1/2" slotted openings, white acid resisting porcelain enamel interior and top, complete with ABS anti-splash interior bottom dome strainer and 1/2" trap primer connection, 2" pipe size. Set rim flush with finished floor.

2.8 HOSE REEL

- A. American Lube industrial series heavy duty hose reels as follows:
 - 1. Air & Water Reels – Low Pressure: Model TIM-3108-75P; ½" x 75' platinum series double arm air/water reel with rubber hose

2.9 CLEANOUTS

- A. Cleanouts in membrane dampproofed floors shall have flashing flange and membrane clamps. Plugs shall be bronze, with cast iron body ferrule for cast iron pipe.
- B. Floor Cleanouts (FCO): Mifab C1100-R-3, or equal Watts, Zurn or Jay R Smith, adjustable floor cleanout with lacquered cast iron body and anchor flange, secondary "O" ring Test Seal, 4" diameter cleanout opening, and scoriated combined cover and plug top assembly with stainless steel vandal proof allen key screws and primary gasket seal. (For membrane floors, add Suffix -C for membrane clamp.)
- C. Grade (COTG): Mifab C1300-MF-4, or equal Watts, Zurn, or Jay R Smith, lacquered cast-iron heavy-duty access housing with fixed anchor flanges, extra heavy duty ductile iron access cover with 6 ½" clear bottom access. Cleanouts in un-paved areas shall be set in 18" x 18" x 14" concrete pads.
- D. Accessible:
 - 1. Cast iron pipe: Mifab C1450 series, or equal Watts, Zurn or Jay R Smith line cleanout plug with blind tapping.
 - 2. Steel pipe: Mifab C1430 series, or equal Watts, Zurn, or Jay R Smith, cast bronze recessed head bronze line cleanout plug with blind tapping.
 - 3. Copper tubing: NIBCO figure 816 or 817.
- E. Wall Cleanouts (WCO):
 - 1. Copper tubing: Mifab C1400-S7-1 or equal Watts, Zurn, or Jay R Smith, square smooth access cover and frame (specify material) with anchor lugs and vandal resistant stainless steel allen key screws. (7" x 7")
 - 2. Cast iron pipe: Mifab C1450-RD or equal Watts, Zurn, or Jay R Smith, line cleanout plug with blind tapping and 6" round, smooth stainless steel access cover with 3 ½" anchor screw.
 - 3. Steel pipe: Mifab C1430-RD or equal Watts, Zurn, or Jay R Smith, cast bronze cleanout plug with round, smooth, stainless steel access cover (specify diameter) and 3 ½" long anchor screw

2.10 SLEEVES, WALL PLATES

A. Sleeves

1. For non-rated penetrations, provide sleeves of 18-gauge iron, large enough to provide ½ inch annular clear space between sleeve and pipe or pipe insulation. Where pipes cross through footings or footing walls, provide a minimum 1 inch annular clearance between sleeve and pipe.
2. Seal annular space between sleeve and piping or piping insulation. Pack the annular space with joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 Section "Joint Sealants".
3. Pipe sleeves are required when pipes pass through footings or walls. Where piping passes through foundations, footings or bearing walls, provide pipe sleeves 2 sizes larger than the pipe passing through the structure. Provide Link-Seal at foundation walls.
4. Fire-Barrier Penetrations: Provide fire stops, and smoke sealant materials for all plumbing services penetrating through rated assemblies. Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.
 - a. 3M Fire Barrier CP25WB+ Sealant: High-performance, intumescent, water-based sealant. No-sag, fast drying, paintable, red in color. Versatile firestop sealant for pipes (not for use with CPVC), cables, cable tray, blank opening and other penetrations along with mineral wool or other fire-rated assembly products.
 - b. Fire Resistance: For use in 1-, 2-, 3- or 4-hour fire-rated systems.
 - c. Locations: Vertical assemblies, horizontal assemblies and smoke barrier.

B. Escutcheons

1. Where pipes pass through finished floors, ceilings, or walls in exposed locations, in finished areas only, provide chrome plated brass or chrome plated steel, one piece split type escutcheons with concealed hinge, with set screw for fastening to pipe or sleeve. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings, and pipe sleeve extension, if any.
2. Prime zinc base paint finish is allowed for unoccupied areas.
3. Moist Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate, provide stainless steel, cast brass, or sheet brass escutcheons, solid or split hinged.
 - a. Manufacturers: Keeney, Sioux Chief, Oatey, Brasscraft, or equal.

2.11 ACCESS DOORS

- A. Where construction is not inherently accessible, provide adequately sized and conveniently located access doors in ceilings, walls, and furring for access to controls and for servicing valves, equipment, etc.
- B. Access doors shall be flush, prime coated steel except for tiled surfaces, and screwdriver operated latch/locks, except for fire-rated. Minimum size shall be 12" x 12". Provide larger sizes where required.
 - 1. Fire Rated walls and ceilings: Milcor style UFR, Elmdor FRC, Karp KRP, or equal, U.L. Class B, 1½ hour rated, 20-gauge steel door; 16-gauge steel frame; insulated, self-closing, continuous piano hinge; keyed paddle latch, interior latch release.
 - 2. Drywall ceilings or walls: Milcor style DW, Elmdor DWB, Karp KDW or equal, drywall bead; 16-gauge steel frame & door or 16-gauge steel frame & 14-gauge steel door; concealed spring hinge
 - 3. Masonry walls: Milcor style M, Elmdor DW, Karp DSC-214M, or equal, 16-gauge steel frame & door or 16-gauge steel frame & 14-gauge steel door; spring loaded hinge
 - 4. Tiled walls and ceilings: Milcor style MS, Elmdor DW-SS, Karp DSC-214M(S), or equal, 16-gauge stainless steel frame & door or 16-gauge stainless steel frame & 14-gauge stainless steel door; satin finish; spring loaded hinge
 - 5. Plastered walls and ceilings: Milcor Style K, Elmdor ML, or equal, prime coated steel, flush screwdriver-operated cam lock. Minimum size shall be 12" x 12". Provide larger sizes where required.
- C. Doors shall be delivered to the General Contractor for installation.

2.12 SHOCK ABSORBERS

- A. MIFAB model WHB, Zurn model Z1700, or equal, water hammer arrestors, with nesting type stainless steel bellows and male N.P.T. connection. Arrestors shall comply with PDI WH-201.
- B. Water hammer arrestors are required for cold and hot water supplies to all lavatories, sinks, drinking fountains, water closets, urinals, and any other fixtures with quick closing valves. Install on both hot and cold-water branch lines, in an upright position, as close as possible to the valve or valves being served. Provide with ball valve/shut off valve. Arrestors shall be accessible. Provide with access door, if required.
- C. A single unit sized in accordance with the manufacturer's recommendations may serve a battery of valves.

2.13 PIPE INSULATION

A. General

1. Products shall not contain asbestos, lead, mercury, or mercury compounds.
2. Water lines installed in conditioned spaces can be installed without insulation.
3. Removable insulation jackets shall be provided on all valves.

B. Insulate all hot water supply piping, all hot water return piping, all tempered water supply piping, all tempered water return piping, all piping above ceilings, all cold water supply lines in unconditioned spaces, and all storm and overflow piping (including the body of the drain) with pre-formed fiberglass pipe insulation complying with ASTM C547, with factory applied all service vapor retarder jacket (ASJ), self-sealing longitudinal closure laps (SSL), and butt strips. Johns Manville "Micro-Lok HP®" or Owens Corning "SSL II with ASJ Max Jacketed Fiberglas®" pipe insulation, Armacell LLC Armaflex, or equal.

C. All insulation shall have composite (insulation, jacket, tape seal, and adhesive used to adhere the jacket to the insulation) Fire and Smoke Hazard ratings as tested under Procedure ASTM E 84, NFPA 255 or UL 723, not exceeding: Flame Spread - 25, Smoke Developed - 50. PVC fitting covers, jacketing and accessories such as adhesives, mastics, cements and cloth for fittings should have the same component ratings.

D. All-Service vapor retarder Jacket (ASJ) shall be constructed of high density, white kraft paper, reinforced with a glass fiber yarn and bonded to aluminum foil with self-sealing longitudinal closure laps (SSL) and butt strips. Adhesives or staples will not be required to seal the jacket and butt strips.

E. Fittings, valves, and flanges shall be insulated with Johns Manville "Zeston 2000" one-piece PVC fitting covers and "Hi-Lo Temp" insulation inserts or Proto "Lo Smoke".

F. Insulation for all exposed piping and all piping in crawl spaces shall be covered with Zeston or LoSmoke PVC jacketing. PVC jackets shall be 20 mil thick and shall be bonded with Zeston "Perma-Weld" or equal adhesive.

G. All piping exposed to the weather shall be finished with field applied aluminum jacketing, 0.016" thick with a factory-applied moisture retarder/protective liner. Johns Manville, ITW Insulation Systems, or equal. Aluminum jacketing shall be overlapped 2 to 3 inches and held in place with stainless steel bands to form a weather tight system. Elbows and tees shall be fitted with matching two-piece aluminum fitting covers. Other fittings in metal-jacketed systems shall be finished with conventional weather-resistant insulating materials with painted aluminum finish.

- H. Provide removable covers on pumps, backflow devices, valves greater than 2 inches, flanges, strainers, etc., where periodic maintenance or removal of insulation may be required.
- I. All domestic water piping below grade shall be insulated with flexible elastomeric insulation, Armacell "Armaflex", Trymer 2000XP, or equal. Pipes shall be sleeved with 30 mil PVC jacket, with glued joints.

2.14 HANGERS AND SUPPORTS

- A. All piping shall be supported with Superstrut, B-Line, Anvil, MIFAB, or approved equal pipe hangers and supports. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with shield for insulated piping.
- B. Hangers and supports shall be designed and manufactured in conformance with ANSI/MSS SP-58. Selection and application shall be in accordance with ANSI/MSS SP-69.
- C. All hangers shall be electro-chromate or corrosion resistant finished. Hanger rods shall have electro-galvanized finish.
- D. Roof top pipe supports
 - 1. MIFAB "C-Port" series or B-Line "Dura-Block" or approved equal.
 - a. Model C rubber support series with 14-gauge galvanized channel.
 - b. Seismic: Model CZ rubber base with 14-gauge galvanized channel
- E. Seismic hanger rod stiffeners: B-Line SC-228, Anvil AS 3500 or equal
- F. Copper tubing:
 - 1. B-Line 3690, Superstrut C-711 or Anvil Figure 67 "J" pipe hangers or approved equal, complete with isolator.
 - 2. Isolators: B-Line "Vibra Cushion" B1999, Type L & K for copper tubing, Superstrut C-716 isolator for copper, Anvil Figure CT-769 or approved equal
- G. Insulated pipe:
 - 1. Hangers: B-Line 3690 "J" pipe hanger, Superstrut C -711 or Anvil Figure 67 fitted to outside of insulation or approved equal
 - 2. Pipe Shields: B-Line 3151 insulation protection shield, Superstrut C-790, or Anvil Figure 167 or approved equal
- H. Channel: B-Line B22, Superstrut A 1200, Anvil AS 200 or approved equal.
- I. Trapeze hangers: Grouped pipes may be supported by channel bolted to rods.

J. Point of support connectors:

1. Wood construction:

- a. Stationary pipes: B-Line B3060, Superstrut 540 or Anvil Figure 206 side beam hanger clip or approved equal
- b. Pipes subject to movement: B-Line B-756 or Superstrut S-541 beam clamp swing connector or approved equal

2. New concrete construction: B-Line B2501 light duty spot inserts or Superstrut 452-TB spot inserts or approved equal.

3. Existing concrete construction: Phillips "Red-Head" 3-piece concrete anchors or Hilti "Quik-Bolt", drilled-in, concrete anchors.

4. Plywood decks: machine bolts, nuts and washers.

K. Vertical pipe risers:

1. Riser clamps: Superstrut C-720 extension riser clamps anchored to construction

- a. Bare cold-water pipe: Superstrut C-720P, PVC coated to prevent corrosion.

L. Cable Bracing: Cables shall be pre-stretched galvanized 7x19 strand core aircraft cable, with no limit to their installed length. Cables meet the following specifications: MIL-DTL-83420M with Amendment 2, Type 1 non-jacketed cable.

2.15 IDENTIFICATION OF SYSTEMS / LABELING

A. Pipe labeling shall be in compliance with ANSI/ASME A13.1 2015 "Scheme for the Identification of Piping Systems" and ANSI Z535.1 2017 "Safety Color Code". Brady, Brimar, Seton or approved equal. All piping shall be identified

B. Pipe Labels: Preprinted, color-coded, with lettering giving name of the contents (full or abbreviated) and arrows to indicate direction of flow.

1. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

2. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction(s).

3. Pre-tensioned Labels: Semi-rigid plastic wrap around pipe marker that extends 360° around the pipe at each marker location. The label shall have a ½" strip of adhesive on the inside to further secure the marker.

C. Pipe Label Sizes (per ANSI A13.1 / ASME A13.1-2015 Standards):

1. For pipes or covering with outside diameter $\frac{3}{4}$ to $1\frac{1}{4}$ inches, minimum length of label: 8 inches, minimum height of letters: $\frac{1}{2}$ inch.
 2. For pipes or covering with outside diameter $1\frac{1}{2}$ to $2\frac{3}{8}$ inches, minimum length of label: 8 inches, minimum height of letters: $\frac{3}{4}$ inch.
 3. For pipes or covering with outside diameter $2\frac{1}{2}$ to $7\frac{7}{8}$ inches, minimum length of label: 12 inches, minimum height of letters: $1\frac{1}{4}$ inch.
- D. Pipe Label Color Schedule: (per ANSI A13.1 / ASME A13.1)
1. Potable, Cooling, Boiler Feed and other Water Piping:
 - a. Background Color: Green.
 - b. Letter Color: White.
 2. Fire Quenching Fluids:
 - a. Background Color: Red.
 - b. Letter Color: White.
 3. Toxic and Corrosive Fluids
 - a. Background Color: Orange.
 - b. Letter Color: Black
 4. Flammable and Oxidizing Fluids:
 - a. Background Color: Yellow.
 - b. Letter Color: Black.
 5. Combustible Fluids:
 - a. Background Color: Brown.
 - b. Letter Color: White
 6. Compressed Air:
 - a. Background Color: Blue.
 - b. Letter Color: White.
 7. Abandoned Pipes
 - a. Background Color: White
 - b. Letter Color: Black
- E. Valve Tags:
1. For identification and Owner's maintenance records, all valves shall be numbered and identified with brass tags stamped with service abbreviation and sequential number, and pre-drilled holes for attachment hardware, in accordance with Drawings and service performed. Control valves shall be also marked whether normally open (N.O.) or normally closed (N.S.).

2. Minimum size letters: ¼-inch; numbers ½-inch. Minimum tag size: 1½-inch diameter.
- F. Fasteners: Attach to stem or body of valve so that tag is visible but doesn't interfere with the valve operation. Use Brass wire-link chain or beaded chain.
- G. Equipment
 1. All equipment shall be labeled with 1" high stencils showing identifying mark noted on drawings, and usage.
 2. A printed schedule of all stencils and valve tags used, with identification, shall be framed and posted in mechanical rooms, at locations as directed.

2.16 FIXTURES

- A. The quantity and location of fixtures shall be taken from the Architectural and Plumbing drawings. Provide adequate supports and all standard trim normally furnished for fixtures. All enamel shall be acid resisting. Traps, unless otherwise noted shall be 17 gage brass tubing, chrome plated when exposed.
- B. Except as otherwise shown, provide ¼" steel backing plates, 36" wide by 12" high minimum size, secured to a minimum of three studs by welding, or with ¼" x 2½" lag screws for all wall hung fixtures for which no other means of support is specified.
- C. Stops and supplies: Provide stops for all fixtures. Unless otherwise specified, stops exposed at lavatories and similar fixtures shall be Chicago #1016ABCP chrome plated, loose key.

D. FIXTURES

1. P-1 WATER CLOSET

- a. Fixture: Kohler "Highcliff™ Ultra" #K-96057, floor mounted, top spud, elongated bowl, 1.28 gpf
- b. Flush valve: Sloan "Royal" #111-1.28; 1.28 gpf; vandal resistant stop cap; adjustable tailpiece.
- c. Seat: Olsonite #95SSCT or equal, extra heavy duty; elongated; open front;

2. P-2 HAND SINK

- a. Fixture: Kohler "Ladena" #K-2214-G, 21" rectangular undermount sink, glazed underside, no overflow
- b. Faucet: Chicago Faucets 405-HE2805-317AB, concealed deck-mount with fully adjustable 6"-26" centers, chrome plated, wristblade handles, non-aerated flow outlet, rigid cast brass spout, 5" center-to-center. 0.5 GPM (HW/CW).

- c. Drain: McGuire 155A grid drain or equal
 - d. P-Trap: McGuire 8902C with cleanout or equal
3. P-3 URINAL
- a. Fixture: Kohler "Dexter™", #K-5452-ET, washout urinal, vitreous china, anti-backsplash wall, extended lip, 0.125 gpf
 - b. Flush Valve: Sloan "Royal" 186-0.125, manual, exposed, non-hold open handle, dual filtered bypass
 - c. Carrier: Zurn Z1222
4. P-4 JANITOR SINK
- a. Fixture: Florestone model 90 or equal, square drop front mop receptor; Terrazo surface, 24" x 24" x 12"
 - b. Faucet: Chicago Faucets #897-CP; vacuum breaker; pail hook; chrome plated; adjustable centers.
5. P-4A JANITOR SINK
- a. Fixture: Florestone model 90 or equal, square drop front mop receptor; Terrazo surface, 32" x 32" x 12"
 - b. Faucet: Chicago Faucets #897-CP; vacuum breaker; pail hook; chrome plated; adjustable centers.
6. P-5 HAND WASH SINK (ADA)
- a. Fixture: Elkay "Lustertone" LRAD151765PD; single compartment; drop-in ADA sink, 15" x 17 ½" x 6½" deep; 12" x 12" bowl; self-rimming; with "Perfect Drain®" 18-gauge, type 304 stainless steel; center drain, (1) 1 ¼" diameter faucet hole.
 - b. Faucet: Chicago Faucets #626-GN8FCABCP, remote rigid/swing gooseneck spout w/flow control, chrome plated, single supply. 1.5 GPM laminar flow insert in spout inlet.
 - c. Foot Pedal: Chicago Faucets #625-ABCP, pedal box fitting for hot & cold water, with short pedals, chrome plated. NAIAD rebuildable self-closing metering cartridge, immediate shut-off, opens with push.
 - e. P-trap: McGuire 8903C with cleanout with TrueBro® Soft Guard Plus™ under sink pipe protection to meet ADA compliance.
7. P-5A KITCHEN SINK (ADA)
- a. Fixture: Elkay "Crosstown" #ECTSRAD332260; single compartment; drop in undermount ADA sink, 33" x 22" x 6" deep; self-rimming; 18-gauge, type 304 stainless steel; rear center drain, (3) 1 ¼" diameter faucet holes for 8" centers faucet

- b. Faucet: Delta "Antoni™" series, #18803-DST; single handle, pull down, with escutcheon, ceramic cartridge, rotating spout 360°, hot/cold indicator markings, dual integral check valves in sprayer assembly, aerated stream or spray wand; 1.8 gpm (HW/CW)
 - c. Drain: Elkay LK99, stainless steel drain, tail piece, strainer basket
 - d. P-trap: McGuire 8903C with cleanout
8. P-5B LARGE COMPARTMENT SINK
- a. Fixture: West Star Industries "Premier Line" SP-1-2323-2D26.5 custom size, overall dimensions 76" x 28 ½"; 1 compartment, 2 drainboards; tub size 23" x 23"; drainboards 26 ½" each; single hole drilled, left splash option; 14 gauge type 304 stainless steel, 1 5/8" stainless steel adjustable flanged feet
 - b. Faucet: Chicago Faucets 629GN8FCABCP, wall mounted rigid/swing gooseneck remote spout with flow control, chrome plated, 1.5 gpm laminar flow insert (HW/CW)
 - d. P-trap: McGuire 8903C with cleanout
9. P-5C LAUNDRY SINK
- a. Fixture: Elkay "Lustertone® Classic", #1918; single compartment; drop in sink, 19" x 18" x 7-5/8" deep; self-rimming; 18 gauge, type 304 stainless steel; center drain, (3) 1 ¼" diameter faucet holes.
 - b. Faucet: Chicago Faucets #786-E35ABCP, manual faucet, 8" fixed centers, softflo aerator, 4" wristblade handles, soft flo aerator, 1.5 gpm; (HW/CW)
 - c. Drain: LK18, 3 ½" Type 304 stainless steel flat strainer and tailpiece
 - d. P-trap: McGuire 8903C with cleanout
10. P-6 DRINKING FOUNTAIN (SINGLE) + BOTTLE FILLER:
- a. Fixture: Haws model 1105-1920 drinking fountain + bottle filler. Drinking fountain: wall mounted, stainless steel, satin finish. Includes push button valve, polished chrome plated brass bubbler head and waste strainer, vandal-resistant bottom plate and 1¼" NPT trap. Bottle Filler: Haws model 1920 bottle filler, wall mounted, push button operated, flow adjustment, mounted over the 1105. See Architectural Drawings for mounting height. NOTE: Model #'s **1105+BP3+1920+BP15** must all be ordered to complete the assembly.

- b. Back panels: Haws model BP3, satin finish stainless back panel for fountain, model BP15, satin finish stainless back panel for bottle filler.
- c. Carrier: Haws #6700 in wall mounting plate

11. P-8 SHOWER

- a. Fixture: Tile shower area. Kohler "Venza®" series, #K-TS28128-4G "Rite-Temp®" shower trim kit, 1.75 gpm, faceplate with metal lever handle to control temp and on/off activation, single function showerhead, shower arm, flange
- b. Valve: Kohler "RiteTemp®" #K-8304KS valve body & cartridge kit complete, includes valve body, pressure balance cartridge, rough-in guide and mudguard. ½" universal NPT and direct sweat inlets and outlets, service stops with integral check valves, single lever, antiscald protection, adjustable high limit stop (ordered separately)

12. P-8A SHOWER (ADA)

- a. Fixture: Tile shower area. American Standard kit #TU-662SG.213 commercial shower system trim kit, includes valve trim with pressure balance cartridge, in-line vacuum breaker, 59" metal hose, wall supply, diverter handle, 36" slide-grab bar, showerhead, and hand shower 1.5 gpm
- b. Handshower: American Standard #1660.766, 3-function w/non-positive shut-off (included)
- c. Showerhead: "FloWise" #1660.710, fixed 1.5 gpm (included)
- d. Valve: "Flash™" series rough valve body #RU101SS with flash connections and screwdriver stops, cast DZR brass body, flush plug, retaining ring with flats (ordered separately)

2.17 WASHING MACHINE OUTLET BOX

- A. GB: Guy Gray model FR-12 metal washing machine outlet box with quarter-turn water hammer arrester valve. Heavy duty steel with white powder coated finish.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

- A. Prior to commencing the work of this Section, Contractor shall inspect the installed work of other trades and verify that their work is sufficiently complete to permit the start of work under this Section and that the finished work will be in complete accordance with the original design. In the event of discrepancy, the Contractor shall immediately notify the Architect and proceed as directed

- B. The Contractor shall have examined the site, compared it with the Contract Documents, and be satisfied with the conditions under which the work is to be performed. The Contractor shall be held responsible for all existing conditions, whether accurately described. No allowance shall subsequently be made on the Contractor's behalf for any error, omission, or extra expense that is due to failure or neglect on the Contractor's part to make such examination and notification.
 - 1. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected. Coordinate all work with other trades before proceeding with installation.
- C. Unless otherwise specifically indicated, equipment and materials shall be installed in accordance with the recommendations of the manufacturer. This includes the performance of tests as recommended by the manufacturer. Refer conflicts between the manufacturer's instructions and the contract drawings and specifications to the Architect for resolution
- D. Provide all necessary cutting in connection with the work of this Section. No structural members shall be drilled, bored, or notched in a manner that will impair their structural capacity. All penetrations of concrete or masonry shall be made with core drills. No cutting shall be done without the approval of the Architect or DSA. Cutting or boring of joists or other structural members shall be done only when alternative routing is impossible and only upon written approval of the Architect.
- E. Install gages, thermometers, valves and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position thermometers and gages to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.
- F. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing without impacting adjacent equipment or piping. Joints and fittings shall not be located in inaccessible locations such as wall, floor, and roof penetrations.

3.2 VERIFICATION OF EXISTING CONDITIONS AND DEMOLITION

- A. Before installation of any new work, verify the location, size and other conditions at all points of connection to services or other existing piping, and at all locations where new work will cross or pass near existing piping, electrical, or other facilities.
- B. Information shown relative to existing services is based upon available records and data during preparation of the Drawings, but shall be verified. Contractor shall make reasonable deviations found necessary to conform with actual locations and conditions, without extra charges to Owner,

- C. Remove piping, controls, fixtures, and equipment that is not to remain in service as shown on the Drawings or as required. This includes the removal of associated appurtenances and supports.
- D. Patch, cap, or repair existing works affected by this demolition in concealed spaces within 6" of a live main or branch.
- E. Deliver removed material to the Owner as directed by the Architect. Dispose of all other removed material offsite.

3.3 ACCESSIBILITY

- A. Equipment shall be placed, and piping connections made in such a manner that all routine adjustments and maintenance operations may be carried out without inconvenience and so that all code requirements for clearances are maintained.

3.4 DELIVERY, STORAGE, AND HANDLING

- A. Contractor shall be responsible for delivery, storage, protection and placing of all equipment and materials.
- B. Contractor shall protect the work and materials from damage during construction. Equipment stored at the jobsite shall be protected from dust, water or other damage, and be covered if equipment is exposed to weather. Protect interiors of new equipment and piping systems against entry of foreign matter. Clean both inside and outside before painting or placing equipment in operation.
- C. Any items damaged shall be repaired or replaced, at no additional cost to the Owner.
- D. Cleanliness of Piping Systems:
 - 1. Exercise care in storage and handling of piping material to be incorporated in the work. Remove debris arising from cutting, threading and welding of piping.
 - 2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.
 - 3. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

3.5 EQUIPMENT

- A. Equipment shall operate quietly and without objectionable vibration. Such problems, other than from equipment operating at optimum conditions, shall be the Contractor's responsibility and shall be eliminated at the direction of the Architect.
- B. Install equipment to provide good appearance, easy access, and adequate space to allow replacement and maintenance. Provide bases, supports, anchor bolts, and

other items required to achieve this. Installation shall be level, above moisture level, and adequately braced.

- C. Extend 1/4" schedule 40 black steel lubrication pipes from hard-to-reach locations to front of equipment or to access doors. Terminate with proper lubrication fittings.
- D. Move equipment into building through available openings. Dismantle equipment where necessary to accomplish this. After reassembly, test equipment to verify its satisfactory operating condition.
- E. Thoroughly lubricate equipment before operating. Repair of damage resulting from failure to comply with this requirement shall be the Contractor's responsibility.
- F. Connections to piping shall be secured and properly aligned and all utility and control connections shall be properly isolated from the building structure by means of vibration isolators and flexible connections. Any equipment not meeting this requirement will be modified and properly reinstalled at no expense to the Owner.

3.6 VIBRATION AND SOUND CONTROL

- A. Make all necessary provisions to prevent the transmission of vibration to the building structure and the passage of noise from the equipment rooms to other rooms. Provisions shall include: vibration isolators for motor driven equipment; flexible pipe connections to motor driven equipment; resilient mounting for piping; sealing off pipe and duct penetrations of walls, floors and ceilings of equipment rooms.
- B. Piping shall be installed and supported in a manner to provide for expansion without strains. Guides shall be properly installed to ensure this requirement.
- C. All piping which is not isolated from contact with the building by its insulation shall be installed with a manufactured type isolator.

3.7 SHOCK ABSORBERS

- A. Shock absorbers shall be installed at all solenoid, remote operated, or quick closing valves and at each plumbing fixture or battery of plumbing fixtures. Install on both hot and cold water branch lines, in an upright position, as close as possible to the valve or valves being served.
- B. Install where required by code in piping systems and where indicated on Drawings. Provide upstream of quick closing valves, including flush valves. Install on cold-water branch lines in an upright position, as close as possible to the valve being served. Install with gate valve shut-off valve and access door at all flush valves or other automatic valves. A single unit sized in accordance with the manufacturer's recommendations may serve batteries of valves.

3.8 INSULATION INSTALLATION

- A. The insulation shall be applied in complete accordance with the manufacturer's published installation instructions. All insulation shall be applied on clean, dry surfaces and shall be continuous through wall and ceiling openings and sleeves, except where fire stop materials are required.
- B. Install insulation with least number of joints practical. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- C. All pipe insulation ends shall be tapered and sealed, regardless of service.
- D. All surface finishes are to be extended to protect all surfaces, ends and raw edges of insulation.
- E. All joints shall be firmly butted together and longitudinal jacket laps and butt strips shall be smoothly secured.
- F. Adhesives, mastics, and coatings shall be applied at the manufacturer's recommended minimum coverage per gallon.
- G. Insulation on all cold surfaces must be applied with a continuous, unbroken vapor seal. Hangers, supports, anchors, etc. that are secured directly to cold surfaces must be adequately insulated and vapor sealed to prevent condensation. Seal all pipe terminations with vapor barrier mastic.
- H. Galvanized metal shields shall be applied between hangers or supports and the pipe insulation. Shields shall be formed to fit the insulation and shall extend up to the centerline of the pipe and the length specified for hanger inserts less 4" to allow for vapor retarding butt joints on each side of shields.
- I. Inserts shall be installed at outside hangers. Inserts between the pipe and pipe hangers shall consist of rigid closed cell pipe insulation of thickness equal to the adjoining insulation. Inserts shall not be less than 10" long for pipe sizes through 2½" and not less than 12" long for pipes larger than 2 ½". Refer to manufacturer's recommendations for densities, sectional length, gauge of metal shield and distance between centering.
- J. All piping exposed to the weather shall be finished with aluminum jacketing, ASTM B 209 M, with a laminated moisture retarder or self-adhesive water and weather seals. Aluminum jacketing shall be overlapped 2 to 3 inches and held in place with stainless steel bands, 12 inches o.c. and at end joints to form a weather tight system. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Elbows and tees shall be fitted with factory fabricated matching aluminum fitting covers.
- K. Install insulation with self-sealing factory-applied jackets as follows:
 - 1. Locate all longitudinal pipe insulation jacketing laps in least visible location.

2. Draw jacket tight and smooth.
 3. For proper sealing, seal lap joints with reasonable pressure being applied with a plastic squeegee or sealing tool.
 4. Vapor seal all circumferential joints with factory furnished matching pressure sensitive butt strips installed with reasonable pressure being applied with a plastic squeegee or sealing tool.
- L. For piping subject to abuse in mechanical rooms or high traffic areas, protect insulation from mechanical abuse by using appropriate thickness of PVC jacketing, metal jacketing, or laminated self-adhesive water and weather seal.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.9 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem 45 degrees above center of pipe, if possible. In no case shall the stem be installed below horizontal piping.
- D. Install valves in position to allow full stem movement.
- E. Install check valves for proper direction of flow and as follows:
- F. Swing Check Valves: In horizontal position with hinge pin level.
- G. Lift Check Valves: With stem upright and plumb.
- H. Provide a union immediately downstream from each valve unless the valve is flanged.
- I. Removable insulation jackets shall be provided on all valves connected to insulated piping.
- J. When soldering use paste flux that is approved by the manufacture for use with Lead Free Alloys.

- K. Adjusting: Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.10 MIXING VALVE INSTALLATION

- A. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
 - 1. Install thermometers and water regulators where indicated.
- B. Labeling and Identifying
 - 1. Equipment Nameplates and Signs: Install equipment nameplate or sign on or near each of the following:
 - a. Primary, thermostatic water mixing valves.
 - b. Provide explanatory text on signs. Identify units. Distinguish among units, inform operator of operating requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
- C. Testing and Adjusting
 - 1. Set field-adjustable temperature set points of temperature-actuated water mixing valves. Adjust set point within allowable temperature range.
 - 2. Test and adjust installation.
- D. Remove and replace malfunctioning thermostatic mixing valves and retest.

3.11 PAINTING

- A. Properly prepare work under this Section to be painted. Painting shall be applied under the Painting section requirements, except preservative and special painting. Priming as required shall conform to the Painting section requirements and be of a material compatible with paint for finish painting.
- B. All equipment and materials shall be cleaned of grease, wax, oil, rust or dirt in preparation for finish painting. Any prime coated surfaces showing signs of rust before being finish painted shall be thoroughly cleaned and a new prime coat applied.
- C. Prime paint both sides of flashings prior to installation.
- D. Furnish can of touch-up paint with each factory finished piece of equipment.
- E. Paint all piping in mechanical rooms. Color as selected by the Architect.

- F. Black steel piping exposed to the environment shall be painted with rust-inhibiting paint. Color as selected by Architect.

3.12 IDENTIFICATION OF SYSTEMS

A. Pipe Markers

1. Identify all piping on this project, except piping located within walls or inaccessible areas.
2. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces, machine rooms, and accessible maintenance spaces such as shafts, tunnels, and plenums and at exterior exposed locations, as follows:
 - a. Adjacent to all valves and flanges;
 - b. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch;
 - c. Before and after all wall, floor, and ceiling penetrations and inaccessible enclosures;
 - d. Adjacent to changes in direction;
 - e. At access doors, manholes, and similar access points that permit view of concealed piping;
 - f. Near major equipment items and other points of origination and termination;
 - g. On piping above removable acoustical ceilings, omit intermediately spaced labels.
 - h. Install pipe markers on long straight runs every 20 feet. Reduce intervals in areas of congested piping and equipment.

B. Placement:

1. Mark pipes adjacent to all valves and flanges.
2. Mark pipes at both sides of floor.
3. Mark pipes adjacent to change in direction.
4. Mark pipes every 25-to-50-foot intervals on straight runs.

C. Valve Tags

1. Identify all valves on this project, except drain lines. Attach tags so that they are easily visible but do not obstruct the operation of the valve.

2. Fasteners: Attach to stem or body of valve so that tag is visible but doesn't interfere with the valve operation.
3. Control valves shall be also marked whether normally open (N.O.) or normally closed (N.S.).

3.13 INSTALLATION, HANGERS & SUPPORTS

- A. Pipe supports shall be spaced according to CPC 2022, Table 313.3 and sufficiently close to support pipes properly without formation of pockets. Hangers shall be installed at ends of mains and branches.
- B. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- C. Install lateral bracing with pipe hangers and supports to prevent swaying. Sway bracing shall be installed at intervals of 30 to 40 feet on pipe runs to prevent excessive lateral motion
- D. Provide resilient mounting for domestic water piping. Thermal insulation may serve as resilient mounting for insulated piping.
- E. Suspended water piping shall be anchored with steel struts installed at midpoint of each run.
- F. No valve or piece of equipment shall be used to support piping.
- G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- H. Installation of piping shall be such that damage cannot result through loading, expansion or contraction of piping. Anchors shall be installed to obtain uniformity of pipe movement.
- I. Hanger rod sizes shall be no smaller than 3/8-inch for pipe and tube sizes ½ to 4 inches and ½ inch for sizes 5 - 8 inches.
- J. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

3.14 FIXTURES

- A. Examine rough-in for potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures.
- B. Install a stop valve in an accessible location in the water connection to each fixture.

- C. Install escutcheons at each wall, floor, and ceiling penetration in exposed finished locations and within cabinets and millwork.
- D. Seal joints between plumbing fixtures, counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Division 07 Section "Joint Sealants."
- E. Space between wall mounted fixtures and wall surface shall be neatly pointed up with G.E. silicone rubber compound of color matching fixture.
- F. All exposed bolt heads and nuts used to secure fixtures shall be concealed with vitreous china caps.
- G. Seal joints between plumbing fixtures, counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Division 07 Section "Joint Sealants."

3.15 PIPE WELDING

- A. Weld all pipes 2.5 inches and larger. Use the following procedure. All welders must be AWS certified. AWS B2.1 SMAW 6G Pipe Welding Procedure Specifications

Welding process: SMAW Position: 6G Fixed position Weld Progression: Up Backing: No Current/Polarity: DCEP Root Opening: 1/16 to 1/8	Groove Angle: 60 degrees Material/Spec: A 106 Thickness (pipe/tube): Groove (in) .280 Notes: Sch. 40 Pipe Filler Metal Class: E6010Rt/E7018F1 Other Filler Metal Class: Rt. 1/8, 3/32
- B. Welded joints shall be beveled and butt-welded. Reductions of pipe shall be made with forged steel welding fittings. Branch reductions of two or more pipe sizes smaller than the main, shall be Bonney "Weld-O-Let" fittings or equal. Job fabricated reductions and branches shall not be used. All pipe burrs shall be reamed out. Welding rods shall be as follows (or equal):

1. Pipe Size	Arc Welding	Gas Welding
2. 2" and larger	Fleetweld #5	Oxweld #1
3. 1½" and smaller	None	Oxweld #1

3.16 INSTALLATION, PIPING

- A. General
 - 1. Rough in shall proceed as rapidly as general construction will permit. All rough-in shall be complete, at locations verified by Architect and Owner, and tested and inspected prior to installation of concrete, lath, plaster, gypsum wallboard, or other finishes.

2. All piping shall be concealed in finished rooms, installed in furred walls and partitions. Where furred or suspended ceilings occur, piping shall be installed in the concealed space at points adjacent to beams and/or other structural members and coordinated with ductwork and equipment. Where exposed piping occurs, it shall be installed parallel to or at right angles to building walls, unless specifically shown otherwise on the Drawings.
3. Installation of piping shall be such that damage cannot result, through thermal expansion or contraction, to piping, building, or pipe hangers and supports. Anchors shall be installed at midpoints of all runs in main piping for the purpose of localizing pipe expansion or prevention of creepage.
4. Vertical lines shall be supported and braced at every floor/roof level.
5. All pipelines shall be installed free from traps and air pockets, true to line and grade, with suitable supports properly spaced. All piping shall be installed without undue stresses and with provision for expansion and contraction.
6. All piping shall be new and free from foreign substances. American standard pipe threads shall be used for IPS threaded work. Joints in threaded piping shall be made up with Teflon tape applied to the male threads only. No screwed pipe joints shall be caulked or packed with rope or other packing materials. Pipe shall be free from tool marks, threads cut accurately with not more than two (2) threads showing beyond fitting. Friction wrenches shall not be used with plated, polished, or soft metal piping. All changes in pipe size shall be made with reducing fitting. Bushings will not be permitted.
7. All copper tubing shall be formed in a workmanlike manner, in accordance with the Pipe and Tube Bending Handbook of the Copper and Brass Research Association. A tube bender giving support to the periphery of the tube shall be used. The tubing shall be protected against flattening or other injury.
8. All copper connections and joints shall be made in accordance with the Copper Tube Handbook, Copper and Brass Research Association. No swaged connections will be permitted. All valves, pumps, and similar equipment shall be connected to copper piping through union or flange adapter fittings.
9. No water or drainage piping shall pass over electrical equipment unless adequate protection is provided to prevent damage by leaks or condensation.
10. Install air vents at all water piping high points when direction of flow is downward. Install sediment drain faucets at all low points.
11. Valves, cocks, etc., shall be installed to allow convenient accessibility and operation.
12. Unions and flanges shall be installed to allow convenient replacement of all equipment and cleaning tubes.

13. A union connection shall be installed downstream from all valves, at equipment connections and at other locations as required or directed.
 14. Shut off valves shall be provided in all main services, and where required to permit proper servicing of equipment. Valves of one type shall be of one manufacturer.
 15. All valves shall be of the same size as the pipelines in which they are installed, unless specifically sized on the Drawings. All hand- controlled line valves shall be ball valves, except where throttling control or frequent operation is required, in which case globe or angle valves shall be used. Globe valves in horizontal lines shall be installed with stem in horizontal to permit line draining. All globe and angle valves shall be installed to close against pressure. Disc valves shall have discs suitable for the services for which they are to be used.
 16. All valves shall be accessible and shall not be installed with the stems below the horizontal plane. Provide access panels at walls, ceilings, or floors.
 17. Provide prime coated escutcheon plates at all points where exposed piping penetrates finished wall ceilings or floors.
 18. Cleanouts shall be located where indicated on the Drawings; at all horizontal offsets; at ends of waste or sewer branches more than 5' in length; where drain exits the building; at intervals of 100' in straight runs of piping, or at closer intervals if directed or required by local code.
 19. Cutting or boring of joists or other structural members shall be done only when alternative routing is impossible and only upon written approval of the Architect.
 20. No water or drainage piping shall pass over electrical equipment unless adequate protection is provided to prevent damage by leaks or condensation.
 21. Protect unattended openings in piping during construction
- B. Soil, Waste, Vent, Drain Piping:
1. Soil, waste, and vent piping occurring within the building shall be installed to a uniform minimum grade of $\frac{1}{4}$ " per foot unless otherwise noted. Vent piping shall be graded so that all condensation shall flow directly to a soil or waste line.
 2. Exterior soil and waste lines shall be installed to inverts or grades indicated on the drawings.
 3. Bell and Spigot pipe shall be installed with the bell up grade.
 4. Changes in direction of drainage piping shall be accomplished by the use of appropriate drainage and sanitary fittings.

5. Drilling and tapping of drains, soil, waste, or vent pipes and the use of saddle hubs and bands are prohibited.
 6. Protection against breakage of piping passing under or through walls shall be provided using specified sleeves and caulking.
 7. Adapters shall be installed between threaded iron and soil pipe.
 8. Test tees shall be installed at the foot of all soil, waste, and storm water stacks.
 9. Cleanouts shall be located where indicated on the Drawings; at all horizontal offsets; at ends of waste or sewer branches more than 5' in length; at intervals of 100' in straight runs of piping, or at closer intervals if directed or required by local code. Location of cleanouts in finished spaces shall be approved by the Architect prior to installation.
- C. Hot, Cold Water Systems:
1. Di-electric unions shall be installed where copper pipe is connected to galvanized steel piping or stub outs.
 2. Connections from copper pipe to fixture supply fittings shall be made with copper or brass nipples.
 3. Provide 18" high vertical air chambers, of size equal to "local connection schedule" size, at all domestic water connections to fixtures and/or equipment that are not specified to have shock absorbers.
 4. All domestic water piping shall be kept clear of the building structure. Where it is within 1" of the building structure, it shall be wrapped with felt (3/16" minimum thickness).
 5. To the greatest extent possible, domestic cold-water piping shall be kept separated from hot piping and where there is a choice shall be run in the coolest portion of the available space.
- D. Excavation, Backfill:
1. Provide all excavation, trenching, and backfill in connection with the work of this Section.
 2. Excavation shall be carried to 4" below the bottom of pipes. Provide a sand bedding for all sloped drainage piping and provide smooth uniformly graded bedding of firm but yielding material for all other piping, catch basins, and similar structures.
- E. Flashing:

1. All roof and wall penetrations shall be flashed and counter-flashed water tight with 26 gauge sheet metal, except as noted.

F. Indirect Waste Piping:

1. Indirect waste piping shall be installed to a uniform minimum grade of $\frac{1}{4}$ " per foot unless otherwise noted.
2. Changes in direction of indirect waste piping shall be accomplished by the use of appropriate drainage fittings.
3. Drilling and tapping of indirect waste pipes and the use of saddle hubs and bands are prohibited.
4. Protection against breakage of piping passing under or through walls shall be provided using specified sleeves and caulking.

G. Compressed Air Piping:

1. Install piping systems in accordance with the drawings and details. Pitch horizontal pipe in such a manner as to force moisture content of system with air flow to automatic moisture traps. Install air cocks ahead of all air outlets.
2. Slope compressed air main lines in the direction of flow to a dirt pocket and automatic condensate trap, inverted type. Slope at $\frac{1}{4}$ " per 10 feet.
3. All compressed air and vacuum piping shall be installed, examined, inspected and tested in accordance with the requirements of ASME B31.9, Building Services Piping, current edition

3.17 INSTALLATION, HANGERS & SUPPORTS

- A. Pipe supports shall be spaced according to CPC 2016, Table 313.3 and sufficiently close to support pipes properly without formation of pockets. Hangers shall be installed at ends of mains and branches.
- B. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- C. Provide resilient mounting for domestic water piping. Thermal insulation may serve as resilient mounting for insulated piping.
- D. Suspended water piping shall be anchored with steel struts installed at midpoint of each run.
- E. No valve or piece of equipment shall be used to support piping.
- F. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to

- facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- G. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, 2-½ inches and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
 - H. Installation of piping shall be such that damage cannot result through loading, expansion or contraction of piping. Anchors shall be installed to obtain uniformity of pipe movement.
 - I. Metal Pipe-hanger Installation: Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
 - J. Metal Trapeze Pipe-Hanger Installation: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes
 - K. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
 - L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
 - M. Pipe Slopes: Install hangers and supports to provide required pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
 - N. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.

3.18 CONNECTION, OWNER FURNISHED EQUIPMENT

- A. All electrical wiring and connections for equipment furnished under this Section shall be furnished and installed under the Electrical Sections.

3.19 TESTING, INSPECTIONS

- A. The Contractor shall make all tests required by all local, state, and federal laws, codes, ordinances, and regulations having jurisdiction over this work. The Contractor shall not allow or cause any work of this Section to be covered or enclosed until it has been inspected, tested, and approved by the Architect and the

authorities having jurisdiction over the Work. Should any of this work be enclosed or covered up before such inspection, testing, and approval, this Contractor shall uncover the work, have the necessary inspections, tests, and approvals made and, at no expense to the Owner, make all repairs necessary to restore both his work and that of other contractors which may have been damaged to be in conformity with the Contract Documents.

1. Piping systems shall be filled and air removed from system at least 24 hours before test begins.
2. Correct leaks in screwed fittings by remaking the joint. Cut out leaks in welded joints and reweld; caulking is not permitted.
3. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. Should leaks develop while testing, repairs shall be made, and tests shall be repeated until a satisfactory test result is obtained.

B. Tests

1. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent stack openings on roof and building drains where they leave the building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
2. Hot and Cold-Water Piping: Shall be hydrostatically tested for 6 hours at 150 psi. All equipment shall be tested water-tight at utility pressure.
3. Compressed Air Piping Systems: Shall be tested with compressed air at 150 psig for 6 hours. No pressure drop shall be allowed during the last 4 hours of the test. Check for leaks with a soap solution.
4. Drainage and Vent Piping: Shall be tested for 1 hour by plugging all outlets and filling the pipes with water to the top of vertical sections of pipes. No loss of water shall be permitted.

3.20 DOMESTIC WATER SYSTEM STERILIZATION

- A. Upon completion of this work, the new domestic water system shall be thoroughly flushed, sterilized and re-flushed. Sterilization and re-flushing shall be performed using the procedure below. All work shall be performed in the presence of the inspector.

- B. All domestic water outlets shall have signs posted at their location stating that the water has not been sterilized and shall not be used for human consumption. The signs shall remain until the sterilization process is complete.
- C. Procedure
 - 1. Introduce chlorine or a solution of sodium hypochlorite, filling the lines slowly and supplying the sterilization agent at a rate of 200 parts of chlorine per million. The entire system shall be completely filled with the solution. All valves shall be operated and ends of all branches tested for residual chlorine. Continue to inject the solution until at least 200 ppm of free chlorine is indicated.
 - 2. After the sterilizing agent has been applied, the system shall be isolated with the solution retained for at least 3 hours. Test for residual chlorine after retention. If less than 200 ppm is indicated, repeat the sterilization procedure.
 - 3. After satisfactory sterilization, flush the system until all traces of the chemical are removed or until the chlorine content is no greater than that in the existing supply.
- D. After a minimum period of 48 hours, bacteriological tests, using samples from at least 3 representative points, shall be made by recognized testing agency, who shall certify to the Architect that the system is bacteriologically safe and at least equal in safety to that of the principal water supply. The laboratory report and certification shall be transmitted to the Architect.

3.21 ADJUSTING

- A. Properly adjust all stops, and controls, and demonstrate safe and satisfactory operation of all equipment.

3.22 CLEANING OF PIPING

- A. All new piping shall be thoroughly cleaned of rust, scale, etc., prior to enclosing and placing in operation. Flush all water piping systems. Water shall be forced through pipes until the systems are free from foreign substances.
- B. Remove, clean and replace all strainer baskets prior to final inspection.
- C. Blow out all compressible fluid piping with compressed air before connecting with regulators or equipment.

3.23 CLEANUP

- A. Upon completion of the work of this Section, remove all surplus material, debris, and equipment associated with or used in the performance of this work.

END OF SECTION 22 00 00

SECTION 23 00 00

HVAC

PART 1 - GENERAL**1.1 INCLUSION OF GENERAL CONDITIONS AND GENERAL REQUIREMENTS**

- A. The Contract Documents, including Bidding Requirements, Contract Forms, General Conditions, Supplemental General Conditions, and Division 01 Sections are a part of this Section and the Contract for this work and apply to this Section as fully as if repeated herein.

1.2 SUMMARY

- A. This Specification establishes the required standards for all labor, materials, equipment and workmanship in connection with the furnishing, fabrication and installation of complete "Heating, Ventilating, Air Conditioning" systems. Heating, ventilating, air conditioning work includes, but is not necessarily limited to, the following:
 - 1. Refrigerant piping and appurtenances
 - 2. Packaged rooftop air conditioning system
 - 3. Ductless split system single zone air conditioning
 - 4. VRF split system air conditioning
 - 5. Infrared heaters
 - 6. Ductwork, inclusive of all air turns, dampers, grilles, diffusers, fire dampers, sound traps, supports, bracing and fresh air/combustion air ducts;
 - 7. Roof, ceiling, and wall mounted exhaust fans
 - 8. Supply fans
 - 9. HVAC insulation
 - 10. Air Terminals
 - 11. Gravity intake and relief ventilators

1.3 RELATED SECTIONS

- A. Division 07 or Section 07 60 00 - Sheet Metal Flashing and Trim
- B. Division 09 or Section 09 91 00 for finish painting

- C. Condensate drainage piping to points adjacent to equipment: Section 22 0000 - "Plumbing".
- D. Section 23 0500 - General Mechanical
- E. Section 23 0593 - Testing, Adjusting and Balancing for HVAC
- F. Division 26 for basic electrical requirements and line voltage wiring, disconnect switches, conduit for temperature control wiring, etc.
- G. The Contractor shall furnish all materials and labor under the scope of the Contract, unless otherwise noted. Anything accepted as standard trade practice reasonably incidental to the completion of the system shall be furnished without additional cost to the Owner. The Contractor shall understand that the work herein described shall be complete in every detail, notwithstanding every item necessarily involved is not particularly mentioned, and the Contractor shall be held to provide all labor and material necessary for the entire completion of the work.

1.4 DEMONSTRATION & TRAINING

- A. Prepare formal training program for operating staff prior to the scheduled start-up date. The program shall consist of the design, start-up, and operation of the HVAC systems. The training program shall be coordinated with production of the operation and maintenance manuals. Operations and Maintenance data is to be available for training sessions.
 - 1. Provide a minimum of 4 hours of on-site training. All instruction shall be provided at no cost to the Owner.

PART 2 - PRODUCTS

2.1 REFRIGERANT PIPING

- A. Refrigerant piping shall be Type ACR, ASTM B 280, drawn temper, seamless copper tube.
- B. Pipe fittings and unions shall be wrought copper with brazed joints. ASME B16.22. Mechanical joints on refrigerant piping are prohibited. All refrigerant piping joints shall be brazed with lead-free silver brazing alloy, minimum 15% silver content. Harris "Stay-Silv® 15" or equal.
- C. Flexible connectors shall be bronze, double braided, with inlet and outlet connections as required. Metraflex RAF or equal.
- D. Sight glasses shall be color change moisture indication type, replaceable element, filter screen and pad, sweat solder ends. Sporlan "See-All", Henry, or equal.

- E. Charging and purge valves shall be forged brass, diaphragm packless, globe type, angle or straight through, one end solder, one end flare. Henry 623 and 643 series, Sporlan, or equal.
- F. Solenoid valves shall be of forged brass, extended solder end connections, molded coil; Sporlan "E" series or equal. AHRI 760 & UL 429
- G. Isolation/shut off valves shall be Mueller Streamline "Cyclemaster" series ball valves or equal. 700 psig maximum working pressure. Valves shall be compatible with all CFC, HCFC and HFC refrigerants and oils, be full port construction to match line size ID, and shall have internally equalized ball design, rupture proof encapsulated stem, and shall be UL Listed and CE Certified. -40°F/300°F working temperature range.
- H. Filter driers shall be replaceable media, angle type, AHRI 730 compliant; Henry "Dri-Cor" or equal.
- I. Electronic thermostatic expansion valves shall have stainless steel body and connections, ceramic slide and port, linear flow capacity, continuous modulation, and direct coupling of motor and valve; Emerson "EX" series or equal.
- J. Expansion loops shall be Metraflex "VRF Metraloop" or equal. Loop shall be constructed of two parallel sections of corrugated Type 321 stainless-steel metal hose, Type 304 stainless-steel braid, 180° return bend with factory supplied hanger support lug at bottom, and inlet and outlet connections. Fittings shall be Schedule 40 S Type 304 stainless-steel. The loop shall be equipped with stainless-steel to copper conversion fitting with XHP copper stub ends for copper pipe systems. Provide as required to accommodate any thermal expansion or contraction or as indicated on the Drawings. Return fitting shall be supported to allow movement.
- K. Pipe hangers: All refrigerant piping shall be supported 8 feet on center and within 2 feet of a change in direction of the piping. Piping shall be supported at points not more than 15 feet apart.
- L. Split system fan-coil units and heat pump units shall have brazed sweat-fitting connections on the refrigerant piping between the units with a flexible piping section at the outdoor unit.

2.2 GRAVITY INTAKE AND RELIEF VENTILATORS

- A. Greenheck, model GRSI for intake and model GR SR for relief, rooftop mounted gravity ventilators as scheduled on the Drawing or approved equal.
- B. The housing shall be constructed of aluminum, including wind band and curb cap. Windband shall be one piece spun aluminum construction and maintain original material thickness throughout the housing. Windband to include an integral rolled bead. Curb cap to have integral deep spun inlet venturi and pre-punched mounting holes to ensure correct attachment to roof.

- C. Internal components shall be constructed of rigid galvanized steel and include birdscreen. Birdscreen shall be constructed of ½ inch galvanized (or aluminum) mesh and mounted horizontally across the intake area of the hood.
- D. Curb cap shall be constructed of heavy-gauge aluminum and include a one-piece spun venturi. Curb cap shall be pre-punched for mounting.
- E. Provide with roof curb, and gravity type backdraft damper for intake or relief as indicated on Drawings.

2.3 EXHAUST FANS

- A. Greenheck "G" series, roof mounted exhaust fans as scheduled on the Drawings or approved equal. The fan shall be downblast type with maximum continuous operating temperature of 180°F. Each fan shall bear a permanently affixed manufacturer's engraved metal nameplate containing the model number and individual serial number. All fans shall bear the AMCA Certified Ratings Seal for sound and air performance. The fans shall be UL/cUL 705 Listed – Power Ventilators.
- B. Wheel
 - 1. The fan wheel shall be constructed of aluminum, and of the non-overloading, backward inclined centrifugal type.
 - 2. The wheel cone and fan inlet will be matched and shall have precise running tolerances.
 - 3. Wheels shall be statically and dynamically balanced according to AMCA Standard 204-05.
- C. Housing
 - 1. The housing shall be leak proof and have rigid internal support structure. All components shall have final thicknesses equal to or greater than preformed thickness.
 - 2. The motor cover, shroud, curb cap, and lower windband be constructed of heavy gauge aluminum. The shroud and motor cover shall be drawn from a disc. Air shall be directed downward.
 - 3. The curb cap shall have pre-punched mounting holes.
 - 4. The housing supports and drive frame assemblies shall be constructed of heavy gauge steel and mounted on rubber vibration isolators sized to match the weight of each fan.
- D. Motor (ECM)
 - 1. The motor enclosure shall be open type.

2. The motor shall be a DC electronic commutation type (ECM) specifically designed for fan applications. AC induction type motors are not acceptable.
 3. The motor shall be permanently lubricated, heavy duty ball bearing type, prewired to match voltage and phase. The internal motor circuitry shall convert AC power supplied to the fan to DC power to operate the motor.
 4. Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by a potentiometer dial mounted at the motor.
 5. Motor shall be a minimum of 85% efficient at all speeds.
 6. A NEMA 1 rated positive electrical shut-off disconnect switch shall be factory installed and wired from the fan motor to a junction box within the motor compartment.
- E. Options/Accessories
1. Galvanized bird screen
 2. Gravity operated backdraft dampers with galvanized frames and pre-punched mounting holes. Dampers shall be balanced for minimum resistance to flow
 3. Roof curb model GPI, I-inch insulation, mounted onto roof with fan
 4. Hinge Kit: Aluminum hinges. Allows the fan to tilt away for access to wheel and ductwork for inspection and cleaning

2.4 CEILING MOUNTED EXHAUST FANS

- A. Furnish and install Greenheck model SP-AP0511W ceiling mounted exhaust fans as scheduled on the Drawings or approved equal.
- B. The fans shall be specification grade and shall be supplied with flow selection switch, multi-speed dial, time delay dial, and air trimming dial.
1. Flow Selection: The switch chooses 50, 80 or 110 cfm and is the default high speed.
 2. Multi-Speed: The switch allows the fan to run continuously at low speed. Example: Flow Selection setting is 110 cfm, Multi-Speed can be chosen 0, 30, 40, 50, 60, 70 or 90 cfm as a low speed
 3. Time Delay: Sets the time required to return to low speed after high-speed input is completed. Setting range is 0, 5, 10, 20, 30, 45 or 60 minutes.
 4. Air Trimming: Allows for adjustment of the airflow up to 70 cfm. Dial adjustments impact high and low speed.
- C. Motor:

1. The SP-AP series fans shall have an electronically commutated motor (ECM) with constant cfm adaptive, variable speed technology. The fan shall have a built-in airflow selector with high-speed airflow settings of 50-80-110 cfm and a built-in 0 to 60 minutes time delay.
- D. The fans shall be provided with a universal duct adapter that accommodates, 4", 5" or 6" ducting.
- E. Options/Accessories (See equipment schedule remarks)

2.5 DIRECT DRIVE INLINE FAN

- A. Greenheck model "SQ-70-VG", duct mounted, direct driven, backward inclined, centrifugal inline fan as scheduled on the Drawings or approved equal. Each fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number.
- B. Wheel
 1. Wheel shall be non-overloading, backward inclined centrifugal type, constructed of composite.
 2. The wheel shall be statically and dynamically balanced in accordance with AMCA Standard 204-05.
 3. The wheel cone and fan inlet shall be matched and shall have precise running tolerances.
 4. Single thickness blades shall be securely riveted or welded to a heavy gauge back plate and wheel cone.
- C. Electronically Commutated Motor (Vari-Green)
 1. Motor enclosures shall be ODP (open drip proof) type.
 2. Motor to be a DC electronic commutation type motor (ECM) specifically designed for fan applications. AC induction type motors are not acceptable.
 3. Motors shall be permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase.
 4. Internal motor circuitry shall convert AC power supplied to the fan to DC power to operate the motor.
 5. Motor shall be speed controllable down to 20% full speed (80% turndown). Speed shall be controlled by a potentiometer dial mounted at the motor.
 6. Control shall be Vari-Green dial on exterior of fan housing, mounted and wired.
 7. Motor shall meet motor efficiency requirements set forth in California Title 24.

D. Housing/Cabinet Construction

1. The housing shall be of a square design constructed of heavy gauge galvanized steel.
2. Housing Supports and Drive Frame
 - a. The drive frame shall be constructed of structural steel with formed flanges.

E. Disconnect Switch

1. The disconnect switch shall be NEMA 1 rated. The switch shall have positive electrical shut-off.
2. The switch shall be toggled, shipped loose for field installation.
3. Junction box shall be mounted and wired.

F. Duct collars

1. Square duct companion flange
 - a. Inlet and outlet flat flange face allows fan to slide in and out of ductwork.
 - b. Square design to provide a large discharge area.

G. Access Panel:

1. Two bolted access panels shall permit easy access to all internal components. Access panels shall be located perpendicular to the motor mounting panel.

H. Motor Cover:

1. The motor cover shall be constructed of galvanized steel and shall cover the motor and drives for safety.
2. A motor cover constructed of galvanized steel that covers motor and drives shall be provided.

I. Options/Accessories (refer to equipment schedule remarks)

2.6 WALL MOUNTED DIRECT DRIVE FANS

- A. Greenheck model AER-20-VG wall mounted fans as scheduled on the Drawings or approved equal. Each fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual unit serial number
- B. The fans shall be UL 705 Listed and AMCA licensed for FEI, Air & Sound Performance.
- C. Propeller

1. Fabricated steel propeller constructed of galvanized steel blades and spider, attached to cast aluminum hub
 2. Securely attached to motor shaft with a standard square key, set screw and tapered bushing
 3. Statically and dynamically balanced in accordance with AMCA Standard 204-05
 4. The propeller and fan inlet will be aligned and shall have precise running tolerances for maximum performance and operating efficiency
 5. Propellers are not coated when fan coatings accessory is selected regardless of material type
- D. Electronically Commutated Motor
1. Motor enclosures: Open Drip-Proof
 2. Electronic commutation type motor (ECM) specifically designed for fan applications. AC induction type motors are not acceptable. Examples of unacceptable motors are: Shaded Pole, Permanent Split Capacitor (PSC), Split Phase, Capacitor Start and 3 phase induction type motors.
 3. Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase.
 4. Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor or integrated variable frequency drive.
 5. Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by a potentiometer dial mounted at the motor.
- E. Drive Frame:
1. Drive frames and fan panels shall be bolted construction
 2. Drive frame assemblies and fan panels shall be galvanized steel or painted steel
 3. Drive frame shall be formed steel and fan panels shall have pre-punched mounting holes, formed flanges, and a deep formed inserted venturi
- F. Disconnect switches
1. NEMA rated: 1
 2. Positive electrical shut-off
 3. Wired from fan motor to junction box

G. Options/Accessories

1. Vertical mount exhaust damper, model BD-330

2.7 SUPPLY FANS

- A. Panasonic "Whisper Fresh Select" series, model FV-15NLFS1, fresh air supply fan as scheduled on the Drawings or approved equal. The fan shall be customizable, low noise, remote mount, two-way directional and shall be rated for continuous run.
- B. The housing shall be of galvanized steel and shall have a fully insulated exterior and an integrated 6" duct collar. A gravity damper shall be included on the supply air side of the unit.
- C. The fresh air supply rates shall be manually adjustable for 50-62-70-80-90-100-110-130-150 cfm. The motor shall be ECM type, with DC "Smartflow" technology, four-pole, totally enclosed and shall be equipped with thermal cut-off fuse.
- D. Built-in controls shall have adjustable relative humidity level setting from 30% to 80% and adjustable temperature control from 15° F to 40° F to shut off intake air from entering the space. An alarm shall notify for filter check and maintenance.
- E. Brackets shall be provided for joist, truss, or suspension installations. Replacement MERV 13 filters shall be provided.

2.8 VRF SINGLE PHASE HEAT PUMP OUTDOOR UNITS

- A. Toshiba Carrier model MCY-MAP heat pump variable refrigerant flow system as scheduled on the Drawings or approved equal. The system is a two-pipe system consisting of a single outdoor unit, multiple indoor units of various types and capacities, and individual or central indoor unit controls with on/off temperature settings, all connected by fully insulated refrigerant lines utilizing factory supplied, fully insulated, branching kits. Indoor units are connected to condensate piping that shall be terminated to the nearest drain point.
 1. The system shall be fully capable of providing heating or cooling as requested by the individual indoor zones that can consist of single or multiple indoor units. The heating priority shall be the default factory setting and can be changed to cooling, majority, or a single zone priority.
 2. The maximum number of connected indoor units shall not exceed 9.
 3. The total connected indoor unit capacity shall range between 50 and 135% of the outdoor unit capacity based on indoor unit type & size selected.
- B. Quality Assurance
 1. Units shall be listed by ETL (Engineering Testing Laboratory) and be evaluated in accordance with UL standard 1995, 4th. edition.

2. Units shall be listed in the AHRI directory.
3. All units shall meet the Federal minimum efficiency standards and be tested per AHRI 210/240 Standard.

C. Equipment - General

1. Factory-assembled, single piece air-cooled outdoor unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, and the single inverter-driven twin rotary compressor.
2. The maximum sound pressure rating shall not exceed 55 dBA in cooling and 58 dBA in heating. Sound pressure ratings are measured at 3.3 ft out and 4.9 ft up from the front of the outdoor unit (fan discharge side).
3. The outdoor unit shall include an oversized accumulator and a liquid tank for proper heating performance while allowing the indoor unit PMV (pulse modulating valve) metering device to shut off completely when a zone is satisfied.
4. The outdoor unit shall be protected by a high-pressure switch, high-pressure sensor, low-pressure sensor, fusible plugs, PC board, and inverter overload protector.
5. The outdoor unit shall be capable of operating in cooling mode down to 23 F dry bulb ambient air temperature, and down to -13 F wet bulb ambient air temperature in heating.

D. Unit Cabinet:

1. Unit cabinet shall be constructed of pre-coated steel, finished on both inside and outside.
2. Unit access panels shall be removable with minimal screws and shall provide full access to the compressor, fans, and control components.
3. The compressor shall be isolated in a compartment and have an acoustic wrap to assure quiet operation.
4. The outdoor unit control panel shall include a sliding window to access adjustable controls and an LED display for setup and diagnostics.
5. Unit cabinet shall be capable of withstanding 500-hour salt spray test per Federal Test Standard No. 141 (method 6061).

E. Fans:

1. Outdoor fans shall discharge air horizontally and be driven by a DC inverter variable speed motor with 32 steps.

2. The outdoor fan motor shall be totally enclosed with permanently lubricated bearings.
 3. Motor shall be protected by internal thermal overload protection.
 4. Fan blades shall be non-metallic and shall be statically and dynamically balanced.
 5. Outdoor fans shall be protected by a metallic protective grille.
- F. Compressors:
1. Each outdoor unit shall be equipped with a single inverter-driven twin rotary compressor with full range control to an accuracy of $\pm 0.1\text{Hz}$.
 2. The compressor shall be totally enclosed in the machine compartment.
 3. Internal overloads shall protect the compressor from over-temperature operation.
 4. Motor shall be suitable for operation in an R-410A refrigerant atmosphere.
 5. Compressor assembly shall be installed on rubber vibration isolators.
- G. Outdoor Coil:
1. Coil shall be constructed of aluminum fins mechanically bonded to seamless copper tubes, which are cleaned, dehydrated, and sealed.
 2. The coil configuration shall be 2-sided.
 3. The coil fins shall have a factory-applied corrosion resistant blue-fin finish.
- H. Controls and Safeties:
1. Operating controls and safeties shall be factory selected, assembled, and tested. The minimum control functions shall include the following:
 2. Controls:
 - a. Compressor speed to match the refrigerant flow and capacity with the system requirements.
 - b. Outdoor fan motor speed for higher efficiency and lower sound.
 - c. Oil control for improved system reliability and comfort.
 - d. Pulse modulating valve control for precise control of the refrigerant distribution and accurate capacity management to avoid starving any units.
 3. Safeties: The following safety devices shall be part of the condensing unit:
 - a. High-pressure switch

- b. Fuses
- c. Fusible plug
- d. Overcurrent relay for the compressor
- e. Thermal protectors for compressor and fan motor
- f. Compressor time delay
- g. Overcurrent sensor
- h. Compressor suction and discharge temperature sensor
- i. Compressor suction and discharge pressure sensor

I. Electrical Requirements:

- 1. Two-core, stranded, shielded low voltage cable shall be required for communication between outdoor and indoor units.
- 2. All power and control wiring must be installed per NEC and all local electrical codes.

J. Refrigerant Piping and Line Lengths:

- 1. Piping connections shall be from the front or the bottom of the unit. The unit shall be capable of operating with maximum connected refrigerant line lengths up to 591 (ft) actual based on total system capacity and refrigerant amount.
- 2. The outdoor unit shall have the ability to operate with a maximum height of 164 ft between the outdoor and the lowest indoor unit.
- 3. The maximum distance between the outdoor unit and the furthest fan coil shall not exceed 328 ft actual or 410 ft equivalent. No line size changes or oil traps shall be required.
- 4. The system shall be capable of operating when the height difference between the upper and the lower fan coil is 49 ft.

K. Auxiliary Refrigerant Components:

- 1. All field-supplied copper tubing connecting the outdoor unit to the indoor unit shall use factory-supplied branching kits consisting of either Y joints or headers to ensure even refrigerant flow.
- 2. To ensure piping flexibility, the system shall allow having Y joints or headers downstream of another header.

L. Options/Accessories

- 1. Programmable wired controller #RBC-AWSU52-UL

2.9 VRF SPLIT SYSTEM INDOOR UNIT

- A. Toshiba-Carrier model MMK_ UP high wall indoor unit as scheduled on the Drawings or approved equal. The indoor units shall be high wall mounted, direct expansion units matched with heat pump VRF outdoor unit.
- B. Unit shall be complete with coil, fan driven by DC inverter motor, PMV (pulse modulating valve), piping connectors, electrical controls, microprocessor control system, and integral temperature sensing. Unit shall be furnished with integral wall mounting bracket and mounting hardware.
- C. Unit Cabinet:
 - 1. Cabinet, discharge and inlet grilles shall be attractively styled, high-impact nonmetallic material.
- D. Fans:
 - 1. Fan shall be tangential direct-drive blower type with air intake at the top of the unit and discharge at the bottom front. Automatic, motor-driven louver swing function (vertical) shall be standard.
 - 2. Louver swing operation (vertical) shall be user selectable using the remote control and adjust the horizontal air flow manually.
- E. Coil:
 - 1. Coil shall be copper tube with aluminum fins and galvanized steel tube sheets. Fins shall be bonded to the tubes by mechanical expansion and specially coated for enhanced wettability. A drip pan under the coil shall have a factory-installed drain connection (on both ends) for hose attachment to remove condensate.
- F. Motors:
 - 1. Motors shall be totally enclosed, permanently lubricated ball bearing with inherent overload protection. Fan motors shall be inverter controlled variable speed.
- G. Controls:
 - 1. The system shall be microprocessor-controlled to maintain precise room temperature and minimum power consumption. The controls system shall employ a genetic algorithm for temperature control.
- H. Filters:
 - 1. Unit shall have factory-supplied resin net (cleanable) type filters. The return air filter material shall have the following characteristics:
 - a. Odorless

- b. Temperature resistant to 185 F
 - c. Humidity resistant up to 95% RH
- I. Electrical Requirements:
 - 1. Indoor units are 208/230-1-60 (V-Ph-Hz).
- J. Special Accessories (sold separately)
 - 1. Condensate pump

2.10 SPLIT SYSTEM HEAT PUMP UNITS

- A. Carrier "Performance" series model 27SPA6 heat pump units with "InteliSense" technology, as scheduled on the Drawings or approved equal. The unit shall be an outdoor-mounted, air-cooled, split-system heat pump unit suitable for ground or rooftop installation. The unit(s) shall be a factory assembled, single piece. Contained within the unit enclosure is all factory wiring, piping, controls, compressor, refrigerant charge "R-454, Puron Advance™", and special features required prior to field start-up.
- B. The unit consists of a hermetic compressor, an air-cooled coil, propeller-type condenser fan, and a control box. Unit will discharge supply air upward as shown on the Drawings. The unit will be used in a refrigeration circuit to match up to a packaged fan coil unit.
- C. Quality Assurance
 - 1. Unit will be rated in accordance with the latest edition of AHRI Standard 210/240.
 - 2. Unit will be certified for capacity and efficiency and listed in the latest AHRI directory.
 - 3. Unit construction will comply with latest edition of ANSI/ ASHRAE and with NEC.
 - 4. Unit will be constructed in accordance with UL standards and will carry the UL label of approval.
 - 5. Unit cabinet will be capable of withstanding Federal Test Method Standard No. 141 (Method 6061) 500-hr salt spray test
 - 6. Air-cooled condenser coils are pressure tested and the outdoor unit is leak tested.
 - 7. Unit constructed in ISO9001 approved facility.
- D. Construction

1. Modular Unit Cabinet
 - a. Unit cabinet will be constructed of galvanized steel, bonderized, and coated with a powder coat paint. Available with louvered coil guard only.
 2. Fans
 - a. Condenser fan will be direct-drive propeller type, discharging air upward.
 - b. Condenser fan motors will be totally enclosed, 1-phase type with class B insulation and permanently lubricated bearings. Shafts will be corrosion resistant.
 - c. Fan blades will be statically and dynamically balanced.
 - d. Condenser fan openings will be equipped with steel wire safety guards.
 3. Compressor
 - a. Compressor will be hermetically sealed.
 - b. Compressor will be mounted on rubber vibration isolators.
 4. Condenser Coil
 - a. Condenser coil will be air cooled. Coil will be constructed of aluminum fins mechanically bonded to copper or aluminum tubes which are then cleaned, dehydrated, and sealed.
 5. Refrigeration Components
 - a. Refrigeration circuit components will include liquid-line shutoff valve with sweat connections, vapor-line shutoff valve with sweat connections, system charge of Puron Advance™ refrigerant, POE compressor oil, accumulator, and reversing valve.
- E. Unit electrical power will be single point connection. Control circuit will be 24v.

2.11 DUCTED HEAT PUMP SPLIT SYSTEM SPLIT SYSTEM FAN COIL INDOOR UNITS

- A. Carrier "Performance" series, model FT5A fan coil with "Intelisense" technology, as scheduled on the Drawings or approved equal. Units are multi-poise type and have provision made for suspending from roof or ceiling joists.
- B. The fan coil units shall use Puron Advance®, chlorine-free, non-ozone depleting refrigerant and shall have a refrigerant leak detection dissipation system for added safety. A factory installed Thermostatic Expansion Valve (TXV) shall be provided to maximize performance with Puron Advance® refrigerant.
- C. The motor shall be variable speed constant airflow ECM (Electronically Commutating Motor) type, which operates efficiently at all speeds.
- D. The fan coils shall have a diffuser air discharge section, and high duct static capability. The design meets stringent regulations for cabinet air leakage of less

than 2% cabinet leakage rate at 1 inches W.C. and 1.4% cabinet leakage rate at 0.5 inches W.C. when tested in accordance with ASHRAE 193 standard.

- E. Condensate fittings are relocated away from turbulent airflow patterns at the blower entrance for improved condensate control performance. An overflow feature for slope coil units allows condensate to exit the unit without damage to product under clogged primary and secondary line conditions. The units are tested for condensate disposal at conditions much more severe than those required by AHRI. Primary and secondary drain connections are provided in the fan coil units. All pans constructed of an injection molded glass-filled polycarbonate engineered resin material, with brass drain connections.
- F. The modular cabinet is constructed of pre-painted galvanized sheet metal with high density, super thick cabinetry insulation with vapor barrier. Provision is made for suspending from roof or ceiling joints. Sweat connections are provided for leak free service. Cabinets include multiple electrical entry for application flexibility (high and low voltage), and a low voltage terminal strip, to safely hold connections within the cabinet. Cabinet construction features innovations designed to prevent cabinet sweating.
- G. The heat exchanger shall have grooved tubing and lanced sine wave aluminum fins. Counter-flow refrigerant circuitry and a bi-flow hard shut-off TXV metering device with mechanical fittings is provided with all units.
- H. An IntelliSense™ board controls the units and have an easy plug connection for quick installation of accessory heater packages. The transformer is 40VA 208/230V. Replaceable 5A blade-type auto fuse protects against transformer secondary short .
- I. Factory supplied filter and standard sized filter rack fits most common size replacement filters.
- J. Options/Accessories (see equipment schedule remarks)
 - 1. Electric heater

2.12 DUCTLESS SPLIT SYSTEM INDOOR UNIT

- A. Carrier "Performance" series, model 45MAHA high wall indoor unit as scheduled on the Drawings or approved equal.
- B. Standard features include 5 modes: cool, heat, dry, fan, auto; 4 fan speeds, sleep mode, turbo mode, louver angle memory, auto-restart function, condenser high temperature protection, anti-corrosion fin coating.
- C. R454B, "Puron Advance" refrigerant.

2.13 SINGLE ZONE DUCTLESS SPLIT SYSTEM OUTDOOR UNIT

- A. Carrier "Performance" series, model 37MAHAQ single zone heat pump ductless system outdoor unit as scheduled on the Drawings or approved equal.

- B. Standard features include variable speed drive (inverter), factory installed basepan heater, factory installed crankcase heater, low voltage controls, auto-restart function, condenser high temp protection, anti-corrosion fin coating.
- C. R454B, "Puron Advance" refrigerant.

2.14 INFRARED HEATERS

- A. Schwank "eSchwank Ghost" series, model ESM, overhead mounted, electric powered, medium wave infrared heaters, as scheduled on the Drawings or approved equal.
- B. The heater will be warranted by the manufacturer for defects in material and workmanship for a period of two (2) years on heater components.
- C. Heating element:
 - 1. The heater uses fast-response, carbon fiber, medium wave bulbs, to emit infrared heat.
 - 2. The heating element will be manufactured utilizing tubular quartz with woven carbon fiber filament.
- D. Heater construction:
 - 1. The heater shall be constructed with 2 mm 6063 grade aluminum alloy extruded profile, with black powder coated finish.
 - 2. The heater shall be rated IP65 to protect against dust and other particles and low-pressure jets of directed water from any angle (limited ingress permitted with no harmful effects).
 - 3. Heating elements shall be pre-assembled with housing with completed wiring. Loose packed elements may be damaged during shipping or site installation. Loose packed elements are not allowed.
- E. Reflector:
 - 1. Reflectors shall be constructed of 0.5 mm aluminum.
 - 2. The reflectors are curved for optimized infrared reflection.
- F. Junction box:
 - 1. Heaters shall come up with IP65-rated weatherproof junction boxes with single-phase capability.
 - 2. Main PCB board shall be included in the junction box, and pre-connected with heating elements.

G. Front decorative grille (Safeguard):

1. Heaters shall have front decorative grille on the front face, constructed with 1.5 mm stainless steel 304, with bluing treatment.
2. It also works as a safeguard, to protect against accidental contact with heating elements. It shall be removable to allow heater maintenance.

H. Heater Brackets

1. Mounting brackets shall be included in the product packaging.
2. Heaters shall have the ability to be mounted horizontally, 23 deg or 45deg.

I. Serviceability:

1. Heaters shall be serviceable from the front while installed, following the detailed instructions from the manual. The operator shall be able to replace the heating element after its terminated life.

J. Controls:

1. The heaters shall be controlled with an IR remote included in the product packaging.

2.15 INFRARED HEATERS

- A. Schwank "electricSchwank" ESD series electric medium wave infrared heaters as scheduled on the Drawings or approved equal. The heaters shall be UL certified.
- B. The heater shall be constructed of high-grade anti-corrosive 304 stainless steel. The bulb shall be single or dual bulb, medium wave quartz bulb.
- C. Controls shall feature on/off, variable, and 2-stage settings.
- D. The heater shall have a 2-year warranty.

2.16 PACKAGED ROOFTOP HEAT PUMP UNITS

- A. Carrier 50FEQ series heat pump units as scheduled on the Drawings or approved equal.
- B. General:
 1. Outdoor, rooftop mounted, electrically controlled, heating and cooling unit utilizing a fully hermetic scroll compressor(s) for cooling duty and heat pump heating duty.

2. Factory assembled, single-piece heating and cooling rooftop unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, and special features required prior to field start-up.
 3. Units shall use Puron Advance™ (R-454B) refrigerant.
 4. Units shall be installed in accordance with the manufacturer's instructions.
 5. Units must be installed in compliance with local, state, and federal codes.
- C. Quality Assurance:
1. Units meet DOE and ASHRAE 90.1 minimum efficiency requirements.
 2. Units shall be rated in accordance with AHRI Standards 340/360.
 3. Units shall be designed to conform to ASHRAE 15.
 4. Units shall be UL-tested and certified in accordance with ANSI Z21.47 Standards and UL-listed and certified under Canadian standards as a total package for safety requirements.
 5. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.
 6. Unit casing shall be capable of withstanding 500-hour salt spray exposure per ASTM B117 (scribed specimen).
 7. Units shall be designed in accordance with ISO 900 and shall be manufactured in a facility registered by ISO 9001:2015.
 8. Roof curbs shall be designed to conform to NRCA Standards.
 9. Unit shall be subjected to a completely automated run test on the assembly line. The data for each unit will be stored at the factory and must be available upon request.
 10. Unit shall be designed in accordance with UL Standards 60335-1 and 60335-2-40, including testing to withstand rain. Units shall be IPX4 rated.
 11. Units shall be constructed to prevent intrusion of snow and tested to prevent snow intrusion into the control box up to 40 mph.
 12. Unit shake tested to assurance level 1, ASTM D4169 to ensure shipping reliability.
- D. Unit Cabinet:

1. Unit cabinets shall be constructed of galvanized steel and shall be bonderized and coated with a pre-painted baked enamel finish on all externally exposed surfaces.
2. Unit cabinet exterior paint shall be film thickness, (dry) 0.003 in. minimum, gloss (per ASTM D523, 60°F/16°C): 60, Hardness: H-2H Pencil hardness.
3. Evaporator fan compartment interior cabinet insulation shall conform to AHRI Standards 340/360 minimum exterior sweat criteria. Interior surfaces shall be insulated with a minimum 1/2 in. thick, 1 lb. density, flexible fiberglass insulation, neoprene coated on the air side. Aluminum foil-faced fiberglass insulation shall be used in the heat compartment.
4. Base of unit shall have a minimum of four locations for thru-the-base gas and electrical connections (factory-installed or field-installed), standard.
5. Base Rail:
 - a. Unit shall have base rails on a minimum of 2 sides.
 - b. Holes shall be provided in the base rails for rigging shackles to facilitate maneuvering and overhead rigging.
 - c. Holes shall be provided in the base rail for moving the rooftop by fork truck.
 - d. Base rail shall be a minimum of 16-gauge thickness.
6. Condensate Pan and Connections:
 - a. Shall be a sloped condensate drain pan made of corrosion resistant material.
 - b. Shall comply with ASHRAE Standard 62.
 - c. Shall use a 3/4 in. 14 NPT drain connection, possible either through the bottom or side of the drain pan. Connection shall be made per manufacturer's recommendations.
7. Top panel shall be a single piece top panel on 08-12 models.
8. Electrical Connections:
 - a. All unit power wiring shall enter unit cabinet at a single, factory prepared, knockout location.
 - b. Thru-the-base capability.
 - 1) Standard units shall have a thru-the-base electrical location(s) using a raised, embossed portion of the unit basepan.
 - 2) Optional, factory approved, water-tight connection method must be used for thru-the-base electrical connections.
 - 3) No basepan penetration, other than those authorized by the manufacturer, is permitted.

E. Component Access Panels:

1. Cabinet panels shall be easily removable for servicing.
2. Unit shall have one factory installed, tool-less, removable, filter access panel.
3. Panels covering control box, indoor fan, indoor fan motor, gas components (where applicable), and compressors shall have molded composite handles.
4. Handles shall be UV modified, composite. They shall be permanently attached and recessed into the panel.
5. Screws on the vertical portion of all removable access panels shall engage into heat resistant, molded composite collars.
6. Collars shall be removable and easily replaceable using manufacturer recommended parts.
7. All units shall have hinged access panels option. The panels shall provide easy access through integrated quarter turn latches. The hinged access panels shall be on major panels: filter, control box, fan motor, and compressor.

F. Coils:

1. Standard Aluminum Fin-Copper Tube Coils:
 - a. Standard evaporator and condenser coils shall have aluminum lanced plate fins mechanically bonded to seamless internal helically grooved copper tubes with all joints brazed.
 - b. Evaporator coils shall be leak tested to 150 psig, pressure tested to 450 psig and qualified to UL 60335-2-40 burst test at 1775 psig.
 - c. Condenser coils shall be leak tested to 150 psig, pressure tested to 650 psig and qualified to UL 60335-2-40 burst test at 1980 psig.

G. Refrigerant Components:

1. Refrigerant circuit shall include the following control, safety, and maintenance features:
 - a. Thermostatic Expansion Valve (TXV) shall help provide optimum performance across the entire operating range. Shall contain removable power element to allow change out of power element and bulb without removing the valve body.
 - b. Refrigerant filter drier, solid core design with pre and post-filter service gauge connections for filter diagnostics and maintenance.
 - c. Service gauge connections on suction and discharge lines.
 - d. Pressure gauge access through a specially designed access port in the top panel of the unit.

2. There shall be gauge line access port in the skin of the rooftop.
 - a. The gauge access port shall enable maintenance personnel to route their pressure gauge lines.
 - b. This gauge access port shall facilitate correct and accurate condenser pressure readings by enabling the reading with the compressor access panel on.
 - c. This gauge access port shall facilitate correct and accurate condenser pressure readings by enabling the reading with the compressor access panel on.
 3. Compressors:
 - a. Unit shall use tandem scroll compressor assembly on a single refrigeration circuit with two stages of cooling for efficient comfort cooling operation.
 - b. Evaporator coils shall be a full active design to help better control latent removal and minimize unconditioned bypass air.
 - c. Compressor motors shall be cooled by refrigerant gas passing through motor windings.
 - d. Compressors shall be internally protected from high discharge temperature conditions.
 - e. Compressors shall be protected from an over-temperature and over-amperage conditions by an internal, motor overload device.
 - f. Compressors shall be factory mounted on rubber grommets.
 - g. Compressor motors shall have internal line break thermal, current overload and high-pressure differential protection.
 - h. Crankcase heaters shall not be required for normal operating range, unless required by the manufacturer due to refrigerant charge limits.
- H. Filter Section:
1. Filters shall be held in place by a pivoting filter tray, facilitating easy removal and installation and shall consist of factory installed, low velocity, throw-away 2 in. thick fiberglass filters.
 2. Filters shall be standard, commercially available sizes. Only one size filter per unit is allowed.
- I. Evaporator Fan and Motor with EcoBlue™ Technology:
1. Direct Drive Evaporator Fan Motor:
 - a. Shall be an ECM motor design.
 - b. Shall be direct drive design for all static options.
 - c. Shall have permanently lubricated bearings.
 - d. Shall have inherent automatic-reset thermal overload protection.

- e. Shall have slow ramp up to speed capabilities.
- f. Shall require no fan/motor belts for operation, adjustments and or initial fan speed setup.
- g. Fan DC voltage set up on Unit Control Board shall eliminate the need of removal of blower access door, required on conventional belt drive systems.
- h. Shall be internally protected from electrical phase reversal.

2. Evaporator Fan:

- a. Speed shall be easily set with a dedicated selection switch and adjustment pot on unit control board.
- b. Shall provide two-stage cooling capacity control, the indoor fan speed is automatically controlled to meet the code-compliant <66% low fan speed and 100% at full fan speed operation.
- c. Blower fans shall be a vane axial fan design with fan assembly secured directly to ECM motor. Additional shafts, belts, pulleys/sheaves, and bearing blocks to drive fan shall not be permitted or necessary.
- d. Additional variable frequency drive to control fan motor speed shall not be permitted or necessary. All speed control electronics must be on board fan motor assembly.
- e. Shall be constructed of a cast aluminum stator and high impact composite material on rotor and air inlet casing.
- f. Shall be a patented / pending design with corrosion resistant material.
- g. Fan assembly design shall be integrated into fan deck, dynamically balanced, and require no additional vibration isolation for normal operation.
- h. Shall have slow ramp up to speed capabilities to help reduce sound and comfort issues typically associated with single speed belt drive systems.
- i. Shall be a slide out design with removal of a few support brackets.
- j. Shall include an easily accessible Unit Control Board to conveniently and safely provide connection points for vital control functions such as: smoke detectors, phase monitor, economizer, thermostat, DDC control options, and low- and high-pressure switches. Controller shall also provide an intuitive means to adjust the indoor fan speed through a simple switch and pot adjustment design.

J. Condenser Fans and Motors:

1. Condenser Fan Motors:

- a. Shall be a totally enclosed motor.
- b. Shall use permanently lubricated bearings.
- c. Shall have inherent thermal overload protection with an automatic reset feature.

- d. Shall use a shaft-down design on all sizes.
- 2. Condenser Fans:
 - a. Shall be a direct-driven propeller type fan.
 - b. Shall have galvalum blades riveted to steel spider that have corrosion-resistant properties and shall be dynamically balanced.
- K. Electric and Electronic Control System for HVAC
 - 1. General:
 - a. Shall be complete with self-contained low-voltage control circuit protected by a resettable circuit breaker on the 24-v transformer side. Transformers shall have 75 VA capability.
 - b. Shall utilize color-coded wiring.
 - c. Shall include a Unit Control Board to conveniently and safely provide connection points for vital control functions such as: smoke detectors, phase monitor, economizer, thermostat, DDC control options, and low- and high-pressure switches. Controller shall also provide an intuitive means to adjust the indoor fan speed through a simple switch and pot adjustment design.
 - d. Unit shall include a minimum of one 8-pin screw terminal connection board for connection of control wiring.
 - e. Shall include integrated defrost system to prevent excessive frost accumulation during heating duty, and shall be controlled as follows:
 - 1) Defrost shall be initiated on the basis of time and coil temperature.
 - 2) A 30, 60, 90, 120 minutes timer shall activate the defrost cycle only if the coil temperature is low enough to indicate a heavy frost condition.
 - 3) Defrost cycle shall terminate when the defrost thermostat is satisfied and shall have a positive termination time of 10 minutes.
 - f. Defrost system shall also include:
 - 1) Defrost Cycle Indicator LED.
 - 2) DIP switch selectable defrost time between 30, 60, 90, and 120 minutes. Factory set at 30 minutes.
 - 3) Molded plug connection to ensure proper connection.
 - 2. Safeties:
 - a. Compressor Over-Temperature, Overcurrent. High Internal Pressure Differential.
 - b. Low Pressure Switch.
 - 1) Low pressure switches shall use different color wire than the high pressure switch. The purpose is to assist the installer and service technician to correctly wire and or troubleshoot the rooftop unit.
 - c. High Pressure Switch.
 - 1) High pressure switches shall use different color wire than the low pressure switch. The purpose is to assist the installer and service

technician to correctly wire and or troubleshoot the rooftop unit.

- d. Heating section shall be provided with the following minimum protections:
 - 1) High temperature limit switches.
- e. A2L Refrigerant Leak Dissipation System (Electromechanical):
 - 1) Leak dissipation system shall consist of control board and A2L sensor certified to UL 60335-2-40.
 - 2) System shall be designed for the life of the unit.
 - 3) Dissipation system shall be automatic, ship pre-wired, and require no additional field connections to thermostat to function.
 - 4) Refrigerant leak sensor shall be installed in UL-certified location and orientation. Sensor shall be self-correcting and resettable. Single use refrigerant leak sensor shall not be permitted.
 - 5) Factory-installed dissipation controllers shall use onboard microprocessor and include:
 - a) Automatic reset after a dissipation event has occurred.
 - b) Onboard LED with flash code to indicate current unit status and hardware failures.
 - c) Depressible "Test" button to allow for a system test and recall/reset of leak detection history.
 - d) 24-v dry contact alarm terminal to allow for external notification of leak detection.
- f. Dissipation control board shall be accessible via normal maintenance locations and LED shall be visible.
- g. Dissipation system shall "Fail Safe" per UL requirements.
- h. Dissipation shall allow smoke and building fire systems to override in case of event.

L. Thermostats:

- 1. Thermostat must:
 - a. energize both "W" and "G" when calling for heat.
 - b. have the capability to energize 1 or 2 different stages of cooling, and 2 different stages of heating.
 - c. be heat pump design and include capability for occupancy scheduling.

M. HVAC Equipment Insulation

- 1. Evaporator Fan Compartment:
 - a. Interior cabinet surfaces shall be insulated with a minimum 1/2 in. thick, minimum 1-1/2 lb density, flexible fiberglass insulation bonded with a phenolic binder, neoprene coated on the air side.
 - b. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.

2. Electric Heat Compartment:
 - a. Aluminum foil-faced fiberglass insulation shall be used.
 - b. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.
- N. Standard Filter Section:
 1. Filters shall be held in place by a pivoting filter tray, facilitating easy removal and installation.
 2. Shall consist of factory installed, low velocity, disposable 2 in. thick fiberglass filters of commercially available sizes.
 3. Units shall use only one filter size. Multiple sizes are not acceptable.
 4. Filters shall be accessible through a hinged access panel with "no-tool" removal.
- O. Options and Accessories (refer to equipment schedule remarks for additional requirements)
 1. Integrated economizer, ultra-low leak model. Ultra Low Leak design meets California Title 24 section 140.4 and ASHRAE 90.1 requirements for 4 cfm per sq ft on the outside air dampers and 10 cfm per sq ft on the return dampers.
 2. Roof Curbs:
 - a. Full perimeter roof curb
 - b. Structurally calculated, vibration isolated
 - c. Non-insulated
 3. 2-inch MERV 13 Return Air Filters (field installed)
 - a. Accessory kit to field upgrade standard unit filters to 2 in. MERV-13 filters.
 4. Electric Heat:
 - a. Heating Section:
 - 1) Heater element open coil resistance wire, nickel-chrome alloy, 0.29 in. inside diameter, strung through ceramic insulators mounted on metal frame. Coil ends are staked and welded to terminal screw slots.
 - 2) Heater assemblies are provided with integral fusing for protection of internal heater circuits. Auto reset thermo limit controls, magnetic heater contactors (24-v coil), and terminal block all mounted in electric heater control box (minimum 18 ga galvanized steel) attached to end of heater assembly.
 5. Indoor Air Quality (CO₂) Sensor:
 - a. Shall be able to provide demand ventilation indoor air quality (IAQ) control.

- b. The IAQ sensor shall be available in duct mount, wall mount, or wall mount with LED display. The setpoint shall have adjustment capability.
- c. Shall have a recessed momentary switch for testing and resetting the detector.
- d. Controller shall include:
 - 1) One set of normally open alarm initiation contacts for connection to an initiating device circuit on a fire alarm control panel.
 - 2) Two Form-C auxiliary alarm relays for interface with rooftop unit or other equipment.
 - 3) One Form-C supervision (trouble) relay to control the operation of the Trouble LED on a remote test/reset station.
 - 4) Capable of direct connection to two individual detector modules.
 - 5) Can be wired to up to 14 other duct smoke detectors for multiple fan shutdown applications.

2.17 THERMOSTAT

- A. Toshiba/Carrier RBC-AWSU52-UL wired remote controller. The controller is back lit with temperature display and cool, heat, dry, fan, and auto mode settings. Features include dual set-point control, error display, group control, touch buttons, three configurable input ports and two output ports.

2.18 DUCTWORK

A. Sheet Metal Ductwork:

- 1. Ducts and plenums shall be fabricated and installed in conformance with the 2015 edition of NFPA 90A, 2022 California Building Code, 2022 California Mechanical Code, and SMACNA HVAC Duct Construction Standards (Metal & Flexible), third edition. All factory-fabricated duct systems and closure systems shall comply with UL 181. In addition, tapes, sealants, mastics, and other closure systems shall meet the applicable requirements of UL 181, UL 181A, or UL 181B.
- 2. Ducts and plenums shall be constructed of G-60 coated galvanized steel of lockforming grade conforming to ASTM A653 and A924 Standards. Seals shall be airtight Class "A" seals at all transverse joints and longitudinal seams. Tables and figures hereinafter referenced are from the 3rd edition of the SMACNA HVAC Duct Construction Standards (Metal and Flexible).
- 3. Rectangular duct construction shall conform to Table 2-3. All transverse joints shall be flanged per Table 2-32, with corner closures or "Duct Mate" flanged connections with corner closures per Figure 2-16 or 2-17. Elbows shall be standard radius (Type RE 1) or square throat with vanes (Type RE 2) per Figure 4-2, with double thickness turning vanes per Figures 4-3 and 4-4. Offsets and transitions shall be per Figure 4-7. Supply, return, and exhaust branch connections shall be per Figure 4-5 or 4-6. Splitters SHALL NOT be used.

4. Round ducts shall be spiral, McGill Airflow or equal. All transverse joints and longitudinal seams shall have Class "A" seals. All branches in round duct systems shall be made with factory fabricated reducing wye branches. Duct turns shall be made with standard factory-fabricated three-piece elbows.
 5. Lined ducts shall be fabricated such that the net inside dimensions equal the duct sizes shown on the Drawings.
 6. Flexible ducts shall be acoustical type, Flexmaster "6M", Casco "Silent Flex II" model SF-181M, or approved equal. Flexible ducts shall be used only where shown on the Drawings, and the maximum length of any given flexible duct shall not exceed 5 feet. Galvanized sheet metal elbows shall be used for turns greater than 45 degrees on flexible ducts 10 inches and larger. Connections to rectangular ducts shall be made with "spin-in" fittings with air scoops. The installation of flexible ducts shall conform to Figure 3-10, with the exceptions noted herein.
 7. Supports for horizontal ducts and plenums shall be fabricated per Figures 5-5 and 5-6 and Tables 5-1, 5-2, and 5-3. The maximum distance between hangers shall be 8 feet for rectangular ducts and 12 feet for round ducts. Attachments to the structure shall be made with adequately sized lag bolts for strap hangers and adequately sized machine bolts and side beam brackets for rod hangers. Supports for vertical ducts shall be band iron strap or angle bracket type per Figures 5-8 and 5-9.
 8. All roof-mounted ductwork shall be 18-gauge, water-tight and sloped to shed water. All transverse joints shall be T-25 flanged "Ductmate 25" or approved equal.
 9. Outside air intakes shall be type 316 stainless steel.
- B. Fiberglass Ductwork:
1. Fiberglass ductwork is unacceptable and may not be used on this project.
- C. Specialties:
1. Duct Mounted Access Doors
 - a. Including those for removing filters, duct access doors shall be fabricated as detailed in Figure 7-2, with sash locks, piano hinges, and gaskets. Round duct shall be fabricated as detailed in Figure 7-3.
 - b. Access doors shall be double wall, rectangular, insulated or uninsulated same as duct. Insulation fill and thickness shall be as indicated for pressure class.
 - c. Access doors shall have a vision panel and shall have an unobstructed full swing.
 - d. Fabricate doors airtight and suitable for duct pressure class.

2. Dampers:
 - a. Provide butterfly or multiple blade dampers, where indicated on the Drawings or as required for balancing air quantities, to values shown, without generating excessive noise. Provide Duro-Dyne "KS-385" or approved equal, locking quadrants on each manual damper. Locate dampers in furred ceilings near access panels, where possible.
 - b. Butterfly dampers shall be constructed per Figure 7-4, Figures A, B, and C.
 - c. Multi-blade dampers shall conform to Figure 7-5.
 - d. Backdraft dampers: Ruskin CBD6 or approved equal, heavy-duty dampers with 12 gauge galvanized steel structural brace at each corner. Blades shall be of extruded aluminum with extruded vinyl blade edge seals mechanically locked into blade edge. Corrosion resistant bearings, long life synthetic type. Linkage shall be tiebar connected to stainless steel pivot pins.
3. Remote Actuators: Young Regulator Company, Round Cable Controlled Dampers, model 5020-CC or 830A-CC (rectangular) and Remote Cable Control System Kit, model 270-301EZ. All dampers in inaccessible ceilings shall have remote actuators.
4. Air Extractors: Duct mounted volume extractors made of galvanized steel with 1-inch blade spacing, Titus model AG-45, or equal.
5. Flexible Duct Connections: Duro-Dyne "Metal-Fab" constructed of Durolon, or Ventfabrics "ventglas", or approved equal. Install at each point where a blower unit is connected to a duct. A minimum clearance of 3 inches between the duct and the source of vibration shall be maintained. Install per Figure 7-8. Mechanically fasten connections between metal ducts and the inner core of flexible ducts.
6. Screens: Install removable bird screens at all outside air intakes and exhaust air discharges. Screens shall be fabricated from ½ inch x 14-gauge mesh secured in full frames. Screens and frames shall be constructed of the same material as the duct, hood, or equipment to which attached.
7. Access Panels: Milcor, Style M, prime coated steel, or approved equal. Minimum size shall be 10" x 10". Provide larger sizes where required. Locks shall be flush, screwdriver operated. Provide as required for concealed ducts at all fire dampers, electric duct heaters, and automatic dampers, except at suspended acoustical ceilings.
8. Duct Sealing: All ductwork, regardless of system pressure classification, shall be sealed in accordance with Seal Class A. Tapes, sealants, mastics, and other closure systems shall meet the applicable requirements of UL 181, UL 181A, UL 181B, or UL723, and shall be non-toxic and water resistant. Duct systems shall not use cloth-back, rubber adhesive duct tape regardless of UL designation unless it is installed in combination with mastic and clamps. Surface-burning characteristics for sealants and gaskets shall be a maximum

flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723. Sealants for interior applications shall pass ASTM C 731 and D 2202.

- a. Duct sealant: Carlisle "Hardcast Duct-Seal 321", Hardcast CCWI-181, Ductmate "FIBERseal", or equal.
- b. Cloth backed duct tape to seal flex duct to fittings: Berry Plastics, Tapes and Coatings "Polyken 558CA" or "Nashua 558CA" or Shurtape Industries "Shurtape PC 858CA". No exceptions.

2.19 INSULATION

A. General

1. All duct insulation materials including jackets, tapes, adhesives, and coatings shall meet ASTM E84/UL 723 "25/50 Flame Spread/Smoke Development" requirements and NFPA 90A and 90B.

B. Exterior of Ductwork: (Flexible Duct Wrap)

1. Unless specified to be lined, all sheet metal supply and return ducts shall be externally insulated by wrapping with formaldehyde-free, flexible glass fiber blanket type duct wrap or inorganic glass mineral wool wrap, with factory applied FSK vapor barrier jacket. Thickness shall be 2 inches unless noted or required otherwise.
2. Duct wrap shall meet the requirements of ASTM C1290, ASTM C553, and ASTM C1136. Corrosiveness shall meet ASTM C665. Mold growth/fungi resistance shall meet ASTM C1338.
 - a. Johns Manville "Microlite FSK", Knauf "Atmosphere Duct Wrap", or Certainteed "SoftTouch" or "Wide Wrap".

C. Interior of Ductwork: (Duct Liner)

1. All ducts exposed to the weather shall be internally insulated. All other ductwork within 10 feet of a fan (supply and return) shall be internally insulated. Duct liner shall be installed in supply and return ducts and plenums where noted on the Drawings. Exhaust ductwork need not be insulated.
2. Duct liner shall meet the requirements of ASTM C1071. Operating temperature shall meet ASTM C411. Microbial growth shall meet ASTM C1338 and ASTM G21 and G22.
 - a. Type I - Flexible Duct Liner: Johns Manville "Linacoustic RC", Knauf "Atmosphere Duct Liner", or Owens Corning "QuietR Rotary Duct Liner". Thickness shall be 1 ½ inches, unless otherwise noted.
 - b. Type II - Plenum Liner Board: Johns Manville "Linacoustic R-300", Owens Corning "QuietR Duct Liner Board", or Knauf Insulation "Atmosphere Rigid Plenum Liner". Thickness shall be 1 ½ inches, unless otherwise noted.

D. Refrigerant Piping:

1. Insulate all refrigerant liquid, vapor, and suction lines, fittings, and valves with flexible elastomeric thermal insulation, Armacell "AP ArmaFlex" black and white tube insulation, or equal. Formaldehyde free, microbial protection conforms to Title 24 standards, and GREENGAURD®. Install according to manufacturer's suggested installation procedures.
2. Liquid, suction, and hot gas (where applicable) lines shall be insulated individually.
3. Oil equalization lines between multiple condensing units shall be insulated.
4. All piping exposed to the weather shall be finished with aluminum jacketing with a laminated moisture retarder. ITW Insulation Systems, RPR Products "Insul-Mate" or equal. Aluminum jacketing shall be overlapped 2 to 3 inches and held in place with stainless steel bands to form a weather tight system. Elbows and tees shall be fitted with matching aluminum fitting covers. Other fittings in metal-jacketed systems shall be finished with conventional weather-resistant insulating materials with painted aluminum finish.

2.20 HANGERS, SUPPORTS

A. Ductwork

1. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
2. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
3. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
4. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
5. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
6. Trapeze and Riser Supports:
 - a. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - b. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 - c. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.21 REGISTERS, GRILLES, AND DIFFUSERS

- A. Air terminals shall be Titus, or approved equal, as scheduled on the Drawings.
- B. All terminals shall be steel and shall be factory painted. The finish shall be #26 white. The finish shall be an anodic acrylic paint, baked at 315°F for 30 minutes. The pencil hardness must be HB to H. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering or deterioration of film. The paint must pass a 250-hour ASTM D870 Water Immersion Test. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50-inch pound force applied.
- C. The manufacturer shall provide published performance data for the diffusers and grilles. The diffuser shall be tested in accordance with ANSI/ASHRAE Standard 70-1991.
- D. Air terminals for installation in gypsum board shall have a 1" border for surface mounting. All air terminals for installation in lay-in ceilings shall have a lay-in frame to match the specified grid system.
 - 1. Wall Supply Registers (WS)
 - a. Steel supply grilles shall be model 300RS (double deflection). The deflection blades shall be parallel to the short dimension of the grille. Construction shall be of steel with a 1¼-inch wide border on all sides. Screw holes shall be countersunk for a neat appearance. Corners shall be welded with full penetration resistance welds.
 - b. Deflection blades shall be contoured to a specifically designed and tested cross-section to meet published test performance data. Blades shall be spaced on ¾-inch centers. Blades shall have steel friction pivots on both ends to allow individual blade adjustment without loosening or rattling. Plastic blade pivots are not acceptable.
 - 2. Wall Return Grilles (WR)
 - a. Steel return grilles shall be model 350ZRL (¾-inch blade spacing). The fixed deflection blades shall be parallel to the long dimension of the grille. Construction shall be of steel with a 1¼-inch wide border on all sides. Screw holes shall be countersunk for a neat appearance. Corners shall be welded with full penetration resistance welds.
 - b. Deflection blades shall be contoured to a specifically designed and tested cross-section to meet published test performance data. Blades shall be firmly held in place by mullions from behind the grille and fixed to the grille by welding in place. Blade deflection angle shall be at 0°.
 - 3. Ceiling Diffusers (CD)
 - a. Ceiling diffusers shall be TITUS Model TDC (steel) for fixed, horizontal discharge pattern. These diffusers shall consist of an outer frame assembly of the sizes and mounting types shown on the plans and outlet schedule. A square or rectangular inlet shall be an integral part of the

- frame assembly and a transition piece shall be available to facilitate attachment of round duct. An inner core assembly consisting of fixed deflection louvers shall be available in one-, two-, three- or four-way horizontal discharge patterns. The inner core assembly must be removable in the field without tools for easy installation, cleaning or damper adjustment.
- b. Throw Reducing Vanes (TRV) must be available to deflect a horizontal discharge airstream from each side of the TDC diffuser into diverging airstreams.
4. Ceiling Return Grilles (CR), Exhaust Grilles (EG)
- a. Return grilles shall be model 50F. Return grilles must provide a free area of at least 90%. Outer borders shall be constructed of heavy extruded aluminum with a thickness of 0.040-0.050 inch and shall have countersunk screw holes. Border width shall be 1¼" on all sides and shall be interlocked at the four corners and mechanically staked to form a rigid frame.
 - b. Aluminum grid: ½ x ½ x ½ inch
5. Duct Mount Supply Diffusers (DS)
- a. Aluminum supply grilles shall be direct spiral duct-mounted supply grilles model S300FS (double deflection). The deflection blades shall be parallel to the short dimension (FS) of the grille. All supply grilles shall be constructed with radius end caps and foam gaskets for a tight seal to the duct diameter. All supply grilles shall be constructed with a 1 3/8-inch wide border.
 - b. Blades shall be constructed of heavy duty extruded aluminum and shall be spaced ¾-inch apart. Blades shall extend completely through the side frame on each side to ensure stability throughout the complete cfm operating range of the grille. Blades shall be individually adjustable without loosening or rattling and shall be securely held in place with tension wire.
 - c. Optional air scoop damper/extractor (option ASD) shall be constructed of heavy-duty aluminum. The ASD must be operable from the face with a screwdriver.
6. Door Louvers (DL)
- a. Door return grilles shall be model T-700. Construction shall be of steel with a 1¼-inch border width. The border and blades shall be of 20-gauge steel. Inverted V-blades with a deflection angle of 77° shall be used to create a sight proof design and provide additional stiffness to the grille. Corners shall be welded with full penetration resistance welds with a reinforcing patch for extra strength. Screw holes shall be countersunk for a neat appearance.
7. Round Diffusers (RD-1)

- a. Round ceiling diffusers shall be model TMR (steel). The TMR model shall have three round cones and round neck inlets. Two horizontal discharge settings shall allow the diffuser to be field adjusted for different flow rate conditions. The two inner cones must be easily removable as a unit using a spring lock mechanism.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Provide all necessary cutting in connection with the work of this Section. No cutting shall be done without the approval of the Architect. Comply with requirements specified in Cutting and Patching Section.
- B. No structural members shall be drilled, bored, or notched in a manner that will impair their structural capacity.
- C. All penetrations of concrete or masonry shall be made with core drills.

3.2 HEATING AND AIR CONDITIONING EQUIPMENT INSTALLATION

- A. All units shall be set with curbs plumb, level, and securely attached through framed opening with bolts and/or lag screws as noted on the Drawings. Connections to ductwork shall be secured, filter racks shall be aligned, enclosures and ductwork connections shall be fully waterproofed, and all utility and control connections shall be complete.
- B. Split system fan coil units and heat pump units shall have brazed sweat-fitting connections on the refrigerant piping between the units with a flexible piping section at the outdoor unit.
- C. Install equipment to provide good appearance, easy access, and adequate space to allow replacement and maintenance. Provide bases, supports, anchor bolts, and other items required to achieve this. Installation shall be level, above moisture level, and adequately braced.
- D. Thoroughly lubricate equipment before operating. Repair of damage resulting from failure to comply with this requirement shall be the Contractor's responsibility. Extend ¼-inch schedule 40 black steel lubrication pipes from hard-to-reach locations to front of equipment or to access doors. Terminate with proper lubrication fittings.
- E. Move equipment into building through available openings. Dismantle equipment where necessary to accomplish this. After reassembly, test equipment to verify its satisfactory operating condition.
- F. Connections to pipe shall be secured and properly aligned and all utility and control connections shall be properly isolated from the building structure by means of vibration isolators and flexible connections. Any equipment not meeting this requirement will be modified and properly reinstalled at no expense to the Owner.

3.3 INSULATION INSTALLATION

- A. Insulation shall be applied on clean, dry surfaces and only after tests and approvals required by the specifications have been completed.
- B. Insulation on all cold surfaces must be applied with a continuous, unbroken vapor seal. Hangers, supports, anchors, etc., that are secured directly to cold surfaces shall be adequately insulated and vapor sealed to prevent condensation.
- C. Adhesives, mastics, and coatings shall be applied at the manufacturer's recommended minimum coverage per gallon.
- D. Edges of vapor barrier insulation at valve stems, instrument wells, unions, and other raw edges shall be sealed adequately to prevent moisture from penetrating the insulation.
- E. Insulation Jacketing
 - 1. Provide aluminum jacketing for all piping located aboveground, outdoors. Jacketing shall be secured to prevent removal without the use of tools
- F. Ductwork
 - 1. In general, duct system shall be insulated with fiberglass blanket. Insulation on all cold surfaces shall be provided with a vapor barrier jacket
 - 2. Exterior Ductwork:
 - a. Duct wrap shall be cut in a manner to meet the manufacturers' stretch-out guideline to provide a 2" staple lap and have minimum compression at the corners. All joints shall be lapped 2" and stapled with outward clinching staples 2" on center. The insulation shall be mechanically fastened to the underside of all ducts 24" wide or more using cup-head pins, weld pins, or stick pins with speed clips 18" on center. Insulation shall not be compressed to comply with required installed R-value. All joints and penetrations of the vapor barrier jacket shall be sealed with a minimum 3" wide matching pressure sensitive tape. Pressure-sensitive tape shall be firmly rubbed in place immediately after application using a "squeegee" type tool.
 - b. When a vapor seal is required, two coats of vapor retarder mastic reinforced with one layer of 4" wide, open weave glass fabric may be used in lieu of pressure-sensitive tape. Mastic shall be brushed onto joint and glass fabric imbedded in it. A second coat of mastic shall be brushed over the glass fabric until the fabric is filled. Mastics shall be applied in accordance with application instructions on the container.
 - 3. Interior Duct Liner
 - a. Apply to the inside face of ducts, coated side facing air stream. Fasten using fire retardant adhesive and secure with mechanical fasteners at 12"

maximum o.c., both directions, for velocities up to 2,500 fpm. Velocities over 2,500 fpm shall have fastener spacing of 6" o.c.

- b. Exposed edges must be factory or field coated with adhesive. Metal nosing shall be installed in all liner leading edges facing the airstream at fan discharge, at access doors, and at any interval of lined duct preceded by unlined duct.
- c. Insulation with torn or broken coatings shall be removed and replaced. Loose corners, edges, and butt joints will not be accepted.
- d. Maximum velocity: 5,000 ft/min.

3.4 DUCTWORK INSTALLATION

- A. Install ducts according to SMACNAs HVAC Duct Construction Standard, Metal and Flexible, unless otherwise indicated.
- B. All ductwork shall be installed within spaces provided where possible. Ducts shall be installed true to line and grade, fully secured to structural framing with specified hangers and supports, insulated, and vibration isolated.
- C. Install duct systems as indicated unless deviations to layout are approved on shop drawings.
- D. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of the building.
- E. Install ducts with fewest possible joints.
- F. Each section of supply air ductwork shall be cleaned at the shop, dust and oil free, using a degreasing agent and detergent and sealed airtight at both ends with visqueen and tape. Supply ducts shall be additionally cleaned with a disinfecting solution. Ends of all supply and internally insulated exhaust ducts shall be kept sealed until the time they are joined. When duct sections are joined, wipe down all interior surfaces with a clean tack cloth. If tack cloth shows any dust, then re-clean duct as described above. The intent is that no foreign matter be allowed to enter the ductwork at any time after factory cleaning and during construction.
 - 1. Unlined exhaust ducts shall be vacuum cleaned when installed, but shall otherwise be exempt from shop cleaning and sealing.

3.5 EXHAUST FAN INSTALLATION

- A. Manufacturer's Instructions
 - 1. Compliance: Comply with manufacturer's product data, including technical bulletins, product catalog installation instructions
- B. Examination

1. Examine areas to receive fans. Notify the Architect of conditions that would adversely affect installation or subsequent utilization and maintenance of fans. Do not proceed with installation until unsatisfactory conditions are corrected.

C. Preparation

1. Ensure roof openings are square, accurately aligned, correctly located, and in tolerance.
2. Ensure duct is plumb, sized correctly, and to proper elevation above roof deck. Install duct as specified in "Ductwork".

D. Installation

1. Install fans system as indicated on the Installation, Operation and Maintenance Manual (IOM) and Drawings.
2. Install fans according to manufacturer's instructions.

E. System Startup

1. Refer to Installation, Operation, and Maintenance Manual (IOM)

F. Adjusting

1. Adjust exhaust fans to function properly
2. Adjust belt tension
3. Lubricate bearings
4. Adjust drive for final system balancing
5. Check wheel overlap

3.6 GRAVITY VENTILATORS INSTALLATION

- A. Ensure roof openings are square, accurately aligned, correctly located, and in tolerance.
- B. Ensure duct is plumb, sized correctly, and to proper elevation above roof deck

3.7 INFRARED HEATER INSTALLATION

A. Preparation

1. The heater location shall meet the National Electrical Code, ANSI/NFPA 70 (USA), US National Electrical Code (NEC), and Canadian Electric Code CSA 22.1 (Canada) and comply with all local codes based on jurisdiction, as well as manufactures electrical and clearance requirements outlined in the product manual.

B. Installation

1. Installation shall comply with all National Electrical Code requirements (NEC) and all applicable local codes.
2. The heater shall be installed and operated according to the installation instructions, including maintaining the manufacturers' recommended clearances for combustibles.
3. Electrical Installation must be performed by a licensed Electrician and shall comply with National E

3.8 AIR TERMINAL INSTALLATION

A. Examination

1. Examine areas where registers and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Installation

1. Install Grilles flush against surface wall or lay-in ceiling grid module.
2. Verify Grille air patterns are as indicated on drawings during installation.
3. Ceiling-Mounted Inlets: Drawings indicate general arrangement of ducts, fittings and accessories. Air Outlet and locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. Where architectural features or other items conflict with installation, notify Engineer for determination of final location.
4. Install grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors and fire dampers.

C. Adjusting

1. After installation, verify air flow and volume adjustment if supplied with opposed blade damper as indicated on drawings, or as directed before starting air balance.

3.9 REFRIGERANT PIPING INSTALLATION

- A. Piping installation shall comply with all federal, state, and local regulations and industry guidelines. In addition, the following practices shall be followed.

1. All piping shall be stored with ends sealed to prevent entry of moisture and debris.
 2. A pipe cutter specific to the piping material applied shall be used.
 3. All factory and field cut tube ends shall be de-burred and cleaned.
 4. Flared fittings shall be formed using tools recommended by the equipment manufacturer.
 5. Flare nuts shall be tightened with torque wrench furnished by the equipment manufacturer.
 6. Piping shall be continuously purged with dry nitrogen while brazing. Care shall be taken when brazing near valves or other equipment that may be damaged by extreme heat.
 7. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- C. Install refrigerant piping according to ASHRAE Standard 15, 2022.
- D. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- E. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- F. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- G. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- H. Install piping adjacent to machines to allow service and maintenance.
- I. Install piping free of sags and bends. Install fittings for changes in direction and branch connections. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- J. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection.

- K. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- L. Install refrigerant piping in protective conduit where installed belowground. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
- M. Slope refrigerant piping as follows:
 - 1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
 - 2. Install horizontal suction lines with a uniform slope downward to compressor.
 - 3. Use double-suction riser for maximum compressor efficiencies if load variation is expected.
 - 4. Install traps and double risers to entrain oil in vertical runs.
 - 5. Liquid lines may be installed level.
- N. All refrigerant piping and valves shall be identified.

3.10 DUCTWORK:

- A. Install ducts according to SMACNAs HVAC Duct Construction Standard, Metal and Flexible, unless otherwise indicated.
- B. All ductwork shall be installed within spaces provided where possible. Ducts shall be installed true to line and grade, fully secured to structural framing with specified hangers and supports, insulated, and vibration isolated.
- C. Install duct systems as indicated unless deviations to layout are approved on shop drawings.
- D. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of the building.
- E. Install ducts with fewest possible joints.
- F. Each section of supply air ductwork shall be cleaned at the shop, dust and oil free, using a degreasing agent and detergent and sealed airtight at both ends with visqueen and tape. Supply ducts shall be additionally cleaned with a disinfecting solution. Ends of all supply and internally insulated exhaust ducts shall be kept sealed until the time they are joined. When duct sections are joined, wipe down all interior surfaces with a clean tack cloth. If tack cloth shows any dust, then re-clean duct as described above. The intent is that no foreign matter be allowed to enter the ductwork at any time after factory cleaning and during construction.

1. Unlined exhaust ducts shall be vacuum cleaned when installed but shall otherwise be exempt from shop cleaning and sealing.

3.11 CONTRACTOR RESPONSIBILITIES FOR TEST AND BALANCE

- A. Before testing or balancing is started, the Mechanical Contractor shall adjust belts and sheaves; align all parts; oil and grease bearings in accordance with manufacturer's instructions; clean exterior surfaces of coil tubes and fins; flush interior of coil tubes, pull until clean; and check mixing damper operation to insure free operation and activation by the correct thermostat
- B. The Mechanical Contractor shall be responsible for certifying in writing that the system, as scheduled for balancing, is operational and complete. Completeness shall include not only the physical installation, but the Mechanical Contractor's certification that the prime movers are installed in good working order, and that full load performance has been preliminary tested under the certification of the Mechanical Contractor. Before any testing and balancing is started, a complete report shall be sent to the T&B Agency by the Mechanical Contractor.
- C. The Mechanical Contractor shall be responsible for making all modifications to rectify discrepancies reported by the T&B Contractor as indicating non-compliance with the Contract Documents. By completing the work on time, the Mechanical Contractor shall provide sufficient time before the completion date so that balancing can be accomplished.

3.12 ACCEPTANCE TESTING

- A. The California Energy Code Section 10-103 requires Acceptance Testing on all newly installed mechanical systems envelopes after installation and before project completion. An Acceptance Test is a functional performance test to help ensure that newly installed equipment is operating and in compliance with the Energy Code. The systems must pass the required acceptance criteria. Any deficiencies must be corrected by the installing contractor until the specified systems conform and pass the required acceptance criteria. As of October 2021, all mechanical system acceptance tests must be performed by a certified mechanical acceptance test technician (CMATT) who is trained and certified by an Acceptance Test Technician Certification Provider Program (ATTCP). CMATTs must show that they have a minimum of 3 years of experience working in the area of testing that they will perform.
 1. A listing of certified ATT can be found at <https://www.energy.ca.gov/programs-and-topics/programs/acceptance-test-technician-certification-provider-program/acceptance>.
- B. The acceptance testing procedures must be repeated, and deficiencies must be corrected by the installing Contractor until the construction/installation of the specified systems conform and pass the required acceptance criteria. Project inspectors will collect the forms to confirm that the required Acceptance Tests have been completed.

END OF SECTION

SECTION 23 05 00**GENERAL MECHANICAL**

PART 1 - GENERAL**1.1 SUMMARY**

- A. Drawings and general provisions of the Contract, including General and Special Conditions and all Division 01 Specification Sections, apply to this Section.
- B. This Section includes the following:
 - 1. General requirements specifically applicable to all Division 23 Sections
 - 2. Some piping material and installation instructions common to most piping systems
 - 3. Mechanical demolition (when indicated on the Drawings)
 - 4. Concrete bases
 - 5. Supports and anchorage
 - 6. Pipe and equipment identification
 - 7. Basic electrical requirements
 - 8. Electric motors
- C. This Section applies to all work of Division 23.

1.2 REGULATORY REQUIREMENTS

- A. Regulatory compliance: All work performed under Division 23 shall comply with the latest currently adopted editions of all applicable federal, state, and local codes, ordinances, regulations, and all requirements of the Authorities Having Jurisdiction.
- B. Electrical devices and wiring shall conform to the latest standards of NEC; all devices shall be UL listed and labeled.
- C. All work shall be performed in accordance with the rules and regulations of the following:
 - 1. Title 24, California Code of Regulations, Parts 1 -12.
 - 2. Local jurisdiction codes and amendments
 - 3. Health Department

4. California Occupational Safety & Health Administration (CAL-OSHA) Safety Orders and requirements
 5. California State Fire Marshal (CSFM)
 6. City Fire Marshal requirements
 7. Division of State Architect (DSA)
 8. Environmental Protection Agency (EPA)
 9. National Fire Protection Association (NFPA)
- D. Where material or equipment is specified to conform to referenced standards, the most recent edition of the standard in effect at the time of bid shall be used. If compliance with two or more standard establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement.
1. Associated Air Balance Council (AABC)
 2. American Gas Association (AGA)
 3. Air Movement and Control Association International, Inc. (AMCA)
 4. American National Standards Institute (ANSI)
 5. American Society of Mechanical Engineers (ASME)
 6. American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE)
 7. American Society for Testing and Materials (ASTM)
 8. Air-Conditioning and Refrigeration Institute (ARI)
 9. Canadian Standards Association International (CSA)
 10. National Electrical Manufacturers Association (NEMA)
 11. National Fire Protection Association (NFPA)
 12. Department of Health Care Access and Information (HCAi)
 13. Sheet Metal and Air Conditioning Contractors National Association (SMACNA) Standards
 14. Underwriters Laboratories (UL)
 15. Comply with all ADA requirements for disabled access.

- E. Minimum requirements: The requirements of these are the minimum that will be allowed unless such requirements are exceeded by applicable codes or regulations, in which the regulatory codes or regulation requirements shall govern.
- F. When the Contract Documents call for materials or construction of a higher standard than is required by the above, the Contract Document requirements shall take precedence over the requirements of the said laws, rules, and/or regulations, accepting that nothing in the Contract Documents shall be interpreted as permitting work in violation of said laws, rules, and/or regulations. The Contractor for this work shall furnish any additional materials and/or labor as may be required for compliance with these laws, rules, and/or regulations though such materials and/or labor are not specifically set forth in the Contract Documents, with no additional charges to Owner.
- G. Seismic construction and restraints shall be in accordance with the requirements of Title 24 of the California Code of Regulations. All equipment mounts, isolators, and hanging systems must meet local authority requirements.

1.3 CONTRACT DRAWINGS

- A. The Contract Drawings indicate diagrammatically the general layout of the mechanical systems and other related work. The data given herein and on the Drawings are as exact as could be reasonably secured, but absolute accuracy is not guaranteed. Field verification of scaled dimensions taken from the Drawings is required. Exact locations, distances, elevations, etc. will be governed by shop drawings, the building itself, and actual field conditions.
- B. The Contractor shall review and compare the Architectural, Structural, Plumbing, Mechanical, and Electrical Drawings and all Owner supplied equipment Drawings and adjust their work to be in conformity with the conditions indicated thereon. Discrepancies between different Drawings, between Drawings and actual field conditions, or between Drawings and Specifications, shall be brought to the attention of the Architect promptly for a determination of the modifications to be affected.
- C. Provide offsets, fittings, and accessories required to meet project conditions, even when not shown.
- D. Minor changes in locations of equipment, piping, ducts, etc., from locations shown shall be made when directed by the Architect at no additional cost to the Owner, providing such change is ordered before such items of work, or work directly connected to same are installed and providing no additional material is required.

1.4 WARRANTIES

- A. Warranty all materials, equipment, and apparatus to be free from defects and faulty workmanship. Warranties shall be in accordance with the provisions of the General Conditions and Special Conditions. Should any defects occur during this period, the Contractor shall repair or replace defective items as directed by the Architect, without cost to the Owner.

1. Equipment warranties shall be provided for all equipment, with all necessary information filled in, except purchase date, in favor of the Owner.
- B. Provide new materials, equipment, apparatus, and labor to repair or replace that determined to be defective or faulty.

1.5 SUBMITTALS

A. General:

1. All submittals shall be in accordance with the requirements of the General Conditions and Division 01 Sections for Submittal Procedures and Product Requirements.
2. Before any fixtures, materials, or equipment are purchased, the Contractor shall submit to the Architect for approval, a complete list of materials, fixtures, and equipment, giving the manufacturers' names, catalog number, capacity, size, power requirements, and other pertinent data. Submittal lists and drawings shall be specifically applicable to this project, shall include identifying marks assigned by Specifications and Drawings, and shall not contain extraneous material or optional choices.
3. Product names referenced in the specifications are used as standards of quality. Other materials shall not be used unless approved in writing. Review is required even though the term "or equal" is used. Review of submittals will be only for general conformance with design concept. Review will not include quantities, dimensions, construction methods, or coordination with the work of other trades.
4. The Contractor shall submit for the approval of the Architect, shop drawings of proposed material and equipment that differ from the specified materials and equipment, and of any specified materials and equipment with special conditions and/or arrangements. These drawings shall show necessary modifications of Owner, plumbing, electrical and mechanical work required by the proposed materials and equipment.
5. Submittal of substitutions shall be limited to one proposal for each type or kind of item. If the first proposed product submittal is rejected, the Contractor shall then submit the first named or scheduled product. Installation of reviewed substitution is Contractors' responsibility. Any mechanical, electrical, structural, or other changes required for installation of substituted equipment or material must be made by the Contractor without additional cost to Owner. Review by the Architect of substituted equipment or material will not waive these requirements.
6. Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements. Review of drawings and other material submitted shall not be construed as a complete check or constitute a waiver of the requirements of the Drawings and Specifications but will indicate that the material submitted is acceptable in quality and utility. This review shall not relieve the Contractor of the responsibility to fit

the proposed materials to the spaces provided and to affect necessary rearrangement or construction of other work.

B. Product Data

1. For all HVAC equipment and each type of product indicated, include manufacturer's specifications and data sheets, and certified drawings on major equipment. Include physical and performance data, such as weights, sizes, capacities, required clearances, performance curves, acoustical characteristics, finishes, color selection, and accessories.
2. Include certified drawings on major equipment.

C. Coordinated Layout/Shop Drawings

1. Prepare complete consolidated and coordinated layout drawings for all new systems, and for existing systems that are in the same areas. Shop drawings shall be prepared using AutoCAD 2014 or newer and shall be drawn at a minimum $\frac{1}{4}" = 1' - 0"$ scale.
2. All drawings shall be fully coordinated with HVAC, Plumbing, Fire Protection, Electrical, Structural, and Architectural work. Drawings shall be coordinated and dimensioned indicating equipment, pipe, duct, fire protection, and electrical in relation to architectural and structural features. Indicate exact locations of valves, piping specialties, access doors, etc.
3. Clearly identify and dimension the proposed locations of the principal items of equipment and adequate clearance for all equipment, piping, pumps, valves and other items. Provide detailed layout of all piping systems showing the proposed routes.
4. Show the access means for all items requiring access for operations and maintenance.
5. Submit shop drawings to Architect for approval, prior to fabrication or installation of any work. Do not install equipment or piping until drawings have been approved. Any work installed without prior shop drawing approval shall be removed at the Contractor's expense.
6. Use of contract documents for shop drawings is not acceptable.
7. Any work installed without prior shop drawing approval shall be removed at the Contractors expense.

D. Submit shop-wiring diagrams of temperature controls, exhaust fan controls and air conditioning unit controls for approval. Furnish approved wiring diagrams and assistance to Electrical Contractor.

E. Seismic Shop Drawing Submittal (if applicable)

1. Equipment manufacturer shall design, construct, and certify that his equipment satisfies the special minimum seismic resistance requirements for this project and shall submit calculations or test results supporting his certification.
 2. Provide submittal for seismic supports, anchorages, and restraints indicated to comply with performance requirements and design criteria.
 - a. Calculations performed for use in the selection of seismic supports, anchorages, and restraints shall utilize criteria indicated in Structural Contract Documents.
 - b. Supports, anchorage, and restraints for piping, ductwork, and equipment shall be an OSHPD pre-approved system such as Mason OPM #0043-13. Pipes, ducts, and equipment shall be seismically restrained according to the requirements of the current edition of the California Building Code. The system shall have a current OPM number and shall meet additional requirements of the Authority Having Jurisdiction. Provide supporting documentation required by the reviewing authority and the Architect and Engineer. Provide layout drawings showing piping, ductwork, and restraint locations.
 - c. Bracing of Piping, Ductwork, and Equipment: Specifically state how bracing attachment to the structure is accomplished. Provide shop drawings indicating seismic restraints, including details of anchorage to the building. In-line equipment must be braced independently of piping and ductwork, and in conformance with applicable building codes. Provide calculations to show that pre-approval numbers have been correctly applied in accordance with general information notes of pre-approval documentation.
- F. Field quality-control test reports.
- G. Operation and Maintenance Data
1. The Contractor shall provide all operating and maintenance instructions provided by the manufacturer, describing proper operation and maintenance of any equipment and devices installed. Operating and maintenance instructions shall cover maintenance, adjustment, and operation of all equipment.
 2. Operation and maintenance data shall include a table of contents identifying items therein and index tabs for each system. Neatly obscure or cross out inapplicable data from manufacturer's literature.
 3. The Contractor shall also provide a parts list of all equipment and component parts for all equipment under this Section. The equipment list shall include the manufacturer's name, model number, and local representative, service facilities and normal channel of supply for each item.
 4. Also include the following:
 - a. Manufacturer's certified shop drawings, and lubrication charts and data. Mark each sheet with equipment identification number and actual installed

condition or system and location of installation. Specifically identify which options are provided.

- b. Recommended preventative maintenance schedule and procedures.
 - c. Provide copy of valve schedules for each piping system.
 - d. Provide a copy of the equipment label schedule.
 - e. Description of start-up and operating procedures for each system, including controls diagrams and description of operating sequences.
5. Copies of manufacturer's guarantees/warranties for each system shall be included in the O&M data.
 6. Submit data to the Architect for approval. Final acceptance of the work will not be made until a satisfactory submission of this material is received and approved by the Architect.

H. As-Built Drawings

1. Upon completion of the project, a final set of construction drawings and specifications, with as-constructed information added, are to be submitted as record drawings at completion of project. Plans are to incorporate all addenda items and change orders.
2. The as-built set shall reflect a final record of installed conditions, including all changes made over the course of the project. All equipment, including piping, etc. shall clearly identify both top and bottom elevations as well as distances from equipment to established building lines. Coordinate with other trades and field conditions and show dimensions and details including building construction and access for servicing.
3. In addition to changes made during course of work, show the following:
 - a. Exact location, type and function of concealed valves and controllers.
 - b. Exact size, elevations and location of underground and under floor piping.
4. Submit to Architect for approval.

I. Warranty

1. Equipment warranties shall be provided for all equipment, with all necessary information filled in, except purchase date, in favor of the Owner.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall be responsible for the delivery, storage, protection, and placing of all equipment and materials to be incorporated into the work. Any items damaged shall be repaired or replaced, at no additional cost to the Owner.
- B. The Contractor shall protect the work and materials from damage during construction. Equipment stored at the job site shall be protected from dust, water, or other damage,

and be covered if the equipment is exposed to weather. Protect interiors of new equipment and piping systems against entry of foreign matter. Remove debris arising from cutting, threading, and welding of piping. Piping systems shall be flushed, blown, or pigged as necessary to deliver clean systems. Clean both inside and outside of equipment before painting or placing in operation.

- C. The Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.7 COOPERATION WITH OTHER TRADES

- A. Coordinate all HVAC work with other trades doing work on the project as may be necessary for the proper completion of the project. Refer to the Structural, Plumbing, and Electrical Drawings for details of the building structure and equipment installation that will tend to overlap, conflict with, or require coordination with the work of Division 23, and schedule this work accordingly.
- B. Priority of right of way in space shall be as follows, in decreasing order of authority:
 - 1. Electrical lights, electrical panels, and drain piping.
 - 2. Ductwork.
 - 3. Fire protection piping, domestic hot water, domestic cold water, and condenser water piping.
- C. Any work done without regard for other trades shall be moved, replaced, or reconstructed as required, without extra charges to the Owner.

1.8 FEES AND PERMITS

- A. Obtain permits and services required for the installation of the work. Arrange for required inspections and secure approvals from Authorities Having Jurisdiction.

1.9 UTILITY CONNECTIONS

- A. Arrange for all utility connections, determine their exact requirements, and pay all costs incurred. Send proper notices, make necessary arrangements, and perform other services required for care and maintenance of all utilities, and assume all responsibility concerning same. Observe all rules and regulations of the respective utilities in executing the work.

1.10 ELECTRICAL REQUIREMENTS

- A. Electrical work in this Section shall conform to the requirements of Division 26. Equipment shall conform to the standards of the National Electric Manufacturer's Association. Electrical equipment shall bear the label of Underwriters' Laboratories, Inc. where examination and listing service are available for such materials. Motors and motor control equipment shall be as specified herein.

- B. Refer to Division 26 for conduit fittings and devices, service voltage and power feed wiring, and control and interlock wiring for equipment specified under this Section. The Contractor shall have a responsibility to verify that the electrical services provided are adequate and compatible with equipment requirements.
- C. Electrical work shall include the furnishing of:
1. Duct mounted smoke detectors
 2. Motor starters, 3-phase
 3. Disconnects/circuit breakers, unless specifically called for in equipment schedules or specifications to be factory installed with equipment
 4. Smoke control interlocks to HVAC fans
 5. Electrical systems
 6. Power wiring, including raceway, fittings, wire, boxes and related items, all voltages, that is not part of Controls Contractor work
 7. Control & interlock wiring that is not part of Controls Contractor work.
- D. Electrical work shall include the installing of:
1. All smoke detectors, except duct-mounted
 2. Smoke control interlocks to HVAC fans
 3. Variable speed drives, field mounted
 4. Motor starters, 3-phase
 5. Disconnects/circuit breakers, unless specifically called for in equipment schedules or specifications to be factory installed with equipment
 6. Electrical systems
 7. Low voltage wiring, line voltage "interlock" wiring, control wiring for safety devices, alarms, and refrigeration.
- E. Controls Contractor shall furnish and install:
1. Refrigerant leak detectors, including control & interlock wiring
 2. Control system network backbone
 3. Window switches
 4. Control panels

5. Control devices
 6. Control damper actuators
 7. Terminal box control transformer panels
 8. Digital controller and damper actuator
 9. Air-flow measurement transducer and piping
 10. Wall sensor modules.
- F. Controls Contractor shall furnish, and Mechanical Contractor shall install:
1. Automatic isolation and control valves
 2. Sensor wells, meters, and other pipe-mounted control devices
 3. Wiring includes all connections to devices, and all wiring shall be installed in conduit.
 4. Conduit fittings and devices shall be as specified in the basic electrical materials section of Division 26.
 5. Line voltage work (in equipment assemblies) shall be as specified in Division 26.
- G. Devices shall be installed in NEMA enclosures of the type required for the location.
- H. Electrical Controls:
1. Refer to Electrical, Fire Protection, Plumbing, and Mechanical documents for work and devices required.
- I. The following work will be furnished and installed under Division 26.
1. Disconnect switches, remote switches, motor starters, relays, and test switches that are not mounted as an integral part of equipment assemblies or in temperature control panels.
 2. All line voltage controls and interlocks, all other controls, circuits from electric panel board to disconnect switches, starters, motors, switches and/or other motor controls, to temperature controls and safety devices.

1.11 DAMAGE BY LEAKS

- A. The Contractor shall be responsible for any damage to the work of other Contractors that is caused by leaks in any temporary or permanent piping systems due to pipe rupture, disconnected pipes or fittings, or by overflow of equipment.

- B. Patching and replacing of damaged work shall be done by the Contractor who installed the work, as directed by the Architect, but the cost of same shall be paid by the Contractor who is responsible for the damage.

1.12 LICENSING REQUIREMENTS

- A. All work of Division 23 shall be performed by an appropriately licensed contractor. The licenses shall be current, valid through the term of the contract, and in the name of the Contractor.
 - 1. HVAC work that includes warm air heating systems and water heating pumps, ventilating systems, air conditioning systems, and ductwork, registers, flues, humidity, and thermostatic controls in connection with these systems, shall be performed by a C-20 - Warm-Air Heating, Ventilating, and Air-Conditioning Contractor.

1.13 DEMONSTRATION & TRAINING

- A. Comply with the requirements of the General Conditions, Division 01 Sections, and the following.
 - 1. Prepare a formal training program for the operating staff before the scheduled start-up date. The program shall consist of the design, start-up, and operation of the HVAC systems. The training program shall be coordinated with the production of the operation and maintenance manuals. Operations and maintenance data is to be available for training sessions.
 - 2. Provide a minimum of 4 hours of on-site training. All instruction shall be provided at no cost to the Owner.

PART 2 PRODUCTS

2.1 PRODUCTS CRITERIA

- A. All materials, appliances, and equipment shall be new and the best of their respective kinds, free from defects, and of the make, brand or quality specified or as accepted by the Architect.
- B. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
- C. Apply and install all items according to the manufacturer's written instructions. Refer conflicts between the manufacturer's instructions and the contract drawings and specifications to the Architect for resolution.
- D. All fixtures, materials, and equipment equal in quality and utility to these herein mentioned will be accepted. When specific names are used in describing fixtures, materials, and equipment they are mentioned as standards only, but this implies no right on the part of the Contractor to use other fixtures, materials, and equipment, or

methods unless approved as equal in quality and utility by the Architect. The decision of the Architect shall govern as to what fixtures, materials, and equipment are equal to those mentioned, but the burden of proof as to the quality of any proposed fixtures, materials, or equipment shall be upon the Contractor. If any tests are necessary to determine the quality of proposed fixtures, materials, or equipment, an unbiased laboratory satisfactory to the Architect shall make such tests at the expense of the Contractor.

2.2 HANGERS, SUPPORTS

A. Piping - General

1. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for un-insulated copper piping systems.
2. Hangers and supports shall be designed and manufactured in conformance with ANSI/MSS SP-58. Selection and application shall be according to ANSI/MSS SP-69.
3. All piping shall be supported with Superstrut, B-Line, Anvil, Mifab, or approved equal pipe hangers and supports. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with shield for insulated piping.
4. All hangers shall be electro-chromate or corrosion-resistant finished. Hanger rods shall have electro-galvanized finish.

B. Rooftop pipe supports

1. MiFab "C-Port" series or B-Line "Dura-Block" or approved equal.
 - a. Model C rubber support series with 14-gauge galvanized channel.
 - b. Seismic: Model CZ rubber base with 14-gauge galvanized channel

C. Copper tubing:

1. B-Line 3690, Superstrut C-711 or Anvil Figure 67 "J" pipe hangers or approved equal, complete with isolator.
2. Isolators: B-Line "Vibra Cushion" B1999, Type L & K for copper tubing, Superstrut C-716 isolator for copper, Anvil Figure CT-769 or approved equal

D. Insulated pipe:

1. Hangers: B-Line 3690 "J" pipe hanger, Superstrut C -711, or Anvil Figure 67 fitted to outside of insulation or approved equal

2. Pipe Shields: B-Line 3151 insulation protection shield, Superstrut C-790, or Anvil Figure 167 or approved equal
- E. Point of support connectors:
1. Wood construction:
 - a. Stationary pipes: B-Line B3060, Superstrut 540 or Anvil Figure 206 side beam hanger clip or approved equal
 - b. Pipes subject to movement: B-Line B-756 or Superstrut S-541 beam clamp swing connector or approved equal
 2. New concrete construction: B-Line B2501 light duty spot inserts or Superstrut 452-TB spot inserts or approved equal.
 3. Existing concrete construction: Red Head "Trubolt, Hilti "Kwik Bolt", Simpson "Stong Bolt" or Hilti "Quik-Bolt", drilled-in, concrete anchors.
 4. Steel beams: Series 500 beam brackets.
 5. Plywood decks: machine bolts, nuts, and washers.
- F. Vertical pipe risers:
1. Riser clamps: Superstrut C-720 extension riser clamps anchored to construction
 2. Bare cold-water pipe: Superstrut C-720P, PVC coated to prevent corrosion
- G. Insulated pipe supports: K.B. Enterprises "Snapp Itz".
- H. Pipes through studs or joists shall be isolated from the structure with properly sized Hubbard "Hold-Rite" suspension clamps or LSP "Acousto-Plumb" system.
- I. Ductwork
1. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
 2. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
 3. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
 4. Steel Cable End Connections: Steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
 5. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

6. Trapeze and Riser Supports:

- a. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
- b. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
- c. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

J. Cable Bracing (Ductwork & Piping)

1. Cables shall be pre-stretched galvanized 7x19 strand core aircraft cable, with no limit to their installed length. Cables meet the following specifications: MIL-DTL-83420M with Amendment 2, Type 1 non-jacketed cable.
2. Cables shall be installed slightly slack, so as not to support gravity loads.
3. Cables shall connect the braced item to a building structural element. Cables shall have a bracket at each end to make the connections. The cable assembly with connection brackets shall be Mason Industries "SCB" or "SCBH". The cable is held to end brackets with one or two bolts. Cable bolts shall be tightened to the torque values stated in the details or, in the case where break-off nuts are provided, tighten until the nut breaks off.
4. The Mason Industries "SCBH" component can be used for connection directly to the threaded vertical hanger rod used for supporting system gravity loads as detailed in Section D of OPM-0043-13.
5. The "SCB" bracket and cable (Ref. X1.0), "SCBH" bracket and cable (Ref. X1.1), and "UCC" rod stiffener clamp (Ref. X3.0) manufactured by Mason Industries, are included (with accompanying hardware) in the kit options provided in Section D of OPM-0043-13.

K. Seismic Bracing

1. Seismic cable restraints shall consist of galvanized steel aircraft cables sized to resist seismic loads with a minimum safety factor of two and arranged to provide all directional restraint. Cables must be pre-stretched to achieve a certified minimum modulus of elasticity. Cable and connections shall be steel assemblies that swivel to final installation angle and utilize two clamping bolts to provide proper cable engagement. Cables must not be allowed to bend across sharp edges. Cable assemblies shall have an OPM approval from OSHPD in the state of California verifying the maximum certified load ratings. Cable assemblies shall be type SCB at the ceiling and at the clevis bolt, SCBH between the hanger rod nut and the clevis or equipment, or SCBV if clamped to a beam, all as manufactured by Mason Industries, Inc.

2.3 PIPE LABELS

- A. Brady, Seton, Kolbi, Graphic Products, or approved equal pipe labels. Preprinted, color-coded, with lettering indicating service, and showing flow direction.

- B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent adhesive backing.
- C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
- D. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as a separate unit on each pipe label to indicate flow direction.
- E. Label Sizes (per ANSI A13.1 / ASME A13.1-2020 Standards):
 - 1. For pipes or covering with outside diameter 0.7 to 1.3 inches, minimum length of the color field: 8 inches, minimum height of letters: 0.5 inch.
 - 2. For pipes or covering with outside diameter 1.4 to 2.4 inches, minimum length of the color field: 8 inches, minimum height of letters: 0.7 inch.
 - 3. For pipes or covering with outside diameter 2.5 to 6.7 inches, minimum length of the color field: 12 inches, minimum height of letters: 1.3 inches.
- F. Pipe Label Color Schedule: (per ANSI A13.1 / ASME A13.1-2020)
 - 1. Potable, Cooling, Boiler Feed, and other Water Piping:
 - a. Background Color: Green.
 - b. Letter Color: White.
 - 2. Fire Quenching Fluids:
 - a. Background Color: Red.
 - b. Letter Color: White.
 - 3. Toxic and Corrosive Fluids
 - a. Background Color: Orange.
 - b. Letter Color: Black
 - 4. Flammable Liquids:
 - a. Background Color: Yellow.
 - b. Letter Color: Black.
 - 5. Combustible Fluids:
 - a. Background Color: Brown.
 - b. Letter Color: White
 - 6. Compressed Air:

- a. Background Color: Blue.
- b. Letter Color: White.

7. Abandoned Pipes:

- a. Background: White
- b. Letter Color: Black

G. Duct Markers:

- 1. Self-adhesive duct markers with an arrow indicating the flow direction.

2.4 ELECTRIC MOTORS

- A. With exception of motors in UL labeled equipment, motors for HVAC blowers and fans, pumps, and other general-purpose applications using an adjustable speed drive shall be Baldor Premium Efficient Super-E®, three-phase, foot mounted, Class H insulated motor with AEGIS shaft grounding ring installed internally, re-greasable ball bearings, and dynamically balanced rotors.
- B. Motors shall be certified for quiet operation and shall bear a label so stating. Motors shall be drip-proof frame, 1.15 minimum service factor, and in 104°F ambient windings specially impregnated and epoxy-coated for outdoor service.
- C. Torque characteristics of motors shall be as required to accelerate the machine to 100% full load speed within 10 seconds. Motors shall be dynamically balanced to maximum deflection as follows: 15 HP and larger: 0.0003 inches, 10 HP and smaller: 0.0002 inches.
- D. Motors shall be inverter duty, meet NEMA MG-1, Parts 30 and 31, and shall be guaranteed to satisfactorily operate at $\pm 10\%$ voltage shown on Drawings. Transformers of adequate capacity shall be provided, if necessary, to satisfy this requirement.
- E. All 3-phase motors shall be provided with phase and brown-out protection to shut down all motors in the unit if the phases are more than 10% out of balance on voltage or the voltage is more than 10% under design voltage.
- F. Fractional horsepower fan motors ($\frac{1}{4}$ hp, $\frac{1}{2}$ hp, $\frac{3}{4}$ hp) shall be Greenheck "Vari-Green" series motors, DC electronic commutation type, specifically designed for fan applications. Motors shall be permanently lubricated with heavy-duty ball bearings to match the fan load and pre-wired to the specific voltage and phase. Internal motor circuitry shall convert AC power supplied to the fan to DC power to operate the motor. Motor shall be controllable down to 20% of the full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal. Motor shall be a minimum of 85% efficient at all speeds.
- G. Provide fan drives rated at 150% of motor horsepower. Drives shall be adjustable sheave type unless specified otherwise. Listed fan speeds are only approximate;

select and/or change drives to operate at the approximate midpoint of adjustable range after final balancing.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

- A. Provide all necessary sleeving, core drilling, carpentry, cutting, and patching required for proper installation of material and equipment specified.
- B. No structural members shall be drilled, bored, or notched in a manner that will impair their structural capacity. No structural cutting or drilling shall be done without the approval of the Architect and DSA.
- C. All penetrations of concrete or masonry shall be made with core drills.

3.2 VERIFICATION OF EXISTING CONDITIONS

- A. Before commencing the work of this Section, the Contractor shall inspect the installed work of other trades and verify that their work is sufficiently complete to permit the start of work of Division 23 and that the completed work will be in complete accordance with the original design. In the event of a discrepancy, immediately notify the Architect and proceed as directed.
- B. Before installation of any new work, verify the location, size, and other conditions at all points of connection to services or other existing piping, and at all locations where new work will cross or pass near existing piping, electrical, or other facilities.
- C. Information shown relative to existing services is based upon available records and data during the preparation of the Drawings but shall be verified. Make reasonable deviations found necessary to conform with actual locations and conditions, without extra charge.

3.3 GENERAL DEMOLITION

- A. The Contractor shall retain specific equipment as directed by owner and deliver to owner specified location.
- B. All equipment, mechanical equipment, piping, valving, controls, etc. rendered useless by this work shall be demolished and removed from the site.
- C. Location of existing mechanical equipment, ductwork air outlets, piping, controls, valves, etc. has been based on the best available information obtainable at the site and through record drawings. Contractor shall verify exact locations, sizes, and extent of existing systems prior to start of demolition work.
- D. All unused piping above grade shall be removed. All unused piping below grade shall be capped and abandoned. Cap dead branches as close as possible to live mains.

- E. Patch all walls, ceilings, roof and other surfaces to match existing conditions

3.4 POLLUTANT CONTROL

- A. At the time of rough installation or during storage on the construction site and until the initial startup of the heating and cooling equipment, all duct and other related air distribution component openings shall be covered with tape, plastic, sheet metal, or other methods acceptable to the enforcing agency to reduce the amount of dust or debris which may collect in system.
- B. During construction, protect all filters upstream of air handling units with blankets of 2" fiberglass filter media or 2" disposable panel filters. UL Class 2 listed.
- C. Systems shall not be operated without properly installed filters. Filters used during construction shall be removed and replaced with new filters after construction is completed and the systems are ready for final acceptance by the owner.

3.5 EQUIPMENT

- A. Equipment shall operate quietly and without objectionable vibration. Such problems, other than from equipment operating at optimum conditions, shall be the Contractor's responsibility and shall be eliminated at the direction of the Architect.
- B. Install equipment to provide a good appearance, easy access, and adequate space to allow replacement and maintenance. Provide bases, supports, anchor bolts, and other items required to achieve this. Installation shall be level, above moisture level, and adequately braced.
- C. Move equipment into the building through available openings. Dismantle equipment where it is necessary to accomplish this. After reassembly, test equipment to verify its satisfactory operating condition.
- D. Thoroughly lubricate equipment before operating. Repair of damage resulting from failure to comply with this requirement shall be the Contractor's responsibility. Extend 1/4-inch schedule 40 black steel lubrication pipes from hard-to-reach locations to front of equipment or to access doors. Terminate with proper lubrication fittings.
- E. Piping connections shall be secured and properly aligned, and all utility and control connections shall be properly isolated from the building structure using vibration isolators and flexible connections. Any equipment not meeting this requirement will be modified and properly reinstalled at no expense to the Owner.
- F. Electrical:
 - 1. Contractor shall coordinate electrical requirements and connections for all power feeds with electrical contractor. Refer to Division 26 for additional information

3.6 ACCESS

- A. All items that require access, such as for operating, cleaning, servicing, maintenance, and calibration shall be easily and safely accessible by persons standing at floor level, or standing on permanent platforms, without the use of portable ladders. Examples of these items include but are not limited to all types of valves, filters, strainers, transmitters, and control devices. Prior to commencing installation work, refer conflicts between this requirement and the Contract Drawings to the Architect for resolution.

3.7 MECHANICAL SERVICES

- A. Terminals and services weighing no more than 20 pounds, may be supported directly on the runners of a heavy-duty grid system but in addition, they must have a minimum of two #12- gauge slack safety wires attached at diagonally opposite corners and anchored to the structure above.

3.8 CONCRETE EQUIPMENT BASES

- A. Concrete work that is part of the mechanical installations, as such is shown and/or detailed on the Drawings, shall conform to the requirements of the Concrete Section of these Specifications.
- B. Concrete bases: Anchor equipment to a concrete base according to equipment details on mechanical and structural Drawings. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than the supported unit. Bases shall be neatly finished, have rounded corners, and have a smooth trowel finish.

3.9 PAINTING

- A. Properly prepare work to be painted per the requirements of Division 09, except preservative and special painting as described herein. Priming shall conform to Division 09 requirements and be of a material compatible with paint for finish painting.
- B. All equipment and materials shall be cleaned of grease, wax, oil, rust, or dirt in preparation for finish painting. Any prime coated surfaces showing signs of rust before being finish painted shall be thoroughly cleaned and a new prime coat applied.
- C. Equipment in equipment rooms and like spaces shall be furnished with a factory-applied baked-on prime coat or at the Contractor's option, a standard factory baked enamel finish in approved colors. Machinery such as fans or motors shall be furnished with a factory-applied baked-on prime coat, or at the Contractor's option, a standard paint finish (air-dried or baked enamel) in approved colors. Mechanical equipment in other locations shall be furnished with a factory-applied baked-on prime coat unless noted otherwise.
- D. Paint interior of ductwork at air outlets with one coat of flat black paint.

- E. Prime paint both sides of flashings before installation.
- F. Furnish can of touch-up paint with each factory-finished piece of equipment.
- G. Paint all piping in mechanical rooms. Color as selected by the Architect.
- H. Black steel piping exposed to the environment shall be painted with rust-inhibiting paint. Color as selected by Architect.

3.10 IDENTIFICATION OF SYSTEMS

A. Nameplates

- 1. Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.

B. Equipment

- 1. All equipment shall be labeled with 1" high stencils showing the identifying mark noted on drawings and usage.
- 2. Warning signs shall be placed on machines driven by electrical motors that are controlled by fully automatic starters, per California Code of Regulations, Title 8, Subchapter 7 - General Industry Safety Orders, Article 7, Section 3320

C. Piping

- 1. All piping shall be identified. Attach arrows at one or both ends of the marker to indicate flow direction.
- 2. If the pipe being labeled contains multiple hazards, determine which has the greatest hazardous risk and label accordingly.
- 3. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces, machine rooms, accessible maintenance spaces such as shafts, tunnels, and plenums, and exterior exposed locations as follows:
 - a. Adjacent to all valves and flanges
 - b. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at the branch.
 - c. At both sides of wall or floor penetrations.
 - d. Before and after all wall, floor, and ceiling penetrations and inaccessible enclosures.
 - e. Adjacent to changes in direction.
 - f. At access doors, manholes, and similar access points that permit view of concealed piping.

- g. Near major equipment items and other points of origination and termination.
- h. Spaced at maximum intervals of 25 feet along each run. Reduce intervals to 20 feet in mechanical rooms and other areas of congested piping and equipment, in spaces.
- i. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Ductwork

- 1. Locate labels near points where ducts enter concealed spaces and at maximum intervals of 25 **feet** in each space where ducts are exposed or concealed by a removable ceiling system.
 - a. Exposed ductwork shall be identified every 20 feet in mechanical rooms with removable ceilings, and at each access door in spaces with hard ceilings.

E. Valves

- 1. For identification and the Owner's maintenance records, all valves shall be numbered and identified with clearly stamped 1¼" diameter brass tags, in accordance with drawings and service performed.
- 2. Control valves shall be also marked whether normally open (N.O.) or normally closed (N.S.).

- F. A typewritten schedule of all nameplates and valve tags used, with identification, shall be framed and posted in mechanical rooms, at locations as directed.

3.11 SEISMIC RESTRAINT

A. Equipment:

- 1. Each piece of equipment installed under these sections shall be constructed and anchored to structural supports as indicated on the Drawings.

B. Vibration

- 1. All rotating mechanical equipment and associated piping and ductwork shall be mounted by vibration isolators as required to minimize transmission of vibrations and noise to building structures or spaces.
- 2. All rotating equipment shall be balanced both statically and dynamically.
- 3. To minimize alignment problems, all motors over 5 hp must be designed to be solidly attached to a common base with the driven unit.

4. To minimize vibration, solid sheaves, and band belts shall be designed to be used in multiple V-belt driven equipment over 15 hp.

C. Isolation of Equipment

1. Isolation shall be designed to be stable during starting and stopping of equipment without any transverse and eccentric movement of equipment that would damage or adversely affect the operation of the equipment or appurtenances.
2. Isolation shall be designed for the operating speed of the equipment.
3. Isolators, including springs, exposed to the weather shall be hot-dipped galvanized after fabrication. Hot dipped zinc coating shall comply with ASTM Method A-123 and shall not be less than 2 oz per square foot.
4. Isolators shall be selected and located to produce uniform loading and deflection even when equipment weight is not evenly distributed.
5. Isolation equipment includes neoprene pads, hanger spring and neoprene, travel limited floor spring and neoprene, inertia base, flexible duct connections, flexible pipe connections, thrust limits, grommets, and snubbers.

D. Seismic Control and Restraint

1. Brace or anchor mechanical equipment to resist horizontal forces acting in any direction using the latest editions of the CBC and ASCE.
2. Seismic-restraint devices shall meet CBC seismic restraint requirements, shall have horizontal and vertical load testing and analysis, and shall bear anchorage preapproval OPM number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

E. Ductwork:

1. All ductwork shall be supported in accordance with the recommendations and requirements of the SMACNA Duct Construction Standards, latest edition, except strap hangers and trapeze hangers, which shall have bracing capable of resisting a seismic force equal to 100% of the weight of the duct system in any direction. (Seismic force shall be in addition to static loading.)

F. Piping:

1. The flexibility of piping systems must be maintained by using flexible devices at critical points at junctions of separate building structures. Braces or anchors

shall be designed to damp oscillations or check excessive movement. Flexible devices for piping of gas shall be loops or offsets. Flexible devices for other piping may be loops, Victaulic grooved, or roustabout couplings.

2. Piping at tops and bottoms of risers are critical points where flexibility is required, as well as at changes in direction on long runs of piping 4" and larger. Tops of risers shall be restrained from motion in a horizontal direction, and midpoints shall be anchored in all directions.

3.12 INSTALLATION - HANGERS AND SUPPORTS

- A. Pipe supports shall be spaced according to CMC 2022, Table 313.3, and sufficiently close to support pipes properly without the formation of pockets. Hangers shall be installed at the ends of mains and branches.
- B. Refrigerant piping shall be supported per CMC 1105.2 and 1109.6.
- C. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- D. No valve or piece of equipment shall be used to support piping.
- E. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate the action of expansion joints, expansion loops, expansion bends, and similar units.
- F. Install lateral bracing with pipe hangers and supports to prevent swaying.
- G. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, 2-½ inches and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- H. Metal Pipe-hanger Installation: Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- I. Metal Trapeze Pipe-Hanger Installation: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
- J. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. Insulated Piping:

1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of the insert.
- M. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
- N. Ductwork
 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
 2. Support vertical ducts with steel angles or the channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets. Support at each floor at maximum intervals of 16 feet.
 3. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.13 PIPE WELDING

- A. All hot and chilled water, steam and steam condensate, compressed air, and vacuum piping shall be installed, examined, inspected, and tested in accordance with the requirements of ASME B31.9, Building Services Piping, current edition.
- B. Before any welding is performed, the contractor shall submit to the Architect, copies of any welding procedure specifications and their supporting procedure qualification records for review and acceptance. Copies of welder qualification records shall be made available for review to the owner or his representative at the construction site.
- C. Weld all pipes 2.5 inches and larger. Use the following procedure. All welders must be AWS certified. AWS B2.1 SMAW 6G Pipe Welding Procedure Specifications

Welding process: SMAW

Groove Angle: 60 degrees

Position: 6G Fixed position

Material/Spec: A 106

Weld Progression: Up

Thickness (pipe/tube): Groove (in) .280

Backing: No

Notes: Sch. 40 Pipe

Current/Polarity: DCEP

Filler Metal Class: E6010Rt/E7018F1

Root Opening: 1/16 to 1/8

Other Filler Metal Class: Rt. 1/8, 3/32
Filler

- D. Welded joints shall be beveled and butt-welded. Reductions of pipe shall be made with forged steel welding fittings. Branch reductions of 2 or more pipe sizes smaller than the main shall be Bonney "weldolet" fittings, or equal. Job fabricated reductions

and branches shall not be used. All pipe burrs shall be reamed out. Welding rods shall be as follows, or approved equal:

<u>Pipe Size</u>	<u>Arc Welding</u>	<u>Gas Welding</u>
2" and larger	Fleetweld #5	Oxweld #1
1½" and smaller	None	Oxweld #1

3.14 INSTALLATION, PIPING

- A. Installation of piping shall be such that damage cannot result through thermal expansion or contraction, to piping, building, or pipe hangers and supports. Anchors shall be installed at midpoints of all runs in the main piping for localizing pipe expansion or prevention of creepage.
- B. Rough-in shall proceed as rapidly as general construction will permit. All rough-in shall be complete, at locations verified by Architect and Owner, and tested and inspected before installation of concrete, lath, plaster, gypsum wallboard, or other finishes.
- C. All piping shall be concealed in finished rooms, installed in furred walls and partitions. Where furred or suspended ceilings occur, the piping shall be installed in the concealed space at points adjacent to beams and/or other structural members and coordinated with ductwork and equipment. Where exposed piping occurs, it shall be installed parallel to or at right angles to building walls, unless specifically shown otherwise on the Drawings.
- D. All pipelines shall be installed free from traps and air pockets, true to line and grade, with suitable supports properly spaced. All piping shall be installed without undue stresses and with provision for expansion and contraction.
- E. All piping shall be new and free from foreign substances. American standard pipe threads shall be used for IPS threaded work. Joints in threaded piping shall be made up with Teflon tape applied to the male threads only. No screwed pipe joints shall be caulked or packed with rope or other packing materials. Pipe shall be free from tool marks, threads cut accurately with not more than two threads showing beyond fitting. Friction wrenches shall not be used with plated, polished, or soft metal piping. All changes in pipe size shall be made with reducing fitting. Bushings will not be permitted.
- F. Protect unattended openings in piping during construction.
- G. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- H. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

- I. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- J. Install piping to permit valve servicing.
- K. Install piping free of sags and bends.
- L. Install piping to allow application of insulation.
- M. Install fittings for changes in direction and branch connections.
- N. Install escutcheons for penetrations of walls, ceilings, and floors according to the following. Use one-piece escutcheons wherever possible in new construction. Split-casting units are acceptable for installation on existing piping systems. Provide chrome plated escutcheon plates at all points where exposed piping penetrates finished wall, ceilings, or floors.
- O. No valve or piece of equipment shall be used to support piping.
- P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Through-Penetration Firestop Systems" for materials.
- Q. All copper tubing shall be formed in a workmanlike manner according to the Pipe and Tube Bending Handbook of the Copper and Brass Research Association. A tube bender giving support to the periphery of the tube shall be used. The tubing shall be protected against flattening or other injuries.
- R. All copper connections and joints shall be made according to the Copper Tube Handbook, Copper and Brass Research Association. No swaged connections will be permitted. All valves, pumps, and similar equipment shall be connected to copper piping through union or flange adapter fittings.
- S. Valves, cocks, etc., shall be installed to allow convenient accessibility and operation.
- T. Unions and flanges shall be installed to allow convenient replacement of all equipment and cleaning tubes.
- U. A union connection shall be installed downstream from all valves, at equipment connections, and at other locations as required or directed.
- V. Shut-off valves shall be provided in all main services and where required to permit proper servicing of equipment. Valves of one type shall be of one manufacturer.
- W. All valves shall be of the same size as the pipelines in which they are installed unless specifically sized on the Drawings. All hand-controlled line valves shall be ball valves, except where throttling control or frequent operation is required, in which case globe or angle valves shall be used. Globe valves in horizontal lines shall be installed with the stem horizontal to permit line draining. All globe and angle valves shall be

installed to close against pressure. Disc valves shall have discs suitable for the services for which they are to be used.

- X. All valves shall be accessible and shall not be installed with the stems below the horizontal plane. Provide access panels at walls, ceilings, or floors.
- Y. Cutting or boring of joists or other structural members shall be done only when alternative routing is impossible and only upon written approval of the Architect or Owner.

3.15 CLEANING OF PIPING

- A. All new piping shall be thoroughly cleaned of rust, scale, etc., before enclosing and placing in operation. Water shall be forced through pipes until the systems are free from foreign substances.

3.16 CLEANUP

- A. Upon completion of the work, remove all material, debris, and equipment associated with or used in the performance of this work.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

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. Balancing Air Systems

1.3 SCOPE

- A. The T&B Agency will provide the following services:
 - 1. Provide all supervision, personnel, instruments, calibration equipment, and all other materials necessary to perform balancing and testing, and compile test data including calculations and services necessary for the heating, ventilating, and air conditioning systems for this project, all in accordance with the project Drawings and Specifications and as specified herein.
 - 2. The T&B Agency shall be responsible for inspecting, balancing, adjusting, testing, and logging the data of the performance of fans, all dampers in the duct systems, all air distribution devices or heat exchangers, and the flows of water through all coils.
 - 3. The T&B Agency shall balance, test, and adjust the systemic components to obtain optimum conditions in each conditioned space in the building. If construction deficiencies are encountered which preclude obtaining optimum conditions, the deficiencies will be recorded and given to the Owner's Representative. The T&B Agency is advised that deficiencies in the HVAC construction are often encountered during final T&B services, and should include in the bid an amount deemed advisable to compensate for time in identifying the deficiencies.
- B. During construction, the T&B Contractor shall inspect the installation of pipe systems, sheet metal work, temperature controls, and other component parts of the HVAC systems. Inspections shall be conducted a minimum of three times. Typically this is performed when 60% of the ductwork and piping are installed and again when 90% of the total system is installed and prior to insulation. A copy of the written report is to be issued to the Mechanical Engineer for review.

1.4 SUBMITTALS

- A. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit T&B strategies and step-by-step procedures.
- B. System Readiness Checklists: Within 30 days of Contractor's Notice to Proceed, submit system readiness checklists for use by systems installers in verifying system readiness for T&B. Examination Report: Within 30 days of Contractor's Notice to Proceed, provide a summary report of the examination review required in Part 3 "Examination", if issues are discovered that may preclude the proper testing and balancing of the systems.
- C. Examination Report: Provide a summary report of the examination review if issues are discovered that may preclude the proper testing and balancing of the systems.
- D. Certified T&B reports: Within 30 days of completion of balancing work, submit AABC-certified T&B report.
 - 1. Submit one copy of the final T&B Report directly to the design professional of record. Provide five additional copies to the Contractor.

1.5 QUALITY ASSURANCE

- A. T&B Contractor Qualifications:
 - 1. General Contractor will employ a T&B Agency that is certified by the Associated Air Balancing Council (AABC). The T&B Agency will have experience in the field of air and hydronic system balancing, possess calibrated instruments, and employ qualified Supervisors and skilled Technicians to perform all required tests. The T&B Agency shall have a minimum of 10 years of experience in the Testing, Adjusting, and Balancing field.
- B. T&B technician shall perform the following:
 - 1. Review field data reports to validate accuracy of data and to prepare certified T&B reports.
 - 2. Certify that the T&B team complied with the approved T&B plan and the procedures specified and referenced in this Specification.
 - 3. Certify the T&B report
- C. T&B Conference: If requested by the Owner or Construction Manager after approval of the T&B Agency's submittals, meet to develop a mutual understanding of the details
 - 1. Agenda Items:
 - a. The examination report.

- b. The Strategies and Procedures plan.
 - c. Systems readiness checklists.
 - d. Coordination and cooperation of trades and subcontractors.
 - e. Coordination of documentation and communication flow.
- D. Approved Test and Balance agencies in the area:
- RS Analysis, Inc.**
1035 Suncast Lane, Suite 130
El Dorado Hills, CA 95762
(916) 358-5672
- National Air Balance Company, Inc.**
4171 Business Center Drive
Fremont, CA 94538
(510) 623-7000
- Raglen System Balance, Inc.**
1121 University Terrace
Reno, NV 89502
(775) 747-0100
- Pacific Test & Balance, Inc.**
4771 Mangels Blvd.
Fairfield, CA 94534
(707) 696-2444
- E. T&B Report Forms: Use standard T&B contractor's forms.
- F. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in "AABC National Standards for Total Systems Balance."

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EXAMINATION & REVIEW

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper T&B of systems and equipment.
- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Note the locations of devices that are not accessible for testing and balancing.
- C. Review approved submittals for HVAC systems and equipment.

- D. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas.
- E. Review equipment performance data including fan and pump curves.
- F. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, clean permanent filters are installed, and controls are ready for operation.
- G. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- H. Examine strainers to verify that Mechanical Contractor has replaced startup screens with permanent screens and that all strainers have been cleaned.
- I. Examine two-way valves for proper installation and function.
- J. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- K. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- L. Examine air vents to verify that mechanical contractor has removed all air from all hydronic systems.

3.2 PREPARATION

- A. Prepare a T&B plan that includes:
 - 1. Equipment and systems to be tested.
 - 2. Strategies and step-by-step procedures for balancing the systems.
 - 3. Instrumentation to be used.
 - 4. Sample forms with specific identification for all equipment.
- B. Prepare system-readiness checklists, as described in the *AABC National Standards for Total System Balance*, for use by contractors in verifying system readiness for T&B. These shall include, at a minimum:
 - 1. Airside:
 - a. All ductwork is complete with all terminals installed.
 - b. All volume, smoke and fire dampers are open and functional.
 - c. Clean filters are installed.
 - d. All fans are operating, free of vibration, and rotating in correct direction.
 - e. VFD start-up is complete and all safeties are verified.

- f. Automatic temperature-control systems are operational.
- g. Ceilings are installed.
- h. Windows and doors are installed.
- i. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for T&B procedures.
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain approved submittals and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare single-line schematic diagram of systems for the purpose of identifying HVAC components.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check condensate drains for proper connections and functioning.
- H. Check for proper sealing of air-handling-unit components.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.

- a. Set outside air, return air and relief air dampers for proper position that simulates minimum outdoor air conditions.
 - b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
 - c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
 - d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
 2. Measure fan static pressures as follows:
 - a. Measure static pressure directly at the fan outlet or through the flexible connection.
 - b. Measure static pressure directly at the fan inlet or through the flexible connection.
 - c. Measure static pressure across each component that makes up the air-handling system.
 - d. Report any artificial loading of filters at the time static pressures are measured.
 3. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.
1. Measure airflow of submain and branch ducts.
 2. Adjust sub-main and branch duct volume dampers for specified airflow. Re-measure each sub-main and branch duct after all have been adjusted.
- C. Adjust air inlets and outlets for each space to indicated airflows.
1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
 2. Measure airflow at all inlets and outlets.
 3. Adjust each inlet and outlet for specified airflow.
 4. Re-measure each inlet and outlet after all have been adjusted.
- D. Verify final system conditions.

1. Re-measure and confirm minimum outdoor air, return and relief airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm total airflow is within design.
3. Re-measure all final fan operating data, rpms, volts, amps, static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust, if necessary.
6. Measure and record all operating data.

E. Record final fan-performance data

3.6 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Adjust the variable-air-volume systems as follows:

1. Verify that the system static pressure sensor is located 2/3 of the distance down the duct from the fan discharge.
2. Verify that the system is under static pressure control.
3. Select the terminal unit that is most critical to the supply-fan airflow. Measure inlet static pressure and adjust system static pressure control setpoint so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
4. Calibrate and balance each terminal unit for maximum and minimum design airflow as follows
 - a. Adjust controls so that terminal is calling for maximum airflow (note some controllers require starting with minimum airflow. Verify calibration procedure for specific project).
 - b. Measure airflow and adjust calibration factor as required for design maximum airflow. Record calibration factor.
 - c. When maximum airflow is correct, balance the air outlets downstream from terminal units.
 - d. Adjust controls so that terminal is calling for minimum airflow.
 - e. Measure airflow and adjust calibration factor as required for design minimum airflow. Record calibration factor. If no minimum calibration is available, note any deviation from design airflow.

5. After all terminals have been calibrated and balanced, test and adjust system for total airflow. Adjust fans to deliver total design airflows within the maximum allowable fan speed listed by fan manufacturer.
 - a. Set outside air, return air and relief air dampers for proper position that simulates minimum outdoor air conditions.
 - b. Set terminals for maximum airflow. If system design includes diversity, adjust terminals for maximum and minimum airflow so that connected total matches fan selection and simulates actual load in the building.
 - c. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
 - d. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
 - e. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
6. Measure fan static pressures as follows:
 - a. Measure static pressure directly at the fan outlet or through the flexible connection.
 - b. Measure static pressure directly at the fan inlet or through the flexible connection.
 - c. Measure static pressure across each component that makes up the air-handling system.
 - d. Report any artificial loading of filters at the time static pressures are measured.
7. Set final return and outside airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
 - a. Balance the return-air ducts and inlets the same as described for constant-volume air systems.
 - b. Verify all terminal units are meeting design airflow under system maximum flow.
8. Re-measure the inlet static pressure at the most critical terminal unit and adjust the system static pressure setpoint to the most energy-efficient setpoint to maintain the optimum system static pressure. Record setpoint.
9. Verify final system conditions as follows:
 - a. Re-measure and confirm minimum outdoor air, return and relief airflows are within design. Readjust to design if necessary.
 - b. Re-measure and confirm total airflow is within design.
 - c. Re-measure all final fan operating data, rpms, volts, amps, static profile.
 - d. Mark all final settings.

- e. Test system in economizer mode. Verify proper operation and adjust, if necessary. Measure and record all operating data.
- f. Verify tracking between supply and return fans.

10. Record final fan-performance data.

B. TOLERANCES

- 1. Set HVAC system's air flow rates and water flow rates within the following tolerances:
 - a. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
 - b. Air Outlets and Inlets: Plus or minus 10 percent.
 - c. Minimum Outside Air: Zero to plus 10 percent.
- 2. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.7 FINAL TEST AND BALANCE REPORT

- A. The report shall be a complete record of the HVAC system performance, including conditions of operation, items outstanding, and any deviations found during the T&B process. The final report also provides a reference of actual operating conditions for the owner and/or operations personnel. All measurements and test results that appear in the reports must be made on site and dated by the AABC technicians or test and balance engineers.
- B. The report must be organized by systems and shall include the following information as a minimum:
 - 1. Title Page:
 - a. AABC certified company name
 - b. Company address
 - c. Company telephone number
 - d. Project identification number
 - e. Location
 - f. Project Architect
 - g. Project Engineer
 - h. Project Contractor
 - i. Project number
 - j. Date of report
 - k. AABC Certification Statement

- I. Name, signature, and certification number of AABC TBE
 2. Table of Contents.
 3. AABC National Performance Guaranty.
 4. Report Summary:
 - a. The summary shall include a list of items that do not meet design tolerances, with information that may be considered in resolving deficiencies.
 5. Instrument List:
 - a. Type.
 - b. Manufacturer.
 - c. Model.
 - d. Serial Number.
 - e. Calibration Date.
 6. T&B Data:
 - a. Provide test data for specific systems and equipment as required by the most recent edition of the "AABC National Standards."
 7. Print or sketch, reduced in size, showing all supply, return and exhaust air outlets for easy reference to report data
- C. One copy of the final test and balance report shall be sent directly to the Mechanical Engineer of record. Provide five additional copies to the contractor.

3.8 FINAL ACCEPTANCE

- A. At the time of final inspection, the T&B Agency shall recheck, in the presence of the Owner's Representative, specific and random selections of data, i.e. water and air quantities, recorded in the Certified Report.
- B. Points and areas for recheck shall be selected by the Owner's Representative.
- C. Measurement and test procedures shall be the same as approved for work forming basis of Certified Report.
- D. Selections for recheck, specific plus random, will not normally exceed 25% of the total number tabulated in the report, except that special air systems may require a complete recheck for safety reasons.
- E. If random tests elicit a measured flow deviation of 10% or more from that recorded in the Certified Report listings, by 10% or more of the selected recheck stations, the report shall be automatically rejected. In the event the report is rejected, all systems

shall be readjusted and tested, new data recorded, new Certified Report submitted, and new inspection tests made, all at no additional cost to the Owner.

- F. Following final acceptance of the Certified Report by the Owner's Representative the settings of all valves, splitters, dampers, and other adjustment devices shall be permanently marked by the T&B Agency, so that adjustment can be restored if disturbed at any time. Devices shall not be marked until after final acceptance.

END OF SECTION

SECTION 26 05 00

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL**1.1 WORK INCLUDED**

- A. Work included in this Section: All materials, labor, equipment, services, and incidentals necessary to provide and install the Electrical Work as shown on the drawings and as specified hereinafter, including, but not limited to the following:
 - 1. Electrical and telecommunications service provisions as outlined on the drawings, including temporary power for construction.
 - 2. Main switchboard, distribution switchboards, distribution panels, panels, transformers, circuit breakers, and feeders.
 - 3. Branch circuit wiring, wiring devices and connections to all equipment requiring electrical service.
 - 4. Lighting fixtures completely lamped, including switches, raceways and wiring.
 - 5. Emergency egress/exit illumination system.
 - 6. Central Emergency Lighting Inverter.
 - 7. Telecommunications system.
 - 8. Sleeping unit local smoke and carbon monoxide detectors.
 - 9. Mechanical equipment power connections, and motor starters where noted.
 - 10. Low voltage lighting control system and programming.
 - 11. Alerting system backboxes and raceways.
 - 12. All required incidental work, such as roof flashing, electrical testing, title 24 acceptance testing, and temporary power.
 - 13. Any other electrical work as might reasonably be implied as required, even though not specifically mentioned herein or shown on the the drawings.
 - 14. It is the intent of the drawings and specifications that systems be complete and, except as otherwise noted, be ready for operation.

1.2 RELATED WORK

- A. Division 1 - General Requirements
- B. Division 9 - Finishes
- C. Division 23 - Mechanical
- D. Section 07270 - Firestopping

1.3 INCORPORATED DOCUMENTS

- A. Requirements of the General Conditions, Supplementary Conditions, and Division 1 Sections apply to all work in this Section, unless modified herein.
- B. Published specifications, standard tests or recommended methods of trade, industry or government organizations apply to work of this Section where cited by abbreviations noted below, unless modified herein.

1. 2022 California Code of Regulations.
2. 2022 California Building Standards Administrative Code, Part 1, Title 24, C.C.R.
3. 2022 California Building Code (CBC), Part 2, Title 24, C.C.R. (Based on 2021 International Building Code with 2022 California Amendments).
4. 2022 California Electrical Code (CEC), Part 3, Title 24, C.C.R. (Based on 2017 National Electrical Code with 2022 California Amendments).
5. California Energy Code, Part 6, Title 24, C.C.R.
6. 2022 California Fire Code (CFC), Part 9, Title 24, C.C.R. (Based on 2021 International Fire Code with 2022 California Amendments).
7. 2022 California Green Building Standards (CALGreen) Code, Part 11.
8. American Society of Civil Engineers 7-16 (ASCE/SEI), Minimum Design Loads for Buildings and Other Structures.
9. Underwriters' Laboratories, Inc. (UL).
10. Local Utility Company regulations.

C. All State and Municipal Codes and Ordinances.

1.4 CONDITIONS AT SITE:

- A. Visit to site is required of all bidders prior to submission of bid. All will be held to have familiarized themselves with all discernible conditions and no extra payment will be allowed for work required because of these conditions, whether specifically mentioned or not.
- B. Lines of other services that are damaged as a result of this work shall promptly be repaired at no expense to the Owner to the complete satisfaction of the Owner.

1.5 QUALITY ASSURANCE

- A. Conformance:
 1. All work shall conform to the applicable requirements of Article 1.3 above.
 2. The Contractor shall notify the Architect, prior to submission of bid, about any part of the design, which fails to comply with abovementioned requirements.
 3. If after contract is awarded, minor changes and additions are required by aforementioned authorities, even though such work is not shown on the drawings or covered in the specifications, they shall be included at Contractor's expense.
- B. Coordination:
 1. The Contractor shall become familiar with the conditions at the job site, and with the drawings and specifications and plan the installation of the electrical work to conform with the existing conditions and that shown and specified so as to provide the best possible assembly of the combined work of all trades.
 2. The Contractor shall work out in advance all "tight" conditions, involving all trades and if found necessary, supplementary drawings shall be prepared by this Contractor, for the Architect's approval, before work proceeds in these areas. No additional costs will be considered for work, which must be relocated due to conflicts with the work of other trades.
 3. The Contractor shall coordinate and verify all backbox, device, lighting fixture, or equipment mounting requirements with the devices or equipment to be installed, prior to rough in.

1.6 SUBMITTALS

A. Product Data:

1. Comply with the provisions of Section 01 33 00 - Submittals.
2. Within 15 days after award of the Contract, submit:
 - a. Complete electrical, lighting, and signal systems material list of all items proposed to be furnished and installed under this Division. Provide manufacturers data sheets for all devices, raceways, fixtures, equipment, and related products to be used for the Division 26, 27, and 28 work.
 - b. Manufacturers' specifications and other data required demonstrating compliance with the specified requirements.
 - c. Manufacturers' recommended installation procedures which, when approved by the Architect, shall become the basis for inspecting and accepting or rejecting actual installation procedures used on the work.
3. Shop Drawings: Furnish shop drawings and/or equipment cuts for the following:
 - a. Light fixtures including lamps and ballasts
 - b. Main Switchboard and panel boards. Panel board submittals shall include diagrams of the circuit breaker arrangements in the panels. Arrange circuit breakers in panels exactly as shown on the panel schedules in the construction documents.
 - c. Smoke detectors.
 - d. Telecommunications system
 - e. Disconnect switches
 - f. Motor starters
 - g. Low voltage lighting control system
 - h. Arc flash, Short Circuit, and Protective Device Coordination Study.
 - i. Emergency Generator and Automatic Transfer Switch.
4. Test Reports:
 - a. Factory Tests: As specified for specific equipment.
 - b. Field Tests: Performance tests as specified for specific equipment.
 - c. Megger Tests: As specified under TESTING.
 - d. When series rated circuit breakers are used, provide a letter from the manufacturer of the equipment confirming that U.L. series rating exists for all protective devices. State the available fault current from the Utility Company and indicate that the overcurrent devices exceed the available fault current at the respective point of protection.
5. Maintenance and Operating Manuals:
 - a. Systems Description: Description of operating procedures.
 - b. Controls: Diagrams and description of operation of each system.
 - c. Equipment: Manufacturer's brochures, ratings, certified shop drawings, maintenance data, and parts lists with part numbers. Mark each sheet with equipment identification number and actual installed condition.
 - d. Materials and Accessories: Manufacturer's brochures, parts lists with part numbers, and maintenance data where applicable. Mark each sheet with identification number of system and location of installation.
 - e. The Maintenance and Operation Manual shall be presented in a bookmarked PDF file with tabbed sections as stated below. Provide all information in each section as stated below.
 - 1) 26 2400:

- (a) Insert the approved submittals for the main switchboard and panelboards, and for medium voltage switchgear and transformers if specified herein and/or indicated on the drawings.
 - (b) Provide the names, addresses and telephone numbers of the manufacturer and the two closest manufacturer's representatives of the equipment.
- 2) 26 5101:
 - (a) Insert the approved submittals for the light fixtures.
 - (b) Highlight the lamp type that was installed for each light fixture.
 - (c) Provide the names, address and telephone numbers of the manufacturer and the closest manufacturer's representative for each light fixture.
- 3) 26 5101:
 - (a) Insert the approved submittals for the motion sensing light control equipment.
 - (b) Insert all operating instructions.
 - (c) Provide the names, address and telephone number of the manufacturer and the closest manufacturer's representative of the equipment.
 - (d) Include the manufacturer's recommended maintenance of the equipment.
- 4) 26 5700:
 - (a) Insert the approved submittals for the low voltage lighting control equipment.
 - (b) Insert all operating instructions.
 - (c) Provide the names, address and telephone number of the manufacturer and the closest manufacturer's representative of the equipment.
 - (d) Include the manufacturer's recommended maintenance of the equipment.
- 5) 27 0000:
 - (a) Insert the approved submittals for the telecommunications system.
 - (b) Provide the names, address and telephone number of the manufacturer and the closest manufacturer's representative of the equipment.
 - (c) Include the manufacturer's recommended maintenance of the equipment.
- 6) 26 32 00 and 26 36 00
 - (a) Insert the approved submittals for the generator, fuel tank, diesel particulate filter (if a filter is specified in Section 26 32 00), base tank alarm panel, automatic transfer switch(es), and remote annunciator.
 - (b) Provide the names, address, and telephone numbers of the manufacturer and the two closest manufacturer's representatives of the equipment.
 - (c) Insert all operating instructions.
 - (d) Include the manufacturer's recommended maintenance of the equipment.
- 7) 26 0800:
 - (a) Insert all systems testing results.
- 6. Record Documents: "As-builts": As specified under Paragraph 3.2 of this Section.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the work and materials of all trades.
- B. Delivery and Storage: Deliver all materials to the job site in their original containers with all labels intact and legible at time of use. Store in strict accordance with approved manufacturers' recommendations.
- C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.
- D. This Contractor shall personally, or through an authorized representative, check all materials upon receipt at jobsite for conformance with approved shop drawings and/or plans and specifications.

1.8 SCHEDULING/SEQUENCING

- A. Place orders for all equipment in time to prevent any delay in construction schedule or completion of project. If any materials or equipment are not ordered in time, additional charges made by equipment manufacturers to complete their equipment in time to meet the construction schedule, together with any special handling charges, shall be borne by this Contractor.
- B. The Contractor shall coordinate production and delivery schedule for all Owner-supplied equipment with the equipment suppliers to ensure that all Owner-supplied equipment is delivered to site in coordination with the construction schedule and in such a manner as to cause no delays in completion of the Contract as scheduled.

1.9 REQUIREMENTS

- A. The contract drawings indicate the extent and general arrangements of the conduit wiring systems, etc. If any departures from the contract drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore shall be submitted as soon as practicable, and within thirty-five (35) days after award of the electrical contract.
- B. Unless material list and data is received as a complete and all-inclusive submittal within the stipulated time all items shall be provided as specified, with no deviations permitted.
- C. Any and all additional costs incurred by the substitution of electrical material or equipment, or installation thereof, whether architectural, structural, plumbing, mechanical or electrical, shall be borne by the Contractor under this Section.
- D. Burden of proof of equality of any substitution for a specified product is the responsibility of this Contractor.

- E. Where required by Architect to ascertain equality of substitute product, Contractor may be requested to provide the specified item and the submitted substitution for comparison, at no additional cost to the Owner.

1.10 DESCRIPTION OF DEMOLITION AND REPLACEMENT WORK

- A. This project includes the demolition and replacement, modification, or enhancement of existing facilities. As such, the project scope for this contractor shall include all associated electrical, lighting, and signal system upgrades and demolition/removal work at the existing building and/or site. The intent is that all systems will be complete and functional at the completion of this contract and that all old systems, equipment, feeders, circuits, wiring, and related devices (no longer used) be completely and neatly removed. Where discrepancies between the drawings and existing conditions are noted, the Architect or Owner shall be notified immediately for resolution.
- B. As with every renovation project, the electrical work will include (and require) exploration and other field work on a daily basis to complete the new designed equipment and connections within the constraints of the existing building and existing site conditions.
- C. The contractor shall include as part of the base bid, sufficient labor hours to provide such exploration and field work throughout the duration of the project. Change orders for miscellaneous coordination of existing conditions will not be approved unless specific and latent conditions are uncovered that warrant such additional compensation or require additional work not shown on the drawings or included in the specifications, or implied by the designed conditions.
- D. New raceways and wiring to new and renovated equipment are to be installed unless otherwise noted. Where raceways are installed in accessible concealed locations (i.e. unfinished spaces or electrical / mechanical / attic spaces), EMT with wire shall be used. Where new wiring is required to be routed through existing walls and ceilings that cannot readily be accessible for new conduit, MC cable or flex conduit and wiring may be installed, fished through and secured in each space as required by Code. Non-metallic sheathed cable shall not be utilized on this project.
- E. All new raceways shall be installed concealed and all new equipment installed flush, unless otherwise noted on the drawings or in these specifications.

1.11 GUARANTEE

- A. This Contractor shall guarantee that all work executed under this Section will be free from defects of materials and workmanship for a period of one (1) year or as per the General Conditions of this project, whichever is longer. Dates shall be from the date of final acceptance of the building. The contractor shall further guarantee that he will, at his own expense, repair and replace all such defective work, and all other work damaged thereby, which becomes defective during the term of the guarantee. Such repair or replacement shall be guaranteed for one (1) year from the date of repair or replacement.

1.12 PERMITS AND INSPECTIONS

- A. This Contractor shall arrange for and obtain all required permits and inspections.
- B. Do not allow or cause any of the work to be covered or enclosed until it has been tested and/or inspected.

1.13 IDENTIFICATION

- A. Switchgear, switchboards, distribution panels, and feeder circuit breakers therein, panels, disconnect switches, motor starters, transformers, motor disconnect switches, cabinets, switches for any motorized or electric powered equipment and other apparatus used for the operation of, or control of circuits, appliances or equipment, shall be properly identified by means of engraved laminated plastic descriptive nameplates mounted on apparatus using stainless steel screws. Nameplates shall have white letters with black background and be submitted to the Architect for approval. Cardholders in any form are not acceptable.
- B. Provide p-touch style labeling of circuit designations for all receptacles on the project.
- C. Each branch circuit of panel boards to have a permanently fixed number with load directory, mounted under celluloid on inside of cabinet door, showing circuit numbers and typewritten description of equipment supplied by breakers. Where changes are made to existing panelboards, newly typewritten circuit directories shall be prepared to replace existing directories.
- D. Provide label on all motors: "Caution. Automatic equipment. May start at any time."
- E. Provide silk-screened or engraved identification labels on all switch box covers identifying specific loads that are not readily apparent to the user, including electroshades, projection screens, exhaust fans, audio-visual controls, etc.. Submit proposed labels to Architect for approval prior to manufacture of labels.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Refer to applicable Division 26 and 27 Sections for complete products specifications.

2.2 MATERIALS

- A. Materials of the same type or classification, used for the same purpose, shall be the product of the same manufacturer.

2.3 ACCEPTABLE MANUFACTURERS

- A. Materials shall be of make mentioned elsewhere in this specification. All materials shall be the best of their several kinds, perfectly new and approved by the Underwriters' Laboratories.

- B. Where material, equipment, apparatus or other products are specified by manufacturer, brand name, type or catalog number, such designation is to establish standards of desired quality, style and utility and shall be the basis of the bid. Materials so specified shall be furnished under the contract unless changed by written approval of the Architect. Where two or more designations are listed, choice shall be optional with this Contractor, but this Contractor must submit his choice for final approval.

2.4 POSTED OPERATING INSTRUCTIONS

- A. Furnish approved operating instructions for systems and equipment where indicated in the technical sections for use by operation and maintenance personnel. The operating instructions shall include wiring diagrams, control diagrams, and control sequence for each principal system and equipment. Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions as directed. Attach or post operating instructions adjacent to each principal system and equipment including startup, proper adjustment, operating, lubrication, shutdown, safety precautions, procedure in the event of equipment failure, and other items of instruction as recommended by the manufacturer of each system or equipment. Provide weather-resistant materials or weatherproof enclosures for operating instruction exposed to the weather. Operating instruction shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

2.5 CATALOGED PRODUCTS/SERVICE AVAILABILITY

- A. Materials and equipment shall be current products by manufacturers regularly engaged in the production of such products. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The 2-year period shall be satisfactorily completed by a product for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures. Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6,000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished. The equipment items shall be supported by service organizations which are reasonable convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine the areas and conditions under which the work of this Section will be installed. Correct conditions detrimental to the proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Drawings:

1. The general arrangement and location of wiring and equipment is shown on the electrical drawings and shall be installed in accordance therewith, except for minor changes required by conflict with the work of other trades.
 2. The Contractor shall coordinate and verify all backbox, device, lighting fixture, or equipment mounting requirements with the devices or equipment to be installed, prior to rough in.
 3. Drawings indicate the circuit and panel which supplies each device or fixture. Provide and install conduit and conductors to make all connections from panel to nearest device and from first device to additional devices on same circuit. Conduit size and fill shall satisfy NEC requirements. Two or three different phases supplied by a 3-phase panel may share a single neutral only if circuit positions are adjacent in the panel. Do not exceed 4 #12 or 3 #10 conductors in a 1/2" conduit, 7 #12 or 5 #10 in a 3/4" conduit, and 11 #12 or 9 #10 in a 1" conduit, unless otherwise noted. Provide common handle-tie on breakers for multi-wire branch circuits (with common neutral), per NEC. If more than three current carrying conductors are installed in one conduit, conductor size shall be increased as required per NEC. Do not share neutrals for branch circuit runs to electronic equipment or where noted on the drawings.
 4. Drawings indicate the location of all light switches. Where fixtures in a room are controlled by more than one switch, the same lower case letter is drawn adjacent to a switch and each fixture controlled by that switch. Where no lower case letter is adjacent to a switch, all fixtures in the room are controlled by that switch. Provide and install conduit and wire from fixture to switch and between fixtures as required to accomplish switching shown. Do not route branch circuit wiring for light fixtures through switch boxes. Where dimming controls are specified, provide required dimming control wiring in addition to power wiring from control device to all controlled light fixtures. Provide separate conduit for dimming control wiring unless otherwise indicated on the drawings.
 5. Drawings indicate location of all signal outlet boxes. Provide and install conduit system as required and complete system wiring, unless otherwise noted.
 6. Control wiring is generally not shown on the plans. Contractor shall refer to control diagrams and provide and install all wiring and raceways required to make all interconnections.
 7. All branch circuit wiring No. 12 or No. 10 as noted, all control wiring No. 14, except as noted next to "slash marks" on the drawings, or as noted under "Wire," as specified herein.
 8. All dimensions, together with locations of doors, partitions, etc. are to be taken from the Architectural Drawings, verified at site by this Contractor.
 9. Maintain "as-built" records at all times, showing the exact location of concealed conduits and feeders installed under this contract, and actual numbering of each circuit. Upon completion of work and before acceptance can be considered, this Contractor must forward to the Architect, updated CAD plans, corrected to show the electrical work as actually installed.
 10. All standard 20A branch circuit conductors shall be #12 minimum for up to 75 linear circuit feet, #10 minimum for up to 150 linear circuit feet, and #8 for runs longer than 150 feet.
- B. Measurements: Before ordering any material or closing in any work, verify all measurements on the job. Any differences found between dimensions on the drawings and actual measurements shall be brought to the Architect's attention for consideration before proceeding.

3.3 FIELD QUALITY CONTROL

- A. All workmanship shall be first class and carried out in a manner satisfactory to and approved by the Architect.
- B. This Contractor shall personally, or through an authorized and competent representative, constantly supervise the work and so far as possible keep the same foreman and workmen on the job throughout.

3.4 COORDINATION

- A. In electrical rooms and/or equipment areas (indoor and outdoor), Contractor is responsible for installation of electrical equipment within the space provided. Contractor shall provide 1/4" scale plans of electrical room layouts, and elevations of steel channel supports (where used or required) of electrical equipment for review and approval prior to any installation or rough-in

3.5 INSTALLATION/APPLICATION/ERECTION

- A. All electrical raceways and devices shall be installed concealed (for raceways) and/or flush mounted (for devices), unless otherwise noted. Provide cut-in boxes and "fish" flexible MC or flex conduit and wire through existing walls to remain, unless shown otherwise on plans. Cut and patch to facilitate such installation to match adjacent and original finish.
- B. All cutting, repairing and structural reinforcing for the installation of this work shall be done by the General Contractor in conformance with the Architect's requirements.

3.6 TEMPORARY LIGHTING AND POWER

- A. Provide and install temporary lighting and power systems for the duration of construction, of adequate size to accommodate the required lighting and power loads. Coordinate with other trades to insure adequate sizing.
- B. Provide distribution equipment as required to support all construction activities.

3.7 FIRE STOPPING AND FIRE RATED PENETRATIONS

- A. All electrical equipment mounted in, on, or through fire rated construction shall be installed to maintain the fire rating of the construction.
- B. Provide fire rated pads (or other suitable assembly) around all electrical junction boxes in fire rated walls/ceilings/floors to maintain the fire rating.
- C. Provide fire rated construction around all recessed light fixtures and/or panel board / cabinets mounted flush in fire rated walls to maintain the fire rating. Coordinate depth of construction with other trades to avoid conflicts.
- D. Conduit sleeves shall be provided as a means of routing cables through fire-rated walls or floors. Openings in sleeves and conduits used for system cables and those

which remain (empty) spare shall be sealed with an approved fireproof, removable sagging material. Sleeves which pass vertically from floor to floor shall be sealed in a similar manner using an approved re-enterable system. Additional penetrations through rated assemblies necessary for passage of tel/data wiring shall be made using an approved method and permanently sealed after installation of cables.

3.8 ADJUSTING AND CLEANING

- A. All electrical equipment, including existing equipment not "finish painted" under other sections, shall be touched up where finished surface is marred or damaged.
- B. All equipment, lighting fixtures, etc., shall be left in clean condition, with all shipping and otherwise unnecessary labels removed there from.

3.9 SCHEDULES

- A. Coordination: Coordinate installation of electrical items with the schedule for other work to prevent unnecessary delays in the total Work.

3.10 WARNING SIGN MOUNTING

- A. Provide the number of signs required to be readable from each accessible side, but space the signs a maximum of 30 feet apart.

3.11 PAINTING OF EQUIPMENT

- A. Factory Applied: Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA ICS 6 corrosion-resistance test, except equipment specified to meet requirements of ANSI C37.20 shall have a finish as specified in ANSI C37.20.
- B. Field Applied: Paint electrical equipment as required to match finish or meet safety criteria. Painting shall be as specified in the respective equipment section.

3.12 TESTS

- A. Testing and inspection: See Section 26 08 00 - Testing.

END OF SECTION

SECTION 26 08 00

TESTING

PART 1 - GENERAL**1.1 WORK INCLUDED**

- A. Work Included in This Section: All materials, labor, equipment, services, and incidentals necessary to perform the testing and inspection of the electrical work, including but not limited to the general systems noted below:
1. Grounding system.
 2. Lighting system.
 3. Distribution system.
 4. Lighting control system.
 5. Telecommunications system.
 6. Title 24 Acceptance Testing.
 7. Any other electrical work as might reasonably be implied as required, even though not specifically mentioned herein or shown on the drawings.
 8. All work shall comply with Sections 26 05 00 and 26 27 00.
 9. In addition to the general system tests and inspections indicated above, the Contractor shall perform the following inspections and tests. The Contractor shall provide all material, equipment, labor, and technical supervision to perform such tests and inspections:
 - a. System Grounding.
 - b. Switchgear, Panelboards.
 - c. Feeders.
 10. The purpose of these tests is to assure that all tested electrical equipment is operational and within industry and manufacturer's tolerances and is installed in accordance with design specifications.

1.2 APPLICABLE CODES, STANDARDS, AND REFERENCES

- A. All inspections and tests shall be in accordance with the International Electrical Testing Association - Acceptance Testing Specifications ATS-2021 (referred to herein as NETA ATS-2021).

1.3 QUALIFICATIONS

- A. Qualifications of the Testing Firm shall be as listed in NETA ATS-2021.

PART 2 - PRODUCTS

2.1 THIS ARTICLE DOES NOT APPLY TO TESTING.

PART 3 - EXECUTION**3.1 GENERAL**

- A. Final test and inspection to be conducted in presence of the Authority having Jurisdiction (AHJ) or Inspector of Record (IOR). Test shall be conducted at the expense of, and managed by, the Contractor, at a mutually agreed time. Submit written test report of all tests, with test result values and overall outcome.
- B. All portions of the electrical installation shall be inspected and tested to ensure safety to building occupants, operating personnel, conformity to code authorities and Contract Documents, and for proper system operation.

3.2 INSPECTIONS AND TESTS

- A. Tests: Field tests shall be performed and reports submitted, as per Section 26 05 00, Part 1.
 - 1. Final Inspection Certificates: Prior to final payment approval, deliver to the Owner, with a copy to the Architect, signed certificates of final inspection by the appropriate local authority having jurisdiction.
 - 2. Grounding System:
 - a. All ground connections shall be checked and the entire system shall be checked for continuity. The resistance of grounding electrodes in the system shall be measured using a 3 point fall-of-potential method. The maximum ground resistance shall be three ohms. If the measured ground resistance exceeds three ohms, install (1) additional ground rod, bonded and interconnected with the grounding electrode system.
 - b. Ground tests shall meet or exceed the requirements of the National Electric Code.
 - 3. Lighting Systems:
 - a. The interior and exterior lighting systems shall be checked for proper local controls and operation of entire installation, including the operation of the low voltage lighting control system.
 - 4. Power Distribution System:
 - a. Test main switchboard and panel boards for grounds and shorts with mains disconnected from feeders, branch circuits connected and circuit breakers closed, all fixtures in place and permanently connected and grounding jumper to neutral lifted and with all wall switches closed.
 - b. Test each individual circuit at each panelboard with equipment connected for proper operation. Inspect the interior of each panel.
 - c. Check verification of color coding, tagging, numbering, and splice make-up.
 - d. Verify that all conductors associated with each circuit are in same conduit.
 - e. Demonstrate that all lights, jacks, switches, outlets, and equipment operate satisfactorily and as called for.

- f. Perform megger tests of all new distribution system feeders prior to energizing. All Cables failing megger tests or with evidence of damage shall be removed and replaced in their entirety (no splices), at no cost to the Owner. Damaged cables may not be field repaired without specific approval of the Architect.
 - 5. Lighting Control System: Verify that all equipment, components, and devices function as specified. Refer to Section 26 5101 for additional testing requirements.
 - 6. Telecommunications System: Verify that all equipment, components, and devices function as specified. Refer to Section 27 0000 for additional testing requirements.
 - 7. Where the following systems are specified herein and/or indicated on the drawings, verify that all equipment, components, and devices function as specified and meet all additional testing as described in related individual Sections of this specification:
 - a. Emergency Generator and Automatic Transfer Switch.
- B. Title 24 Acceptance Testing: Contractor shall complete the requirements for Title 24 Acceptance Testing, as per CA Title 24, Part 6.
- 1. Perform testing requirements as per Title 24 Lighting Acceptance requirements. Testing shall include construction inspection of installed controls, occupancy / motion sensor testing, manual daylighting controls testing, automatic time switch controls testing, and demand response system interface, as applicable.
 - 2. Complete and submit all required forms for complete Acceptance Testing.
 - 3. Acceptance tests must be performed or overseen by certified Acceptance Test Technicians.
 - 4. Obtain required review and approval of Acceptance Forms to allow final certificate of occupancy to be granted.

END OF SECTION

SECTION 26 24 00

SERVICE AND DISTRIBUTION SYSTEM

PART 1 - GENERAL**1.1 WORK INCLUDED**

- A. Work Included in This Section: All materials, labor, equipment, services and incidentals necessary to install the electrical work as shown on the drawings and as specified hereinafter, including but not limited to the work listed below.
- B. Underground service distribution conduits and cables where noted for power systems, including utility company coordination.
- C. Temporary power for construction.
- D. Underground vault type transformer and grounding for Utility installed transformer.
- E. Main switchboard and Panel Boards, Grounding, and Overcurrent Protective Devices.
- F. All required incidental work, such as excavating, backfilling, testing, and temporary power.
- G. Any other electrical work as might reasonably be implied as required, even though not specifically mentioned herein or shown on the drawings.
- H. All work shall comply with Sections 26 05 00 and 26 27 00.

1.2 SUBMITTALS

- A. Comply with the provisions of Section 26 05 00 - Submittals.

PART 2 - PRODUCTS**2.1 ACCEPTABLE MANUFACTURERS**

- A. Refer to Section 26 05 00, Part 2 - Products
- B. All new equipment shall match existing.
- C. List of Equipment Manufacturers:
- D. Switchboard
 - 1. Eaton-Cutler Hammer, General Electric, Industrial Electric Manufacturing, Schneider-Square D, Siemens, or equal.
- E. Panelboards
 - 1. Same manufacturer as Main Switchboard.

2.2 MATERIALS

- A. Provide and install conduits for primary cables by utility company, transformer vault and grounding for utility company transformer, and conduit for secondary service to main switchboard. Comply with all Utility Co. requirements.
- B. Grounding:
 - 1. Provide and install grounding system as noted on the drawings.
 - 2. Grounding electrode conductor: bare stranded copper type, #4/0 minimum.
 - 3. Install ground wires in rigid conduit.
 - 4. All grounding electrode conductor connections "thermite" or "cad-weld" welded.
 - 5. Use approved pressure type solderless connector or use fusion welding for all connections to and bonding of grounding electrode system. All connections shall be visible, readily accessible for testing purposes. Grounding electrode conductor between the grounding electrode and service equipment: Minimum #4/0.
 - 6. Furnish and install solid copper or copper-clad 5/8" x 10'-0" ground rod(s). Where multiple ground rods are shown, install a minimum of 20'-0" apart. Install ground rods in accessible boxes with covers. Furnish and install 2-#4/0 bare copper cables between multiple ground rods and main switchboard ground bus.
 - 7. Terminate grounding conduits at equipment with ground bushing, with ground wire connected through bushing.
 - 8. Provide No. 12 stranded (green) THHN conductor from outlet box to ground screw of every receptacle.
 - 9. Ground all isolated sections of metallic raceways.
 - 10. Provide #12 minimum stranded (green) THHN conductor sized per NEC, or as noted, connected continuously throughout branch circuit for all circuits, bonded to panel ground bus, and to all electrical devices and equipment enclosures.
 - 11. Grounding electrode installed as follows:
 - a. Place #4/0 bare copper cable in foundation trench; tensioned, supported in such a manner that it cannot be less than two (2) inches from bottom or side of concrete when housekeeping pad is poured; not less than 50' of conductor. Embed in foundation with a loop at approximate center, brought out at top of foundation at location of building service equipment for connection to service equipment and for bonding to other parts of the grounding electrode system.
 - b. Use approved pressure type solderless connector or use fusion welding for all connections to grounding electrode. Connection visible, readily accessible for testing purposes. Grounding electrode conductor between the grounding electrode and service equipment: Minimum #4/0.
 - c. Connect grounding electrode system to metallic water service entry metallic cold water pipe (if available) with nonferrous clamp and bare copper cable (sized as required) in conduit. Connection shall be accessible for inspection.
 - d. Connect grounding electrode system to effectively grounded building steel as indicated on the drawings. Use exothermic weld, connection shall be accessible for inspection.
 - e. After installation, test system using the three-point fall of potential method only. Record results and submit to Architect for approval. If resistance to ground exceeds three ohms, install an additional ground rod, bonded and interconnected to the grounding electrode system.

C. Main Switchboard:

1. General: Switchboard shall be group-mounted type, metal enclosure with ground bus and insulated full capacity neutral bus.
2. Equipment:
 - a. The switchboard shall be braced for a short circuit current of 42,000 amps minimum. Bracing shall be per NEMA and UL standards.
 - b. The switchboard shall comply with all the requirements of the Utility Company.
3. The switchboard shall be pad-mounted, self- supporting, dead-front and rear, front-operated, front-connected, distribution type. Nema 3R (outdoor). The enclosure shall be 90 inches high, made of cold rolled steel on a structural shape, or formed, steel frame and shall be mounted on two 3-inch, 5-pound continuous channel iron sills, which shall be closed at the ends between the two channels.
4. This contractor is responsible for the complete installation of the switchboard within the space provided (both vertical and horizontal) and shall verify and/or coordinate all dimensions prior to ordering equipment. Proper allowances should be included to allow complete installation and erection.
5. The switchboard shall be a minimum of 24 inches deep and shall be constructed of National Electrical Code (NEC) gauge steel.
6. The switchboard shall be provided with a cable pull section at the top of the switchboard. Provide a minimum 12 inches of vertical clearance between the cable terminal lugs bolted to the switchboard busses and the top and bottom of the switchboard enclosure. Horizontal pull sections and gutters shall be kept free and clear of busses. Where busses cross vertical pull sections, the busses shall be insulated.
7. All connections between bus bars shall be of a bolted type using Belleville washers. Clamps will not be accepted. All bus bars shall be accurately formed, and all holes shall be made in a manner which will permit bus bars and connections to be fitted into place without being forced.
8. The design of all current-carrying devices or parts of the switchboard shall conform to the standard specified in the related sections of Underwriters' Laboratories, Inc. (UL) No. UL-891 and National Electric Manufacturer's Association (NEMA) Standard PB-2, except as these characteristics may be modified herein.
9. Bus bars, connection bars and wiring on the back of the switchboard shall be arranged so that maximum accessibility is provided for cable connections from the front.
10. Ampere ratings for rectangular bus bars shall be in accordance with the temperature rise standard of National Electric Manufacturer's Association (NEMA) and the Underwriters' Laboratories, Inc. (UL).
11. The enclosure shall be chemically cleaned by parkerizing, bonderizing or phosporizing as a unit after all welding has been completed. The enclosure shall then be painted with a rust- resisting primer coat of paint and shall be finished with a coat of light gray, baked enamel.
12. Each section shall be bussed for the full connected load of that section. Extend bussing to spare circuit breaker "Spaces." Drill busses for future circuit breakers, and provide breaker connector hardware where indicated on the drawings or where required for ready installation of future circuit breakers.
13. Provide copper bus bars and connections with silver-plated contact surfaces.

14. The contact surfaces and studs of all devices to which bus connections are made shall also have silver-plated surfaces.
15. Locate ground bus, with a cross-section equal to at least 25 percent of the capacity of the main bus rating, in the back of the switchboard and extend bus throughout the length of the switchboard assembly. Ground each housing of the assembly directly to this bus.
16. Rigidly support all bus and connection bars and current transformers.
17. Fit all nuts and connections with locking devices to prevent loosening.
18. Provide load connections with solderless lugs. Factory-install all devices shown on Drawings as specified herein.
19. Provide a bonding strap from the equipment ground bus to the neutral bus.

D. Panelboards:

1. Surface (or flush where indicated on the drawings) mounted, with branch circuits as indicated on the drawings.
2. Enclosures: code gauge galvanized sheet steel with welded full flange end pieces, stretcher- leveled steel trim, backpan and door.
3. Bussing of copper with silver-plated contact surfaces.
4. Trims on surface-mounted cabinets secured with nickel-plated screws with cup washers, bottom of all trims to have lugs for resting on cabinet flange.
5. Panels shall be 20 inches minimum in width, provided with approved gutter space, barriers and adjustable supports. Doors mounted with concealed hinges provided with combination spring latch and lock. Doors and trims and surface mounted cabinets primed and finished with one coat baked on gray enamel. All visible panel enclosures and covers in finished (occupied) areas shall be painted to match adjacent wall finish.
6. Breakers on same phase to be aligned horizontally. Each panel provided with quantity (5) spare handle locks. Install handle locks on all breakers serving fire alarm equipment.
7. Each branch circuit of panelboards to have a permanently fixed number with one word directory, mounted under celluloid on inside of cabinet door, showing circuit numbers and typewritten description of outlets controlled by breakers. Color code mains and each breaker terminal, same as conductor insulation.
8. Each panel shall be equipped with a copper ground bus.
9. All panels shall be fully bussed to accept future circuit breakers, with breaker hardware provided where indicated on the drawings.
10. Panel board submittals shall include diagrams of the circuit breaker arrangements in the panels. Arrange circuit breakers in panels exactly as shown on the panel schedules in the construction documents - no deviations permitted.

E. Circuit Breakers:

1. General: Circuit breakers shall be molded case rated for 240 volts, multiple or single pole and amperage rating as shown on the drawings, bolt on, manually operated with "de-ion" arc chutes.
2. Main circuit breaker shall be rated to interrupt the available short circuit current - 42,000 amps RMS unless otherwise indicated on the drawings.
3. Distribution circuit breakers shall be rated for the amps interrupting capacity noted on the drawings or U.L. series rated with the main circuit breaker.
4. Branch circuit breakers shall be rated for the amps interrupting capacity or U.L. series rated with the distribution and main circuit breakers, General Electric type THQB or equal, minimum 10,000 A.I.C for 120/208 volt.

5. Where mechanical equipment is U.L. listed for overcurrent protection with fuses or HACR type circuit breakers, provide fuses where a fused switch is shown. Where the overcurrent protection is a circuit breaker provide HACR, (Heating, Air-Conditioning and Refrigeration) type.
 6. Provide switch rated type "SWD" circuit breakers where the circuit breaker is used as a switching device in a panelboard.
- F. Magnetic starters: shall be rated in accordance with latest published NEMA standards for size and horsepower rating, Eaton-Cutler Hammer A-200 series or equal. Provide with overload sensor in each phase, hand-off-auto switch, red "run" pilotlight, in NEMA 1, NEMA 4X, or NEMA 3R enclosure or in motor control center where indicated. Coil shall be rated 120 VAC. Starters shall be across-the-line nonreversing unless otherwise noted.
1. Contacts: Across-the-line magnetic starters shall be equipped with double break silver alloy contacts. All contacts shall be replaceable without removing power wiring or removing starter from panel. The starter must have straight-through wiring.
 2. Coils: Coils shall be of molded construction. All coils shall be replaceable from the front without removing the starter from the panel.
 3. Overload Relays and Thermal Units: Overload relays shall be the melting alloy type with a replaceable control circuit module. Thermal units shall be of one-piece construction and interchangeable. The starter shall be inoperative if the thermal unit is removed.

2.3 ARC FLASH EVALUATION STUDY:

- A. An arc flash evaluation study shall be performed to determine, in coordination with the Owner's safety policy, the required personal protective equipment (PPE) when working on energized equipment.
- B. The arc flash evaluation study shall comply with all NFPA 70E and OSHA requirements for calculating and identifying incident energy levels and the corresponding PPE that would be required in each instance.
- C. The calculated incident energy levels and recommended PPE for each location shall be summarized in a tabulated form listing location, circuit identification, and PPE. Discrepancies, problem areas, or inadequacies shall be promptly brought to the Architect's attention.
- D. Arc flash calculations shall be based on values of fault current magnitudes identified in the short-circuit analysis and the associated clearing times of the over current protective devices determined by the coordination study. The settings recommended by the coordination study shall be the basis of arc flash calculations.
- E. Calculation methods shall comply with IEEE Standard 1584 "IEEE Guide for Performing Arc-Flash Hazard Calculations".
- F. Per IEEE Standard 1584, a maximum arc time of two seconds shall be utilized to limit incident energy values.
- G. Recommended settings of all protective equipment based on the short circuit and equipment coordination study shall be implemented prior to attaching arc flash hazard labels to the equipment.

- H. All electrical equipment shall be field marked to indicate where a flash hazard exists in compliance with NEC 110-116. Labels shall be submitted for approval prior to application. Labels shall be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.
- I. Arc Flash Study Report:
 - 1. The results of the arc flash study shall be summarized in a final report. Five (5) bound copies of the final report shall be submitted to the Architect.
 - 2. The report shall include the following sections:
 - a. Description, purpose, basis, written scope, and a single-line diagram of the portion of the power system which is included within the scope of study.
 - b. Tabulations of circuit breaker, fuse, and other equipment ratings versus calculated arc flash energy levels, and commentary regarding same.
 - c. Tabulation of appropriate tap settings for relay seal-in units.
 - d. Tabulation of arc flash study incident energy levels and PPE requirements.

2.4 SHORT-CIRCUIT ANALYSIS, PROTECTIVE DEVICE EVALUATION, AND COORDINATION STUDY

- A. Scope of Services: Provide a current and complete short-circuit study, equipment interrupting or withstand evaluation, and protective device coordination study for the electrical distribution system..
 - 1. Study shall include all portions of electrical distribution system. Normal and emergency system connections and those which result in maximum fault conditions shall be adequately covered in the study.
 - 2. The study shall be performed by Emerson Network Power, or equal. Study shall be prepared and signed by a California registered Electrical Engineer.
 - 3. In the case of additions or modifications to existing distribution systems, the scope of the Study shall include all new portions of the distribution system, and all existing devices upstream of the distribution system modifications all the way to the facility main service switchboard.
- B. Submittals:
 - 1. Submit Study to Architect for review prior to receiving final acceptance of distribution equipment shop drawings or prior to release of equipment for manufacture. If formal completion of Study may cause delay in equipment manufacture, acceptance from Architect may be obtained for preliminary submittal of sufficient study data to ensure that selection of device ratings and characteristics will be satisfactory.
- C. Short-Circuit Study:
 - 1. The study shall be in accordance with applicable ANSI and IEEE Standards.
 - 2. The study input data shall include the utility company's primary short-circuit single-and three-phase contribution, with the X/R ratio, the resistance and reactance components of each branch impedance, motor and generator contributions, base quantities selected, and all other applicable circuit parameters.
 - 3. Short-circuit momentary duties and interrupting duties shall be calculated on the basis of maximum available fault current at each switchgear bus, switchboard, distribution switchboard, panelboard, and other significant locations through the system.

D. Equipment Evaluation Study:

1. An equipment evaluation study shall be performed to determine the adequacy of circuit breakers, controllers, surge arresters, switches, and fuses by tabulating and comparing the short-circuit ratings of these devices with the available fault currents. Any problem areas or inadequacies in the equipment shall be promptly brought to the Architect's attention.

E. Protective Device Coordination Study:

1. A protective device coordination study shall be performed to select or to check the selections of power fuse ratings, protective relay characteristics and settings, ratios and characteristics of associated voltage and current transformers, and low-voltage breaker and fuse trip characteristics and settings.
2. The coordination study shall include all voltage classes of equipment and protective devices. The phase and ground overcurrent protection shall be included, as well as settings for all other adjustable protective devices.
3. The time-current characteristics of the specified protective devices shall be plotted on appropriate log-log paper. The plots shall include complete titles, representative one-line diagram and legends, significant motor starting characteristics, complete parameters of transformers, complete operating bands of low-voltage circuit breaker trip curves, relay curves and fuse curves. The coordination plots shall indicate the types of protective devices selected, proposed relay taps, time dial and instantaneous trip settings, ANSI transformer magnetizing inrush and withstand curves per ANSI C37.91, cable damage curves, symmetrical and asymmetrical fault currents. All requirements of the current National Electrical Code shall be adhered to. Reasonable coordination intervals and separation of characteristics curves shall be maintained. The coordination plots for phase and ground protective devices shall be provided on a complete system basis. Sufficient curves shall be used to clearly indicate the coordination achieved to each main breaker or fused device, each feeder breaker, and each primary protective device.
4. The selection and settings of the protective devices shall be provided separately in a tabulated form listing circuit identification, IEEE device number, current transformer ratios, manufacturer, type, range of adjustment, and recommended settings. A tabulation of the recommended power fuse selection shall be provided for all fuses in the system. Discrepancies, problem areas, or inadequacies shall be promptly brought to the Architect's attention.

F. Study Report:

1. The results of the power system study shall be summarized in a final report. Five (5) bound copies of the final report shall be submitted to the Architect.
2. The report shall include the following sections:
 - a. Description, purpose, basis, written scope, and a single-line diagram of the portion of the power system which is included within the scope of study.
 - b. Tabulations of circuit breaker, fuse, and other equipment ratings versus calculated short-circuit duties, and commentary regarding same.
 - c. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.
 - d. Fault current tabulations including a definition of terms and a guide for interpretation.
 - e. Tabulation of appropriate tap settings for relay seal-in units.

- f. Tabulation of arc flash study incident energy levels and PPE requirements.

PART 3 - EXECUTION

3.1 REFER TO SECTION 26 05 00 FOR DETAILS OF WORK UNDER THIS SECTION.

3.2 INSTALLATION/APPLICATION/ERECTION

- A. Electric Service: Contact the local electric utility company service planning representative and coordinate with and arrange with the utility company for electric service to the project, including finalization of service application as required. Furnish and install all materials and labor necessary for complete installation as noted on drawings. Submit shop drawings and obtain approval from the utility company prior to fabrication. Also provide and install temporary power as required for construction operations.
- B. Excavate and trench as necessary for the electrical installation, and when the work has been installed, inspected and approved, backfill all excavations with clean earth from excavation, or imported sandy soil in maximum 8" (eight-inch) layers, moisten and machine tamp to 95% compaction, and restore the ground and/or paving or floor surfaces to their original condition.
- C. Switchboards and Distribution Panels Installation: Mount as detailed on the drawings.
- D. Motor Connections:
 - 1. Install motor circuits complete for all motors by other trades
 - 2. Furnish and install all disconnect switches, outlet boxes, etc., as required by code.
 - 3. All motor and temperature control low voltage wiring shall be installed and connected by Division 23 Section of specifications, unless otherwise indicated on electrical drawings.
- E. Motor Starters Installation:
 - 1. Deliver starters to site without thermal overload elements. Determine nameplate rating of each motor, after motor and starter installation, select thermal element rating from measured motor running current and install proper elements in starters.
 - a. Submit chart denoting motor designation, motor H.P., motor running current (N.P.), actual running current fuse/breaker size and thermal element catalog number. Take readings of motor running currents in conjunction with Division 23 - Heating, Ventilating, and Air Conditioning.

3.3 TESTS

- A. Testing and Inspection: See Section 26 08 00 - Testing.

END OF SECTION

SECTION 26 27 00

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL**1.1 WORK INCLUDED**

- A. Work included in this Section: All materials, labor, equipment, services, and incidentals necessary to install the electrical work as shown on the drawings and as specified hereinafter, including but not limited to the work listed below:
 - 1. Raceways, feeders, branch circuit wiring, wiring devices, safety switches and connections to all equipment requiring electric service.
- B. Any other electrical work as might reasonably be implied as required, even though not specifically mentioned herein or shown on the drawings.
- C. All work shall comply with Section 26 05 00.

1.2 RELATED WORK

- A. Division 09 - Finishes
- B. Division 23 - Motors and Mechanical Equipment Installation

1.3 SUBMITTALS

- A. Comply with the provisions of Section 26 05 00.

PART 2 - PRODUCTS**2.1 ACCEPTABLE MANUFACTURERS**

- A. Refer to Section 26 05 00, Basic Electrical Requirements, Part 2 - Products.
- B. List of Equipment Manufacturers:
- C. Conduit and Conduit Fittings
 - 1. Allied Tube and Conduit, Wester Tube and Conduit, LTV Steel Tubular, National Electric Products, AFC, Republic Steel Corporation, Rome Cable Corporation, United States Steel Corporation, Killark Electric Manufacturing Company, Raco, VAW Aluminum Company, Bridgeport, Steel City, Thomas & Betts, Carlon, O.Z. Gedney, Appleton, Regal.
- D. Wire and Cable (600V)
 - 1. American Wire Company, General Wire and Cable Corporation, Okonite Company, Rome Cable Corporation, Cerrowire, American Insulated Wire, AFC Cable Systems, Essex, Simplex Wire and Cable Company, Southwire.
- E. Solderless Lugs and Grounding Connections
 - 1. Burndy Engineering Company Inc, O.Z. Gedney Company Inc, Penn Union Electric Corporation, Thomas and Betts Company Inc.

- F. Pull Boxes, Gutters, Special Cabinets
 - 1. Schneider-Square D Company, Columbia Electric Manufacturing Company, General Electric Company, Eaton Inc.
- G. Outlet Boxes
 - 1. Appleton Electric Company, Killark Electric Manufacturing Company, Lew Electric Fittings Company, National Electric Products Corporation, Raco, Steel City Electric Company, Carlon, Bowers.
- H. Floor Boxes
 - 1. Steel City Electric Company, Hubbell Inc, RCI, Walker.
- I. Wiring Devices
 - 1. Leviton, Arrow-Hart, Cooper, Hubbell, Lutron, Bryant.
- J. Conduit Racks, Hangers
 - 1. General Electric Company, Killark Electric Manufacturing Company, Caddy, National Electric Products Corporation, Republic Steel Corporation, Rome Cable Corporation, United States Steel Corporation, VAW Aluminum Company, Superstrut, B-Line.
- K. Safety Switches (Disconnect and Fusible)
 - 1. Schneider-Square D Company, Eaton-Cutler Hammer Inc, General Electric Company.
- L. Fuses
 - 1. Bussman Manufacturing Company, Chase-Shawmut Company.
- M. Firestopping
 - 1. 3M, Nelson.

2.2 MATERIALS

- A. Raceways: Only the raceways specified below shall be utilized on this project. Substitutions shall be pre-approved in writing. All bare conduit ends (stub-ups or stub-outs) shall be provided with bushed ends or manufactured insulated throat connectors:
 - 1. Rigid Type - hot dip galvanized or sherardized steel, use on all exterior locations, below grade or in concrete slab, and to 18" on either side of structural expansion joints in floor slabs, with completely watertight, threaded fittings throughout. Compression fittings are not acceptable.
 - a. All rigid steel conduit couplings and elbows in soil or concrete or under membrane to be ½ lap wrapped with Scotch #50 tape and threaded ends coated with T&B #S.C.40 rust inhibitor prior to installation of couplings.
 - b. ½ lap wrap all rigid steel conduit stub-ups from slab or grade to 6" above finished grade level with Scotch #50 tape.
 - 2. In lieu of rigid steel conduit for power and control raceways and branch circuit conduits in soil or concrete slabs, "Schedule 40" PVC with Schedule 80 PVC conduit elbows and stub-ups may be used with code size (minimum No. 12) ground wire. A "stub-up" is considered to terminate 6" above the finished surface.
 - a. Schedule 80 PVC conduit shall be used in all concrete footings or foundations and to 18" of either side of footings or foundation walls.

- b. Schedule 80 PVC conduit shall be used in all concrete masonry unit (CMU) walls or columns.
 - c. All conduit runs in concrete floor slabs (where allowed) shall be installed to comply with all applicable CBC and structural codes to maintain the structural integrity of the floor slab. Where conflicts occur, alternate routing shall be provided at no additional cost to the Owner.
 - d. Where schedule 80 PVC is coupled to schedule 40 or other raceways with differing interior dimensions, each end shall be reamed with a reaming tool to reduce the edge profile for protection of the passing conductors during the pull.
- 3. Intermediate metal conduit may be used in all exposed interior locations, except that electrical metallic tubing may be used in some locations as noted below. Utilize steel compression type fittings for all exposed conduit runs, unless otherwise noted. Die-cast zinc fittings are unacceptable.
 - 4. Electrical metallic tubing shall be used exposed in interior electrical and mechanical rooms, in interior unfinished spaces, and in interior concealed and furred spaces, made up with steel watertight or steel set screw type fittings and couplings. EMT shall not be used in under-building crawl spaces or other areas subject to moisture. Set screws shall have hardened points. Die-cast zinc fittings are unacceptable.
 - 5. Surface mounted rectangular steel raceways and boxes: use for all surface mounted installations, unless otherwise noted (all catalog numbers listed are Wiremold - equals allowed) - color Ivory, unless otherwise noted;
 - a. #V500 for branch power runs on ceilings and walls (used with V500 series straps, elbows, connectors and V5000 series low profile boxes and covers).
 - b. #2000 or 2400 low profile for larger power run requirements on ceiling or walls (used with V2000 series straps, elbows, connectors and low profile boxes and covers).
 - c. #2400D for dual service power and tel/data run requirements (used with divided V2400 boxes and covers).
 - 6. Surface mounted rectangular non-metallic dual service raceways; Wiremold #5400 (Ivory) or equal with all required compatible activation covers, bezels, inserts, and blank plates for a complete installation. Refer to drawings for outlet quantities in raceway and feed points. All raceway fed flush from rear with horizontal j-boxes, unless otherwise noted.
 - 7. Use flexible conduit for all motor, transformer and recessed fixture connections, minimum ½"; "Seal tite" type used outdoors and in all wet locations, provide with code size (minimum No. 12) bare ground wire in all flexible conduit.
 - 8. All conduit cuts (factory or field cut) shall be perfectly square to the length of the conduit and cut ends shall be reamed with a reaming tool to provide a smooth edge to the passing conductors and to remove all burs and scrapes. Use of a hand file is not acceptable.
 - 9. All electrical raceways shall be installed concealed, unless otherwise noted. Cut and patch to facilitate such installation to match adjacent and original finish. All exposed conduits, where required, shall be installed parallel to building members.
 - 10. All emergency source circuits shall be installed in separate raceways (from normal power), per 2017 NEC 700.10(B), or the applicable code at the time of permitting.
 - 11. Where existing conditions preclude the installation of EMT in existing walls to remain, provide and install cut-in type boxes and "fish" flexible MC or flex conduit and wire through existing walls to remain, unless shown otherwise on plans.

12. Fasten conduits securely to boxes with locknuts and bushings to provide good electrical continuity.
 13. Provide chrome escutcheon plates at all exposed wall, ceiling and floor conduit penetrations.
 14. Support individual suspended conduits with heavy malleable strap or rod hangers; supports for 1/2 inch or 3/4 inch conduit placed on maximum 7-foot centers; maximum 10-foot centers on conduits 1 inch or larger.
 15. Support multiple conduit runs from Kindorf B907 channels with C-105 and C-106 straps.
 16. Conduit bends - long radius.
 17. Flash conduits through roof, using approved roof jack; coordinate with General Contractor.
 18. To facilitate pulling of feeder conductors, install junction boxes as shown or required.
 19. All empty conduits on the project shall be provided with a nylon pull rope to allow pulling of future conductors intended for the specific raceway. Provide plastic wire-tie style nameplate tags on each end of pull rope with printed identification of conduit use and the location of the opposite end of the rope. Pull ropes for telecommunications service conduits shall meet the utility company requirements.
 20. Where conduits pass through structural expansion joints in floor slab, rigid galvanized conduit shall be used 18" on either side of joint, complete with Appleton expansion couplings and bonding jumpers, or equal. All above grade expansion joint crossings shall also utilize expansion joint couplings or flex conduit transitions as required for each particular installation. Installed condition shall allow for a minimum deflection of raceway and wire (in any direction) equal to the structural expansion joint dimension (building to building). No solid conduits shall be allowed to cross expansion joints without proper provisions for building and seismic movement.
 21. Minimum cover of conduits in ground outside of building - 36 inches, unless otherwise noted.
 22. Provide and install exterior wall conduit seals and cable seals in the locations listed below. Coordinate installation and scheduling with other trades:
 - a. Conduit seals through exterior wall or slab (below grade): O.Z. Gedney series "FSK" in new cast in concrete locations, series "CSM" in cored locations.
 - b. Conduit seals through exterior wall or slab (above grade): O.Z. Gedney series "CSMI."
 - c. Cable seals at first interior conduit termination after entry through exterior wall or slab: O.Z. Gedney series "CSBI." Coordinate quantity of conductors at each location.
- B. Outlet Boxes and Junction Boxes. Verify all backbox requirements with devices to be installed prior to rough-in.
1. One piece steel knockout type drawn boxes, unless otherwise noted, sized as required for conditions at each outlet or as noted.
 2. Flush-mounted boxes equipped with galvanized steel raised covers for device mounting flush with finished surface. Provide extension rings as required on all acoustical or additional wall treatment areas to bring top of cover flush with finished surface (coordinate with architectural drawings). Devices shall be capable of being tightly mounted to boxes without distorting or bending device or mounting hardware.

3. Boxes for fixture outlets: 4-inch octagon or larger as required, or as noted.
 4. Switch and receptacle outlets - not smaller than 4-inch-square in furred walls, with raised cover for single device; ganged where required.
 5. Outlet and switch boxes for wet locations, cast aluminum FS or FD type with cast aluminum gasketed spring lid cover. Weatherproof "Bell" type boxes are not acceptable.
 6. All connectors from conduit to junction or outlet boxes shall have insulated throats. Connectors shall be manufactured with insulated throats as integral part. Insertable insulated throats are unacceptable.
 7. Outlet boxes for telecommunications, 4" square or larger as required or noted, multi-ganged for voice, data, and other services where indicated on the drawings.
 8. Conduit Bodies: Malleable iron type, with lubricated spring steel clips over edge of conduit body, O-Z/Gedney type EW, or equal.
 9. Pull boxes: All site pull boxes shall be flush in-ground concrete, with engraved covers identifying service use (i.e. electrical, communications, etc.). Boxes shall be Nema 250, Type 6, outside flanged, with recessed cover for flush mounting, by Christy or equal, with required depth to provide box and conduit depths shown or required.
 - a. Provide concrete covers for all boxes in planted or paved areas (up to available concrete cover size).
 - b. Provide galvanized steel covers for all larger boxes (when concrete is not available), or in traffic areas. No cast iron covers.
 - c. Provide bolted covers and slab bottoms (with grouted perimeter) or vault type boxes for all electrical distribution and signal system pull boxes used for site distribution, to prevent rodent entry. No collar type boxes with dirt or gravel bottoms
 - d. Provide drain hole at bottom of all vault type boxes, with loose aggregate base below, for proper drainage.
 - e. All covers to be completely flush with finished adjacent surfaces.
 - f. Provide galvanized steel H20 rated covers and installation of box rated for H20 in all traffic areas.
 - g. Provide pullboxes per utility company specifications for all electrical primary and secondary services and for telecommunications service runs. Verify exact size and type prior to order with each utility company.
- C. Wire and Cable (line voltage and signal systems):
1. 600-volt class where used for or run with line voltage power wiring, insulation color coded, minimum No. 12 AWG for power branch circuits, No. 14 for power control circuits, and wiring size and type as directed by signal system manufacturer for each signal system.
 2. All conductors shall be copper.
 3. Size and insulation type:
 - a. Standard locations: #12 to #1 AWG: THWN for wet locations and THHN for dry locations. #1/0 through #4/0 AWG: XHHW (55 Mils). 250MCM and larger: XHHW (65 Mils). All wire sizes used shall be based on a 75 degree insulation rating, unless specifically used with 90 degree rated breakers and devices.
 - b. All wiring (power and signal) installed underground between buildings, or in wet or damp locations, shall be outside listed and rated for wet locations.
 - c. High temperature and non-standard locations: Provide wire type and insulation category suitable for area of use as defined in NEC table 310-13.

4. Conductors No. 8 and larger and as otherwise noted on drawings shall be stranded. Power conductors No. 12 and No. 10 shall be solid or stranded. Power conductors No. 14 or smaller shall be solid.
 5. Provide signal system wiring for each system to meet the system manufacturers requirements and recommendations for each device or equipment type. Signal wiring systems shall be provided with shielding and/or insulation type and cable quantities as directed by the manufacturer, and meet all NEC requirements for locations used.
 6. Install all wiring branch circuits and feeders (low voltage and line voltage) in conduit unless noted otherwise on the drawings. Contractor shall mandrel all feeders and pass a "sock" (or utilize other suitable means) through each raceway prior to pull to remove all water and construction debris. All raceways shall be completely clear of any obstructions or debris and all cut ends shall be reamed, prior to pull. Utilize pulling compound on all runs to insure minimum friction and pulling tension.
 7. Megger test all feeders prior to energizing. See section 26 08 00 for additional information.
 8. Approximately balance branch circuits about the neutral conductors in panels.
 9. Connections to devices from "thru-feed" branch circuit conductors to be made with pigtails, with no interruption of the branch circuit conductors.
 10. Neutral conductor identified by white outer braid, with different tracers of "EZ" numbering tags used where more than one neutral conductor is contained in a single raceway.
 11. Neatly arrange and "marlin" wires in panels and distribution panelboards with "T and B Ty-rap" or approved equal plastic type strapping.
 12. All wire and cable shall bear the Underwriters' Label, brought to the job in unbroken packages; wire color-coded as follows:

a. Voltage	Phasing	A	B	C	N
b. 120/208	3PH4W	Black	Red	Blue	White
c. 2083PH	3W	Black	Red	Blue	--
 13. The equipment grounding conductor shall be insulated copper; where it is insulated, the insulation shall be colored green.
 14. Label each wire of each electrical system in each pull box, junction box, outlet box, terminal cabinet, and panelboard in which it appears with "EZ" numbering tags indicating the connected circuit numbers.
 15. Provide permanently affixed adhesive labels with machine printed lettering (min. 1/8" high) at junction boxes serving fixtures that are supplied by (2) electrical sources (i.e. normal and emergency lighting). Label to read "CAUTION - This light fixture is powered by (2) separate sources. The normal power source breaker and the emergency power source breaker must be turned off before servicing this light fixture."
 16. Install feeder cables in one continuous section unless splices are approved by Architect. Exercise care in pulling to avoid damage or disarrangement of conductors, using approved grips. No cable shall be bent to smaller radius than the spool on which it was delivered from the manufacturer. Color code feeder cables at terminals. Provide identifying linen tags in each pullbox.
- D. Switches: Model numbers are Hubbell, color to be selected by architect, unless otherwise noted. All switches to utilize screw terminals for wire connections - no plug-in terminations:
1. Single Pole - No. HBL1221

2. Two Pole - No. HBL1222
 3. Three Way - No. HBL1223
 4. Momentary contact - No. HBL1557
 5. Momentary contact Keyed - No. HBL1556L
 6. Keyed, - No. HBL1221L
 7. Pilot Light (on with load on) - Hubbell No. 1221-PLC
 8. Motor Rated Double Pole (30A) - Hubbell No. 7832
 9. Motor Rated Three Pole (30A) - Hubbell No. 7810.
 10. Low voltage Data line switches - Refer to lighting control system (for compatibility)
- E. Receptacles: Mounting straps and contacts shall be one piece design, constructed of minimum .050" solid brass. Base shall be high strength, heat resistant, glass reinforced nylon. Device shall accept up to #10 wire, side or back wired with screw terminals - no plug-in terminations. Hubbell, Leviton, Pass & Seymour, or equal. Color to be selected by architect, unless otherwise noted. Numbers listed below are Hubbell:
1. 15A 3PG 125 volt duplex - No. HBL5262
 2. 20A 3PG 125 volt duplex - No. HBL5362
 3. 20A 3PG 125 volt ground fault interrupter receptacle; GFI receptacles shall conform to the 2006 UL requirements to a) interrupt power to the unit in the event of internal failure, or b) provide an audible or visual indication of internal failure of the GFI; No. GF20 or equal. Through wiring to down stream GFI designated receptacles is not acceptable.
 4. 15A 3PG 125 volt half controlled duplex receptacle - No. BR15C1(color), with permanent "controlled" marking, factory applied.
 5. 20A 3PG 125 volt half controlled duplex receptacle - No. BR20C1(color), with permanent "controlled" marking, factory applied.
 6. 15A 3PG 125 volt full controlled duplex receptacle - No. BR15C2(color), with permanent "controlled" marking, factory applied.
 7. 20A 3PG 125 volt full controlled duplex receptacle - No. BR20C2(color), with permanent "controlled" marking, factory applied.
 8. GFI Module (blank face), no indicator light, 20A - No. GFBF20 or equal.
 9. All receptacles located in exterior or wet locations shall be corrosion resistant with UV stabilized body.
 10. All receptacles in locations identified in NEC 406.12 (i.e. dwelling units, business office common areas) shall be tamper resistant.
- F. Plates: Leviton, or equal, except as noted:
1. The color of all faceplates shall match the color of the devices installed under/in the faceplate, except as specifically noted otherwise.
 2. For flush outlet boxes, for switches, and receptacles: nylon, color to be selected by architect, unless otherwise noted.
 3. Plates for surface-mounted outlets: galvanized steel unless otherwise noted.
 4. Weatherproof duplex receptacle plates for exterior locations with ground fault interrupter receptacles in type FS or FD boxes - Hubbell #WPFS26 or compatible equal. Verify cover compatibility with box type and device installed.
 5. Weatherproof "in-use" cover, vertical or horizontal mount, for exterior with GFCI receptacles. Die-cast metal alloy, TayMac MX series or equal with openings to match installed devices.
 6. Locking plates for duplex receptacles where noted; Pass & Seymour #WP26-L (non- weather proof).

7. Locking plates for duplex exterior GFCI receptacles (or in wet or damp locations); Heavy duty cast aluminum flush cover with locking latch and key, Pass & Seymour #4600 with appropriate mounting plate for type of device installed. Coordinate backbox requirements and finished wall trim-out with wall installer prior to rough-in to insure an adequate and neat trim appearance upon completion.
 8. Plates for flush tele/data boxes: white nylon or as otherwise directed - provide and install at each tele/data outlet plate to match duplex power outlet plate, for jack installation under Section 27 00 00. Where the power and tele/data outlet boxes are shared the plate shall be continuous in multi-gang locations. See drawings.
- G. Equipment Disconnects: All disconnects shall be located to allow proper code required clearance in each area. Locations shown on drawings are diagrammatic only. The contractor shall coordinate exact locations in the field (with other trades) prior to rough-in to insure proper clearances.
1. Motor Disconnect Switches and Safety Switches: General Electric Company Heavy Duty Type "THD", cover interlocked with operating handle so that cover cannot be opened with switch in closed position and switch cannot be closed with cover in open position. 240V or 480V rating, single or multi-pole as required or as noted on drawings, in Nema 1 enclosure indoors or Nema 3R enclosure outdoors unless otherwise noted. Provide dual element motor circuit fuses sized as recommended by equipment manufacturer (for final equipment actually installed).
 2. Code required disconnects: Provide a local disconnect in addition to the branch circuit protection device for all equipment as required by code (whether shown or not). Disconnects shall consist of a motor rated switch (or disconnect) for all motor loads less than 3/4HP or other suitable disconnect sized to match branch circuit conductors and load current of equipment, with number of poles as required.
- H. Lugs and Connectors: Thomas and Betts "lock-tite", for No. 4 and larger wire; 3M "Scotchlock" fixed spring screw-on type wire connectors with insulator for No. 6 and smaller wire.
1. All splices shall be made up with screw-on type connectors - no plug-in or push-in style connectors acceptable. Wires shall be solidly twisted together with electricians pliers before screw-on connector is installed to ensure a proper connection in the event of wire nut failure. No exceptions.
 2. Connectors listed or labeled for "no wire twisting required" are not an acceptable substitute for actual wire twisting.
 3. Utilize porcelain type connectors in all high temperature environments (above 105 degrees Celsius).
- I. Splice Insulation: "Scotch" electrical tape with vinyl plastic backing or rubber tape with protective friction tape for interior work.
1. Splices in electrical cables of 600 volt insulation class in underground system duct shall be made only in accessible locations such as pullboxes, light pole handholes, etc., using a compression connector on the conductor and by insulating and waterproofing (for exterior and underground locations) by one of the following methods:
 - a. Cast type splice insulation shall be provided by means of a molded casting process employing a thermosetting epoxy resin insulating material which shall be applied by a gravity poured method or by a pressure injected method. The component materials of the resin insulation shall be in a

packaged form ready for convenient mixing after removing from the package. Do not allow the cables to be removed until after the splicing material has completely set.

- b. Gravity poured method shall employ materials and equipment contained in an approved commercial splicing kit which includes a mold suitable for the cables to be applied. When the mold is in place around the joined conductors, the resin mix shall be prepared and poured into the mold. Do not allow cables to be moved until after the splicing materials have completely set.

J. Identification: Refer to Section 26 05 00.

K. Firestopping: as manufactured by 3M Fire Protection Products or equal.

- 1. Fire-rated and smoke barrier construction: Maintain barrier and structural floor fire and smoke resistance ratings including resistance to cold smoke at all penetrations, connections with other surfaces or types of construction, at separations required to permit building movement and sound vibration absorption, and at other construction gaps.
- 2. Systems or devices listed in the UL Fire Resistance Directory under categories XHCR and XHEZ may be used, providing that it conforms to the construction type, penetration type, annular space requirements and fire rating involved in each separate instance, and that the system be symmetrical for wall penetrations. Systems or devices must be asbestos free.

PART 3 - EXECUTION

3.1 REFER TO BASIC ELECTRICAL REQUIREMENTS - SECTION 26 05 00 FOR WORK UNDER THIS SECTION.

3.2 TESTS

A. Testing and Inspection: See Section 26 08 00 - Testing.

END OF SECTION

SECTION 26 32 14

EMERGENCY ELECTRIC GENERATOR

PART 1 - GENERAL**1.1 WORK INCLUDED**

- A. Provide a complete Emergency Generator plus accessories in a single common housing, as noted herein and as indicated on the Drawings.
- B. Provide CBC 2022 compliant seismic installation. See Section 26 05 00 for all certification and submittal requirements.
- C. Manufacturer shall be responsible for providing a complete assembly of all components in one overall housing with base tank, which is certified to comply as an integrated assembly with CBC 2022 requirements.
- D. Manufacturer shall provide technical assistance to Owner in securing all required local Air Quality Management District permits for installation of the Emergency Generator.
- E. The Contractor shall include a Manufacturer-provided three-year engine-generator maintenance agreement as described herein as part of the bid. The maintenance agreement shall include an annual 2-hour full load test using a portable load bank.

1.2 SUBMITTALS

- A. Refer to Section 26 05 00 for procedure.
- B. Tests and Reports (Test Requirements are detailed in Paragraph 1.4).
 - 1. Provide certified test reports of the following:
 - a. Factory tests.
 - b. Field Tests: Test reports shall include dates performed, method of testing, test results, test interpretation and recommended action.
 - 2. Shop Drawings and Product Data
 - a. The following list includes the required Shop Drawing information that shall be submitted for the generator:
 - 1) Physical dimensions and weights.
 - 2) CBC Special Certificate of Compliance with importance factor of 1.5 for all components and overall assembly.
 - 3) Brake horsepower of engine.
 - 4) Fuel consumption.
 - 5) Cooling requirements.
 - 6) Noise db level. Provide details of acoustical housing and factory testing to prove acoustical housing performance (71dba at 7 meters).
 - 7) Electrical characteristics of generator, voltage regulator, and battery charger.
 - 8) Load graphs.
 - 9) Control panel.
 - 10) Elevation.
 - 11) Wiring and control diagrams.

- 12) Engine and generator details, including governor and base fuel tank.
 - 13) Location of available parts and service.
 - 14) Confirmation that engine meets the latest required EPA Tier Exhaust Emission Compliance Statement, complies with latest CARB requirements for emergency standby equipment, and complies with the local Air Quality Management District requirements.
 - 15) Details of base tank fill connection, including overfill basin.
 - 16) Details of primary tank venting, primary and secondary tank emergency relief venting, high fuel alarm panel and sensing, and tank labeling.
 - 17) Passive diesel particulate filter.
3. Maintenance and operating instruction manuals, six bound copies, including approved shop Drawings, parts list, list of recommended spare parts, sources of purchase and similar information.

1.3 GUARANTEE

- A. Provide a written guarantee against all defects in materials and application, which prevent proper functioning for one (1) year from date of acceptance of the project.

1.4 TESTS

- A. Certified copies of factory test giving guaranteed performance characteristics to meet the Specifications should be furnished by the Manufacturer. The unit shall be tested at the Manufacturer's plant for performance of all functions including a 2-hour full load test, using 0.8pf reactive to 1.0pf resistive load banks and until all temperatures have been stabilized for at least 30 minutes.
- B. The Manufacturer shall have field tests made of the generator and wiring systems in place by a qualified factory technician. The complete engine generator set with all of its appurtenances shall be tested after installation for all functions, including a 2-hour full load test with full-rated resistive (1.0pf) load bank. The Manufacturer shall supply all equipment necessary for the tests.
- C. Testing of fuel system - see Part 3 of this Section.

1.5 FUNCTION

- A. The emergency generator shall function to start automatically immediately upon power failure of the normal power supply, assume full load within ten (10) seconds and automatically switch into the emergency power system. The unit shall be automatically removed from the line upon resumption of normal power and stopped five (5) minutes later.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General:
 1. Provide and install a complete emergency power system, including power plant powered by diesel engine driven generator and operated by means of a signal

from an automatic transfer switch. The system shall be complete, tested and meet all the functional requirements of a fully automatic emergency power source serving full load power stabilized at rated voltage and frequency within three seconds after normal power source failure.

2. The diesel engine generating set shall be fully automatic and shall be complete with starting and control equipment, base fuel-tank, skid-mounted batteries, charger, acoustical enclosure, and other equipment necessary to provide a complete, fully automatic system.
3. Arrange for the services of a factory erection engineer for checking installation, making specified and all other necessary tests, making initial start, instructing operating personnel in operating unit through all of its functions to ensure that the unit is performing in accordance with the intentions of the Specifications.
4. Generator set shall be provided with a vertical scoop on discharge.
5. Manufacturers: Cummins-Onan, Kohler, Caterpillar, or equal.
6. Generator set shall be provided with a passive diesel particulate filter (DPF) mounted above engine-generator in a common housing with the generator set.
7. Power Plant:
 - a. Rating shall be based on continuous standby power rating of the generator and with capabilities to carry 100% full load without damage to the engine, generator or components, and with capabilities for starting the largest motor scheduled for the standby power system while carrying full connected load at an altitude of 350 feet above sea level. Full load power ratings shall be as indicated on the drawing, continuous standby at 0.8 PF at 120/208V 3PH 4W.
 - 1) Voltage regulation shall be +/-0.5% for any constant load between no load and rated load.
 - 2) Frequency regulation shall be isochronous from steady state no load to steady state rated load.
 - 3) The diesel engine generator set shall be capable of single step load pick up of 100% nameplate KW and power factor, less applicable derating factors, with the engine-generator set at rated operating temperature.
 - 4) Under motor starting conditions the generator set shall be capable of sustaining a minimum of 90% of rated no load voltage with the specified KVA load at near zero power factor applied to the generator set.
 - 5) Maximum transient voltage dip shall not exceed 35 percent below rated on application of the single largest surge load step.
 - b. Provide unit and all accessories in a common weatherproof acoustical enclosure, with a common base for unit capable of skidding into place. Provide sound absorbing insulation on interior of weatherproof enclosure to produce overall sound rating noted above. All accessories, including muffler shall be concealed within common generator enclosure. If a diesel particulate filter is specified, it shall be concealed within the enclosure.
 - c. Provide minimum 18" flexible section in all electrical, fuel and exhaust lines at connection to power plant.
 - d. Provide flexible steel disc coupling to engine-generator.
 - e. Provide lifting brackets.
 - f. Provide a CBC 2022 compliant and certified vibration isolation system. The vibration isolation system shall be designed to withstand the seismic forces from ground motions and installation shall comply with critical equipment (importance factor = 1.5) requirements. CBC conforming vibration isolators

shall be provided and installed at the bolt-down locations between the skid and the base fuel tank.

8. Engine:
 - a. The engine shall be 4-cycle design, water-cooled; series turbo charged with after cool, having no inherent unbalanced reciprocating forces. Operating speed shall be 1800 RPM.
 - b. Starting by battery-driven starter. Include cranking sequencer, which shall give three (3) start attempts before locking out over-cranking protection.
 - c. Governor shall be isochronous electronic as required to maintain generated frequency at 60 Hz. at 75% full load within a steady state band-width of (+/-) 0.25%. Frequency shall not vary over 3% from no load to full load. Governors using engine crankcase lube oil will not be acceptable. Governor shall be type EFC, Electronic Isochronous.
 - d. Provide fuel and lubrication systems for diesel engine, complete with replacement element type air cleaner; primary and secondary fuel filter and oil filter; full pressure lubrication system with positive displacement lube oil pump and spring-loaded bypass valve; lube oil cooler; engine driven fuel transfer pump; extended base-mounted fuel tank, sight gauge, automatic float switch to maintain fuel level, and high-fuel and low-fuel alarm dry contacts for local and remote indication. Provide base fuel tank rupture basin contacts (2 sets) for local and remote alarm. Point of fuel fill at the base tank shall have provisions for spill containment. Provide shop drawings indicating spill containment system.
 - e. Provide a cooling system with sufficient capacity for cooling engine when generator is delivering 100% full load for four hours at ambient of 40 degrees C at an altitude of 350 feet. Include water-circulating pump and thermostatic valve to maintain recommended engine temperature; radiator with drain and air vent and fan with protective guard; jacket water corrosion resistant heating elements (wattage as specified by engine manufacturer, rated at 208V 1PH or 3PH). Radiator shall be filled with antifreeze solution of strength as recommended by Manufacturer. Exhaust air shall be discharged vertically, using a scoop design.
 - f. All areas within 24 inches of the muffler shall be covered with 6 lb. density mineral wool. All piping shall be schedule 40 black pipe.
 - 1) The exhaust system, piping, and insulation shall be factory supplied and installed. Extend black standard weight iron pipe from the engine with 18" flexible connection between engine and muffler. The muffler shall be installed within the same overall enclosure as the engine-generator.
 - g. Provide a unit-mounted battery for engine start, 24-volt DC with a capacity of not less than 160-ampere hours at 20-hour rate. The battery shall also be sized for six starts of 30-second cranking duration each, with ambient 15 degree F, mounted on earthquake-proof tray on pad with all necessary battery cables, hydrometer and enclosure-mounted voltage-regulated battery charger in Nema 3R enclosure with float, taper, and equalize charge settings and with DC voltmeter, DC ammeter and circuit for low voltage alarm. Battery shall be lead-acid type.
 - h. Auxiliary switches for over-speed trip and automatic over-speed shut down at a speed 10% greater than the normal specified operating RPM. The engine shall shut down on over-speed, low oil pressure, high oil temperature and high water temperature by means of auxiliary switches, actuating signal lights and alarms.

- i. Temporary batteries may be used for testing, but new, unused batteries shall be furnished after final testing is complete and before acceptance. New batteries shall be used for one generator start to demonstrate adequacy of final battery installation.
 - j. Engine exhaust emissions shall meet the latest adopted EPA Tier Exhaust Emission Compliance Statement, the latest CARB requirements for emergency standby applications, and the local Air Quality Management District standards.
 - k. Provide a DPF - concealed within enclosure.
- B. Diesel Particulate Filter: The DPF shall be a passive continuously regenerating type as manufactured by Johnson Matthey, or equal.
 - 1. DPF shall meet latest EPA and CARB requirements and be on the CARB-approved and verified list for latest emissions standards.
 - 2. It shall meet all applicable CARB requirements for after-treatment of engine-generator emissions.
 - 3. The DPF shall solely use the heat of the engine exhaust and not require any supplemental heat source. The DPF shall regenerate and remain continuously operational even if the KW load on the engine-generator is no more than 25% of nominal.
 - 4. The DPF shall be supplied with a monitoring device which shall log exhaust temperature and backpressure when the engine is running. Back pressure and pressure on the engine shall be continuously monitored as they increase due to build up of the ash layer in the filter. The monitoring device shall derive 24 volt DC power from engine-generator control panel - all connected complete by Manufacturer. It shall have an RS232 interface and be provided with software to download the data onto a portable computer. It shall have alarm points which can be set to indicate the increase in backpressure based upon the Manufacturers' specifications.
 - 5. The DPF shall be housed within a carbon steel, fully insulated, corrosion resistant shell with removable cover panels for full access to the diesel particulate filters mounted inside. The DPF stainless steel shell shall in turn be mounted within the common overall generator housing, with housing access panels aligning with the shell access panels to the filters.
 - 6. The DPF shall have critical-grade sound attenuation.
- C. Generator:
 - 1. Rated for continuous standby service, complying with NEMA standards.
 - 2. Brushless, balanced 4-pole revolving field type with rotating rectifier exciter mounted on end of shaft, single ball bearing support to starter housing, rotor connected by semi-flexible steel disc coupling to engine flywheel to assure permanent alignment free of injurious tensional vibrations at speeds up to 125% of synchronous. Rated for 105 degrees Centigrade rise.
 - 3. Generator insulation shall be in accordance with latest NEMA standards using minimum Class H materials. All insulation system components shall meet NEMA MG1 temperature rise limits for Class H insulation system. Actual temperature rise measured by resistance method at full load shall not exceed 105 degrees centigrade.
 - 4. A permanent magnet generator (PMG) shall provide excitation power for immunity to voltage distortion caused by non-linear loads. The PMG shall sustain

excitation power for optimum motor starting and to sustain short circuit current at approximately 300% of rated current for not more than 10 seconds.

5. Voltage regulator of static solid state design to give (+/-) 2% regulation from no-load to full load; instantaneous voltage dip less than 20% of rated when full load at rated power factor suddenly applied; and recovery to stable operation of voltage within 1% of rated within four seconds. The voltage regulator shall be of the asynchronous pulse width modulated type and shall be insensitive to severe load-induced waveshape distortion from SCR or thyristor circuits such as those used in UPS and motor speed control equipment. Manual adjustment of (+/-) 5% of normal to be included by a lockable device or screwdriver slot in rheostat shaft. All voltage sensing shall be 3-phase.
 - a. The automatic voltage regulator shall be temperature compensated, solid-state design. The voltage regulator shall control build up of AC generator voltage to provide a linear rise and limit overshoot. The regulator shall include a torque-matching characteristic, which shall use differential rate of frequency change compensation to use the maximum available engine torque and provide optimal transient load response. Regulators, which use a straight line fixed volts per hertz characteristic, are not acceptable.
 - b. Shielding of generator, exciter and regulator to prevent radio frequency interference.
 - c. The generator, exciter, and voltage regulator shall be designed and manufactured by the engine-generator set manufacturer so that the characteristics shall be matched to the torque wave of the engine to provide the fastest possible system recovery from transient load changes and to prevent engine stall during transient overload conditions.
6. Control Equipment:
 - a. Panel mounted with vibration isolators to plant frame. Top of panel shall not exceed 6'-6" above slab with generator mounted to a 30" high base tank on top of a 3" high pad.
 - b. The generator set shall be provided with a microprocessor-based control system, which shall be designed, to provide automatic starting, monitoring and control functions for the generator set. The control system shall also be designed to allow local monitoring and control of the generator set and remote monitoring and control as described in this Specification. The control panel shall be mounted on the generator set.
 - c. The control panel shall be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered.
 - d. The control panel shall be UL508 labeled, CSA282-M1989 certified and meet IEC8528 part 4. All switches, lamps and meters shall be oil-tight and dust-tight and the enclosure door shall be gasket. There shall be no exposed points in the control panel (with the door open) that operate in excess of 50 volts. The controls shall meet or exceed the requirements of Mil-Std 461C part 9 and IEC Std 801.2, 801.3 and 801.5 for susceptibility, conducted and radiated electromagnetic emissions. The entire control shall be tested and meet the requirements of IEEE587 for voltage surge resistance.
 - e. The generator set mounted control panel shall include the following features and functions:
 - 1) Three position control switch labeled RUN/OFF/AUTO: In the RUN position the generator set shall automatically start and accelerate to rated speed and voltage. In the OFF position the generator set shall

immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.

- 2) Red "mushroom-head" push-button EMERGENCY STOP switch: Depressing the emergency stop switch shall cause the generator set to immediately shut down and be locked out from automatic restarting.
- 3) Push-button RESET switch: The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.
- 4) Push-button PANEL LAMP switch: Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed or after the switch is depressed a second time.
- 5) Generator Set Metering: The generator set shall be provided with a metering set with the following features and functions:
 - (a) 2.5-inch, 90-degree scale analog voltmeter, ammeter, frequency meter and kilowatt (KW) meter. These meters shall be provided with a phase select switch and an indicating lamp for upper and lower scale on the meters. Ammeter and KW meter scales shall be color coded in the following fashion: readings from 0-90% of generator set standby rating: green; readings from 90-100% of standby rating: amber; readings in excess of 100%: red.
 - (b) Digital metering set, 0.5% accuracy, RMS type to indicate generator voltage, frequency, output current, output KW, KW-hours and power factor. Generator output voltage shall be available in line-to-line neutral voltages and shall display all three-phase voltages (line to neutral or line to line) simultaneously.
- 6) Generator Set Alarm and Status Indication: The generator set shall be provided with alarm and status indicating lamps to indicate non-automatic generator status and existing alarm and shutdown conditions. The lamps shall be high-intensity LED type. The lamp condition shall be clearly apparent under bright room lighting conditions. The generator set control shall indicate the existence of the following alarm and shutdown conditions on a digital display panel.
 - (a) Low oil pressure (alarm)
 - (b) Low oil pressure (shutdown)
 - (c) Oil pressure sender failure (alarm)
 - (d) Low engine temperature (alarm)
 - (e) High engine temperature (alarm)
 - (f) High engine temperature (shutdown)
 - (g) Engine temperature sender failure (alarm)
 - (h) Low coolant level (alarm or shutdown--selectable)
 - (i) Fail to crank (shutdown)
 - (j) Over-crank (shutdown)
 - (k) Over-speed (shutdown)
 - (l) Low DC voltage (alarm)
 - (m) High DC voltage (alarm)
 - (n) Weak battery (alarm)
 - (o) Low fuel-base tank (alarm)
 - (p) High AC voltage (shutdown)
 - (q) Low AC voltage (shutdown)

- (r) Under frequency (shutdown)
 - (s) Over current (warning)
 - (t) Over current (shutdown)
 - (u) Short circuit (shutdown)
 - (v) Ground fault (alarm)
 - (w) Under frequency (alarm)
 - (x) In addition, provisions shall be made for indication of two customer-specified alarm or shutdown conditions. The non-automatic indicating lamp shall be red and shall flash to indicate that the generator set is not able to automatically respond to a command to start from a remote location.
- 7) Engine Status Information: The following information shall be available from a digital status panel on the generator set control:
- (a) Engine oil pressure (psi or kPa)
 - (b) Engine coolant temperature (degrees F or C; both left and right bank temperature shall be indicated on V-block engines)
 - (c) Engine oil temperature (degrees F or C)
 - (d) Engine speed (rpm)
 - (e) Number of hours of operation (hours)
 - (f) Number of start attempts
 - (g) Battery voltage (DC volts)
- 8) The Generator Control Panel shall monitor the status of each Automatic Transfer Switch. The monitoring for each Automatic Transfer Switch shall be:
- (a) ATS Normal Position
 - (b) ATS Emergency Position
- 9) The ATS status for each switch shall also be displayed on the Generator Remote Annunciator.
- f. Control Functions: The control system provided shall also include a cycle cranking system, which allows for user selected crank time, rest time and number of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each with 15-second rest periods between cranking periods.
- g. The control system shall include an idle mode control, which allows the engine to run in idle mode in the RUN position only. In this mode the alternator excitation system shall be disabled.
- h. The control system shall include an engine governor control which functions to provide steady state frequency regulation as noted elsewhere in this Specification. The governor control shall include adjustments for gain; damping and a ramping function to control engine speed and limit exhaust smoke while the unit is starting. The governor control shall be suitable for use in paralleling applications without component changes.
- i. The control system shall include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.
- j. The control system shall include sender failure monitoring logic, which is capable of discriminating between failed senders or wiring components and an actual failure conditions.
7. Remote Indicator Panel: The remote annunciator panel shall be surface or flush-mountable with micarta label reading "Engine Operator Conditions," and with the following devices:
- a. Green pilot light with engraving to indicate "ENGINE RUNNING."

- b. One audible alarm with silencing switch to indicate engine start failure for any of the following reasons:
 - 1) High water temperature.
 - 2) Low oil pressure.
 - 3) Over-speed.
 - 4) Over-crank.
 - 5) Low battery voltage.
 - 6) Low-level fuel alarm.
 - c. Remote indicator panel shall include an amber light indication for each of the following:
 - 1) Control switch not in auto position.
 - 2) Low water temperature.
 - 3) ATS in normal position (for each ATS).
 - 4) ATS in emergency position (for each ATS).
 - d. Each of the functions listed previously in Paragraphs 2.(a) through (f) shall be indicated by a separate red warning light and each warning light shall be so engraved.
8. Fuel System: The fuel system shall conform to NFPA 30 and 37. The fuel system shall be complete and shall consist of a dual filtering system, and engine fuel pump. The engine shall start, operate, and stop on DF-2 fuel.
- a. Fuel Filtering System: The fuel filtering system shall consist of a strainer, located between the storage tank and the fuel transfer pump, and a duplex fuel filter, located between the engine fuel pump and the engine. The filtering system shall be capable of removing from the fuel system flakes, dirt, metallic chips, carbon, water, or other foreign matter, which would be harmful to the engine. The filtering system shall be easily accessible for quick-and-easy replacement of the filter element and cleaning of the strainer. Components of the filtering system shall be the standard products of the engine Manufacturer.
 - b. Engine Fuel Pump: The engine fuel pump shall be a positive-displacement, engine-driven pump capable of supplying an adequate quantity of fuel to the engine under all operational conditions. Solenoid shut-off valve in fuel line discharge side of pump shall be interlocked with the emergency engine shutdown circuitry.
 - c. Fuel Tank: The fuel tank shall be skid mounted under the engine, and shall be capable of providing an immediate fuel supply to the engine fuel pump. The tank shall be no more than 30" high. The tank shall be provided with a flexible tubing suction line to the engine, an excess fuel return line from the engine to the tank, a fuel gauge, a vent, a drainpipe, and high and low-level float switches for activating the low-level alarms. Usable fuel tank capacity shall be as listed on the drawings. The tank shall be a full double wall, U.L. listed design and shall be factory tested in accordance with the requirements of U.L. 142. The outer containment cavity shall be equipped with an emergency leak-detection float switch for the leak detection and alarm system. The tank shall as a minimum include the following:
 - d. Primary tank venting shall be provided and shall be a minimum of 1.25" nominal inside diameter. The primary vent shall be extended thru the roof of the generator enclosure to a height not less than 12 feet above grade. The normal vent shall have a screened mushroom style cap.
 - e. Emergency relief venting shall be provided for both the primary and secondary tanks. Rain protected, open style rupture basins are not

- acceptable. These vents shall be extended thru the roof of the generator enclosure to a height of not less than 12 feet above grade. The extended emergency vents shall be capped with U.L. listed pressure relief type caps designed to open at 2.5 PSI. Materials used for vent pipes, supply and return piping, valves and fittings shall conform to Article 79, Division VII.
- f. A 5 gallon capacity overfill basin shall be provided around the fill pipe and shall include a means of draining spills back into the main tank. The fill pipe shall be extended down into the fuel tank and terminate within 6" of the bottom of the tank.
 - g. The high fuel sensor shall be wired to an audible and visual local alarm that shall be activated at 90% of the tank capacity. The alarm panel shall be mounted at the fill location and shall include a reset/silence for the alarm and light that will automatically reset the controller for the next fill. An "off switch" is not acceptable.
 - h. The tank shall include labels to indicate "Diesel Fuel". The lettering shall be 3" high, half-inch stroke, red letters on a white background outlined in red.
 - i. All of the above items shall be submitted for approval. Do not release the fuel tank for manufacture until it has been approved.
9. Output Circuit Breakers:
- a. Provide engine-generator mounted circuit breakers for each automatic transfer switch, and where indicated on the drawings one for a portable load bank, with ratings as noted on the Drawings. Breaker handles shall not exceed 6'-6" above grade when engine-generator is mounted to a 30" high base fuel tank on top of a 3 inch high structural isolation pad.
10. Weather Protective Sound Attenuated Enclosure:
- a. The generator set and accessories, including muffler, shall be completely housed in a weather protective and sound attenuated enclosure. The enclosure shall have a cambered roof to prevent rain accumulation, shall include stainless steel hardware to prohibit rust, and shall include stainless steel retainers to hold doors securely in place. The enclosure sound level shall be as specified herein. The generator set, enclosure, and sub-base fuel tank shall be U.L 2200 listed as a package.
 - b. Material used for the enclosure shall be 14-gage steel for panels and 12-gage steel for posts. Three hinged lockable access doors shall be provided on each side, with hold-open retainers as indicated in Paragraph 1 above. Non-hygroscopic sound insulating materials shall be provided on the interior walls. Rodent barriers shall be provided on inlet and outlet sides. Louvers shall be fixed. The enclosure shall attach to the sub-bases fuel tank. Oil and coolant drains shall be run to the exterior of the enclosure. Interior valves on the oil and coolant lines shall be provided for ease of service.
 - c. The enclosure shall completely house the muffler on the generator set.
 - d. Provide sheet metal scoop on radiator output, to direct the radiator exhaust air directly up and vertically out of the generator enclosure. Provide screen on output of scoop to prevent dirt, leaves, and bird incursions. Provide drain on floor of scoop to drain off any water. Provide access door in scoop for cleaning of any accumulated debris. Scoop shall be factory-mounted as part of the engine-generator package. Provide detailed shop drawings of scoop with engine-generator submittals.

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. The engine-generator set shall be mounted on a rigid steel chassis suitable for installation on seismic isolators.
- B. The Contractor shall assist the Owner in preparing and submitting a permit-to-construct application to the local Air Quality Management District for installation of the engine-generator. The Contractor shall pay for permit and permit approval fees, and the Owner shall pay for annual operational fees. Granting of such permit will require a site-specific screening application followed by an analysis by the local Air Quality Management District.
- C. Load tests shall be run as required in Paragraph 1.4 of this Section to the generator rated load after generator installation is complete. The Manufacturer shall provide auxiliary load banks for full-load testing of the generator. Manufacturer shall schedule the tests with the Owner so that final tests may be witnessed. Verify correct reading and operation of all meters, indicators and controls.
- D. Readings required during both preliminary and final tests requested in Paragraph 1.04 shall be taken and shall include the following:
 - 1. Frequency.
 - 2. Voltage.
 - 3. Current.
 - 4. Wattage.
 - 5. Ambient temperature.
 - 6. Water temperature.
 - 7. Oil pressure and temperature.
 - 8. Protection: Provide protection facilities and procedures to prevent damage and deterioration.
 - 9. Verify utility phase rotation prior to connection of the Generator to the distribution system. Modify the Generator output phase rotation to match the Utility Company.
 - 10. The Manufacturer shall perform the following fuel tank tests at the site after the installation is complete, but before the fuel is delivered. Tests shall be conducted in the presence of the Owner and shall include as a minimum the following:
 - a. Primary tank shall be pneumatically tested at 5 psig for 30 minutes; during which time the connections to the primary tank shall be soap tested.
 - b. Secondary tank shall be pneumatically tested at 3 psig for 30 minutes; during which time the connections to the secondary tank shall be soap tested.
 - c. Primary piping shall be pneumatically tested at 150 percent of the maximum operating pressure for 30 minutes; during which time all fittings shall be soap tested.
 - d. Secondary piping, if provided, shall be pneumatically tested at 5 psig for 30 minutes, with soap testing.
 - e. Other secondary containment shall be liquid tight as demonstrated by a 24-hour standing water test.
 - f. Correct operation of the leak detection system shall be demonstrated.
 - 11. The DPF manufacturer's authorized factory representative shall verify correct installation of the DPF and filter at the site prior to engine-generator start-up and

shall perform all testing and commissioning of the DPF in conjunction with the engine-generator testing after the installation is complete. Tests shall be conducted in the presence of the Owner.

3.2 INSTRUCTION AND MAINTENANCE

- A. Instruct the Owner's personnel in the proper use, operation and maintenance of the set. Review emergency provisions, including emergency access and procedures to be followed at time of failure in operation and other building emergencies. Train Owner's personnel in the procedures to be followed, checking for the source of an operational failure or malfunction.
- B. Instruct the Owner's personnel in the proper use, operation and maintenance of the DPF, including maintenance and replacement of the filters and periodic use of a portable load bank to maintain DPF in optimum condition.
- C. Maintenance Period: Starting at the date of acceptance of the Work, provide complete systematic inspection and maintenance for the first three years. Furnish trained experts and equipment to check, adjust, lubricate and otherwise maintain the generator set in operation without defects or deterioration. Replace or repair materials and parts, which become defective or deteriorated for any reason.
- D. Furnish a factory-trained Engineer for a minimum of one working day prior to final acceptance of the generator installation, or as needed to satisfy Owner that the system is functioning properly. Testing and training for the new engine-generator installation will take place at non-standard times. Training and testing will take place on weekends, and could be scheduled on holidays and in the middle of the night, at the discretion of the Owner. Provisions shall be made in the bidding for this contract for such scheduling requirements.
- E. Provide 3 year Manufacturer maintenance Contract, for the new engine-generator installation. This shall include two site visits per year and annual load-bank testing as specified in Paragraph 1.1 of this Section.

END OF SECTION

SECTION 26 36 01

AUTOMATIC TRANSFER SWITCH

PART 1 - GENERAL**1.1 WORK INCLUDED**

- A. Provide quantity of automatic transfer switch as indicated on the drawings and as specified herein.

1.2 SUBMITTALS

- A. Refer to Section 26 05 00 and Division 1 for procedure.
- B. Shop Drawings and Product Data, including complete wiring diagrams, including system interconnections.
- C. Test and Test Report for each Automatic Transfer Switch:
 - 1. Visual and Mechanical Inspection:
 - a. Inspect for physical damage.
 - b. Compare equipment nameplate information and connections with single line diagram and report any discrepancies.
 - c. Check switch to ensure positive interlock between normal and alternate sources.
 - d. Check tightness of all cable connections and bus joints.
 - e. Perform manual transfer operations.
 - f. Electrical Tests for Automatic Transfer Switch:
 - 1) Perform insulation resistance tests phase-to-phase and phase-to-ground with switch in both source positions.
 - 2) Set and calibrate in accordance with the Manufacturer's recommendations.
 - (a) Voltage-sensing relays.
 - (b) Transfer time delay relays.
 - (c) Engine shutdown relays.
 - 3) Perform automatic transfer by:
 - (a) Simulating loss of normal power.
 - (b) Return to normal power.
 - 4) Monitor and verify correct operation and timing:
 - (a) Normal voltage-sensing relays.
 - (b) Engine start sequence.
 - (c) Time delay upon transfer.
 - (d) Alternate voltage-sensing relays.
 - (e) Automatic transfer operation.
 - (f) Interlocks and limit switch function.
 - (g) Timing delay and retransfer upon normal power restoration.
 - (h) Engine shutdown feature.
 - (i) Correct functioning of auto-exercising controller.

- D. Maintenance and operating instruction manuals. Submit four bound copies including approved Shop Drawings, parts list, list of recommended spare parts, sources of purchase and similar information.

1.3 REFERENCE STANDARDS

- A. The following Specifications and standards, except as hereinafter modified, are incorporated herein by reference and form a part of this Specification to extend the indicated by the references thereto. Except where specific date is given, issue in effect (including amendments, addenda, revisions, supplements, and errata) on the bid date shall be applicable. In text such Specifications and standards are referred to by basic designation only.
- B. National Fire Protection Association (NFPA)
 - 1. No. 70 National Electrical Code (NEC)
- C. Underwriters' Laboratories, Inc. (UL):
 - 1. No. 1008 Automatic Transfer Switches
 - 2. No. 489 Molded Case Circuit Breakers
- D. National Electrical Manufacturers Association (NEMA):
 - 1. ICS 2.447 Industrial Control and Systems
- E. American National Standards Institute (ANSI):
 - 1. V37-90a Guide for Surge Withstand Capability (SWC) Tests

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. ASCO
- B. Russelectric
- C. Onan
- D. Kohler
- E. Caterpillar

2.2 AUTOMATIC TRANSFER SWITCH, GENERAL

- A. The automatic transfer switch (ATS) shall be 3-pole as indicated on the drawings and rated as indicated on the drawings. Transfer switch shall be listed and labeled under UL-1008 as a device for use on emergency generator systems. ATS shall be mounted in a Nema 3R enclosure as indicated on the drawings. ATS shall be the standard product of a company engaged in manufacturing automatic transfer switches for at least 10 years. ATS shall be manufactured so that no rear or side access is required.

2.3 CONSTRUCTION AND PERFORMANCE

- A. Transfer Switch shall consist of completely enclosed multi- pole contact assembly and a separate control logic panel. The contact assemblies shall be operated by a stored energy mechanism, and be energized only momentarily during transfer providing inherently double throw switching action. Control power for all transfer operations shall be derived from the line side of the source to which the load is being transferred.
- B. Transfer Switch shall be positively interlocked mechanically and electrically to prevent simultaneous closing of both sources under either automatic or manual operation. A neutral position shall not be possible under normal electrical operation except that the switch shall be provided with a Delayed Transition accessory for switching highly inductive loads. Transfer Switch shall have a manual neutral position for load circuit maintenance. A Transfer Switch position indicator shall be visible from the front of the switch to show to which source the transfer switch is connected.
- C. Transfer switch shall be capable of being operated manually under full load conditions. Manual operation shall be accomplished via integrally mounted pushbutton operators located on the face of the contact assemblies. Removable manual operation handles and handles which will move in the event the electrical operator becomes energized while performing a manual transfer operation are not acceptable. The manual operator shall provide the same contact-to-contact transfer time as provided under normal automatic operation to prevent possible flashovers from switching the main contacts slowly. In addition, provisions shall be provided to allow disengagement of the electrical operator during manual operation.
- D. Transfer Switch shall have four extra sets of normally open and normally closed auxiliary contacts, which indicate ATS positions.
- E. A solid state sensing and control logic panel shall be separately mounted from the power-switching portion of the Transfer Switch. The two Sections shall be connected together by control cables with plug-in connectors. The control Section shall be capable of being disconnected from the power Section for maintenance purposes.
- F. The logic circuit shall utilize differential sensing solid-state components mounted on printed circuit boards to accomplish proper operation and to perform functions such as timing and voltage and frequency monitoring. LED's on each PC card shall indicate the proper operation of each function furnished. Construction shall be such that functions cards are individually replaceable without requiring replacement of the complete solid-state package. Cards for plug-in modifications shall be available for field installation with retention of the UL label.
- G. Where indicated on the drawings, ATS shall be provided with power meter, Square D PM850 or equal, with network card for communications interface with Owner's power management system.

2.4 SEQUENCE OF OPERATION

- A. Upon reduction of phase-to-phase voltage of the normal source to 80% of nominal, and after a time delay of 1-90 seconds (adjustable to meet field conditions) to override

momentary dips and/or outages, the auxiliary engine start contacts shall close to initiate starting of the Emergency Generator.

- B. After the Generator has reached 90% of nominal voltage and frequency, and after a time delay, ATS shall transfer the load to the Generator. Provide an under-voltage / under-frequency monitor for the Emergency/Standby Source.
- C. When the Normal Source has been restored to 90% of rated voltage, and after a time delay adjustable from 0.5-30 minutes (to insure the integrity of the Normal Power Source), the load shall be retransferred to the Normal Source.
- D. A time delay module shall be provided in the ATS, adjustable 0.5-30 minutes, to delay shutdown of the Emergency/Standby Power Source after retransfers to allow the generator to run unloaded for cool-down.
- E. If the Emergency Generator should fail while carrying the load, transfer to the Normal Power supply shall be made instantaneously upon restoration of the Normal Source to satisfactory conditions.
- F. ATS shall be provided with a Delayed Transition timer, adjustable 0-120 seconds. The ATS shall pause during transfer with both sources disconnected from the load, to allow back-EMF from large inductive loads to decay. Methods, which use relative phase-angle differences to control transfer, are not acceptable.
- G. ATS shall be provided with 4 sets of Auxiliary Contacts to indicate 'Normal' or 'Emergency' Position of the ATS.

2.5 ADDITIONAL ACCESSORIES/SPARE PARTS

- A. Provide an engine exercise timer in the ATS indicated on the drawings which shall automatically start the engine periodically. Timer shall be digital, with lithium battery back up. Provide a selector switch to select exercise with load transfer or without load transfer. The timer shall include a failsafe circuit, such that if the engine fails during exercise the ATS will immediately retransfer to the Normal source.
- B. Provide pilot lights to indicate to which source the load is connected, and to indicate the availability of each power source.
- C. The transfer switch shall be rated for the short circuit currents noted on the Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Section 26 05 00 for details of Work under this Section, including seismic installation requirements.
- B. Testing: See Section 26 08 00 and Section 26 32 14.

END OF SECTION

SECTION 26 51 01

LIGHTING

PART 1 - GENERAL**1.1 WORK INCLUDED**

- A. Luminaires (i.e., lighting fixtures): Refer to the Luminaire Schedule and provide a complete and working facility Lighting System. Catalog numbers in the Luminaire Schedule are design series references and may not represent the exact catalog number as specified or as required for particular installations. Provide complete luminaires to correspond with the number of LEDs, power supply, wattage, mounting hardware, ceiling type, trim, size, and special requirements as specified in the Luminaire Schedule for each luminaire type. Additional features, accessories, and options specified, described, scheduled, or necessary for installation shall be included.
- B. LEDs and power supplies.
- C. Lighting controls, including occupancy sensors. See Section 26 57 00 for Low Voltage Lighting Control System.
- D. Exit and Emergency Egress lighting where indicated and where required.
- E. Supports for outlet boxes and luminaires, including seismic restraint slack wires for recessed luminaires in suspended ceilings per code and backing in walls as required to keep luminaires secure and level.

1.2 INCORPORATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.
- B. Section 26 05 00 and 26 27 00 apply to all work in this section.
- C. Division 03: Concrete (Bases for pole-mounted luminaires as noted in Luminaire Schedule).
- D. Division 09: Painting and Finishes (cutting of holes in finished surfaces for recessed luminaires).

1.3 RELATED WORK

- A. Ceiling Access panels where required for access to equipment, outlets, transformers, etc., located above suspended ceilings, sheet rock or plaster ceilings. Coordinate with the Architect and other trades.

1.4 SUBMITTALS

- A. Submit under provisions of Division 1 and Section 26 05 00.

- B. Submit (6) six sets of submittals for review by the project team unless otherwise noted in these specifications. The submittals shall include the following information:
1. Product Index: The following information shall be included in the product index.
 - a. Luminaire Type. The index shall list, in alphabetical order, each luminaire type per the Luminaire Schedule.
 - b. Manufacturer's Catalog Number. Outstanding information required to make a complete catalog number shall be clearly identified in the index.
 - c. Where a pole is included with the luminaire, include the catalog number of the pole in addition to that of the luminaire.
 - d. LED Data. Provide the Manufacturer's name for each LED array including wattage, color temperature, lumen output, and color rendering index.
 2. Manufacturer's literature for every luminaire listed on the Luminaire Schedule.
 - a. Catalog Information:
 - 1) Luminaire Data Sheet: The manufacturer's cut sheet shall include the following:
 - (a) Photometrics: Candlepower distribution curve or table with horizontal readings at 0, 22.5, 45, and 90 degrees and vertical readings from 0 to 180 degrees in 5 degree increments in accordance with the Illuminating Engineering Society published test procedures.
 - (b) Catalog Number Nomenclature
 - (c) Coefficient of Utilization Tables
 - (d) Luminaire Line Drawing
 - (e) Power supply (each type)
 3. Data sheets for electronic ballasts and power supplies. Indicate luminaire types on applicable ballast/power supply data sheets.
 4. Data sheets for wallbox controls and other products specified in this section.
 5. Shop Drawings:
 - a. Provide shop drawings of suspension details for luminaires recessed in, mounted on, or suspended from hung ceilings. Details shall clearly illustrate proposed methods for supporting luminaires independent of the suspended ceiling system.
 - b. Detailed shop drawings of all cove or box mounted luminaires containing the following information:
 - 1) Exact field measured length (clear inside dimension) of cove pocket or box.
 - 2) Exact luminaire length and arrangement of luminaires in cove or box.
 - c. Detailed shop drawings of pendant mounted luminaires constructed with linear metal housings containing the following information.
 - 1) Support mechanism, including swivel canopies.
 - 2) Trim details.
 - 3) Closure piece details.
 - 4) Pattern configurations.
 6. Samples:
 - a. Provide samples of luminaire trim where "Finish as selected by Architect" is indicated on the Luminaire Schedule. Submit two finish samples, 75 mm x 75 mm (3" x 3") minimum, of all custom color, decorative metal, or anodized aluminum finishes. Samples must be approved in writing by the Architect prior to ordering.
- C. For Any Luminaires Substituted For Those Specified:

1. Refer to Division 1 - Product Requirements, for all substitution procedures.
2. Provide Independent Testing Laboratories, Inc., or equal, photometric test report for each Luminaire type and lamp combination listed on the Luminaire Schedule. Test reports shall be based on Illuminating Engineering Society published test procedures and shall contain polar coordinate candlepower distribution curves in five lateral planes for luminaires with asymmetric distributions and luminaire luminance data for vertical angles above 45 degrees from nadir. Test results shall indicate luminaire efficiency for the lamp and aperture assembly specified. luminaires with efficiencies more than 2% below the values of specified luminaires are not acceptable and will be rejected.
3. Provide photometric calculations for each room or area where a substituted luminaire is proposed. Such calculations shall be made using comprehensive lighting software, such as AGI32, and include point-by-point illuminance values at IES recommended heights, average illuminance, and maximum-to-minimum and average-to-minimum uniformity ratios. Room dimensions, configurations (including sloping ceilings), room surface reflectances, light loss factors, and heights of suspended luminaires shall match the heights specified in the contract documents.
4. Due to the variety of lumen outputs and light distributions of LED Luminaires, substitutions will require additional review on the part of the Engineer or Architect to ascertain the equivalency of the substituted luminaires. Substitutions will be reviewed to determine their aesthetic, construction, and photometric equivalency to maintain similar design impact and performance in their intended environment. The Engineer and Architect have not included such unknown and unquantifiable review time in their scope of work and are not compensated by the Owner for such services. The Contractor shall reimburse the Engineer and Architect for labor costs to review substitutions.
5. Prior approval does not guarantee final approval by the Engineer. The Contractor shall be responsible for providing luminaires that meet or exceed the quality and performance of the specified products in their entirety. All deviations in quality and performance from the specified products must be listed and individually signed off by the engineer.
6. The Owner reserves the right to reject a proposed substitution based on their agent's professional judgment as to the utility, quality, performance, visual appropriateness, or finish of substitutions.

1.5 OCCUPANCY SENSORS

A. Equipment Qualification

1. Wall switch products must be capable of withstanding the effects of inrush current. Submittals shall clearly indicate the method used.
2. Contractor's work to include all labor, materials, tools, appliances, control hardware, sensor, wire, junction boxes and equipment necessary for and incidental to the delivery, installation and furnishing of a completely operational occupancy sensor lighting control system, as described herein.
3. Contractor and Contractor's Supplier shall examine all general specification provisions and drawings for related electrical work required as work under Division 26.

4. Contractor shall coordinate all work described in this section with all other applicable plans and specifications, including but not limited to wiring, conduit, luminaires, HVAC systems and building management systems.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site and store in unopened cartons in protected location. Inspect products immediately and report all damage accordingly.

1.7 GUARANTEE AND WARRANTIES

- A. All work performed under this section must be guaranteed to be free of defects in products or workmanship for one year after date of acceptance by Owner, unless noted otherwise in General Conditions.
- B. Warranties:
 1. Electronic power supplies must be warranted against failure for at least five years after date of substantial completion.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide luminaires as indicated in Luminaire Schedule; if conflict exists between Luminaire Schedule and Specifications, the more stringent requirement shall take precedence.
- B. Provide luminaires new and complete with mounting accessories, junction boxes, trims, and lamps.
- C. Provide products with UL labels appropriate to intended installation conditions, or with labels from other testing laboratories whose results are acceptable to local inspector, showing compliance with UL standards. Labels must be concealed from normal viewing angles.
- D. All products of same type by same manufacturer.

2.2 SOLID STATE LUMINAIRES

- A. Housing, where applicable:
 1. Steel bonderized or equal rust protected, or aluminum, rigid construction. Minimum gauge thickness shall be as follows:
 - a. Interior locations: No. 20-gauge steel, No. 16-gauge aluminum.
- B. Finish:
 1. Baked enamel finish (except when otherwise specified).
 - a. Concealed interior surfaces (this applies to interior hardware, circuit boards, etc.) matte black.
 - b. Concealed exterior surfaces: matte black.
 - c. Visible surfaces: color and texture as specified below for each luminaire type or as selected.

- C. Light Emitting Diode (LED) requirements:
1. Correlated color temperature (CCT) for phosphor-coated white LEDs must have one of the following designated CCTs, as specified on the Luminaire Schedule, and fall within the following binning standards.
 - a. 3000K defined as 3045 +/- 175K
 - b. 3500K defined as 3465 +/- 245K
 2. Color spatial uniformity shall be limited to variations in chromaticity for different directions (i.e. changes in viewing angle) within 0.004 from the weighted average point on the CIE 1976 (u',v') diagram.
 3. Color maintenance shall be limited to a maximum change in chromaticity of 0.007 on the CIE 1976 (u',v') diagram over the lifetime of the product.
 - a. Color rendering index: Color rendering index to be determined using ANSI C78.377-2008 and applicable IESNA standards.
 - b. Laboratory tests must be produced using specific module(s)/array(s) and power supply combination that will be used in production.
 - c. Manufacturers must provide a test report from a laboratory accredited by NVLAP or one of its MRA signatories
 4. Lumen depreciation
 - a. Lumen depreciation to be measured using IESNA LM-80-08 and TM-21-11 standard for IES approved method of measuring lumen maintenance of LED light sources.
 - b. Phosphor-coated white LED modules/arrays shall deliver at least 70% of initial lumens for a minimum of 50,000 hours when installed in-situ and operated at 100% output and the maximum specified operating temperature.
 - c. Colored LED modules/arrays shall deliver at least 50% of initial lumens for a minimum of 50,000 hours when installed in-situ and operated at 100% output and the maximum specified operating temperature.
 5. Acceptable LED manufacturers:
 - a. Cree
 - b. Nichia
 - c. Osram Opto Semiconductors
 - d. Philips Lumileds
 - e. Xicato
- D. Luminaire Efficacy:
1. Luminaire efficiency shall be measured using IESNA LM-79-08 standard for electrical and photometric measurements of solid state lighting products.
 2. Manufacturer shall provide published luminaire efficacy, which is defined as luminaire light output divided by luminaire input power measured in a 25 degree Celsius environment. Efficacy shall include power supply, thermal, optical, and luminaire losses.
- E. Thermal Management:
1. Solid state luminaire shall not exceed LED manufacturer's maximum junction temperature requirements when operated in-situ at luminaire manufacturer's maximum ambient operating temperature and 100% light output.
 2. Solid state luminaires shall be thermally protected using one or more of the following thermal management techniques:
 - a. Metal core board
 - b. Gap pad
 - c. Internal monitoring firmware

3. Solid state luminaire housing shall be designed to transfer heat from the LED board to the outside environment.
- F. Power Supplies (LED Drivers) requirements:
1. Power factor of 0.90 or greater for primary application
 2. Input current shall have Total Harmonic Distortion (THD) of less than 20%.
 3. Minimum operating temperature of minus 20 degrees Celsius or below when used in luminaires intended for outdoor applications.
 4. Operating frequency equal to or greater than 120 Hz.
 5. Operate with sustained input variations of +/- 10% (voltage and frequency) with no damage to the driver.
 6. Tolerate sustained open circuit and short circuit output conditions without damage and without need for external fuses or trip devices.
 7. Output shall be regulated to +/- 5% across published load range.
 8. Class A sound rating.
 9. Outputs shall have current limiting protection.
 10. Operate LEDs at constant and regulated current levels. LEDs shall not be overdriven beyond the diode manufacturer's specified nominal voltage and current.
 11. Inrush currents not exceeding peak currents specified in NEMA 410.
- G. Solid State Lighting Controls:
1. Control interface to dimmable power supplies shall consist of one of the following:
 - a. Line Voltage Dimming. Controls to be rated for magnetic or electronic low voltage transformer operation.
 - b. Low voltage (0-10V) control. Controls to be compatible with either current sink or current source operation.
 2. Dimmable LED power supplies shall use pulse width modulation (PWM) or constant current reduction (CCR) to regulate power to LEDs.
 - a. PWM power supplies shall have 12-bit or greater resolution to obtain flicker-free operation throughout their dimming range.
 - b. PWM power supplies shall be provided in luminaires that will be dimmed lower than 40% and must maintain consistent color temperature.
 - c. CCR power supplies shall be provided in areas that have strict electromagnetic interference (EMI) requirements, high motion activity, or rotating machinery.
- H. System Installation
1. Hardwired connections to solid state luminaires shall be reverse polarity protected and provide high voltage protection in the event connections are reversed or shorted during the installation process.
 2. All solid state luminaires (100% of each lot) shall undergo a minimum eight-hour burn-in test during manufacturing. Solid state lighting installations shall be UL Listed as a low-voltage lighting system including, but not limited to, luminaire, power supply, controller, keypad, and wiring.
- I. Warranty
1. Luminaires, drivers, and controllers for solid state lighting systems shall be covered by a five-year warranty against defects in workmanship or material. Warranty shall include in-warranty service program providing for payment of authorized labor charges incurred in replacement of inoperative in-warranty equipment.

2.3 LUMINAIRE CONSTRUCTION

- A. Sheet metal: materials and thicknesses shall be 20 gauge (0.7 mm or 0.027") min., free of dents, scratches, oil-can, or other defects.
- B. Painted luminaires: exposed weld marks, joints, and seams shall be filled and sanded smooth before finishing.
- C. All edges cleaned and dressed to remove sharp edges or burrs.
- D. Extrusions: 1/10" min. wall thickness, smooth and free of tooling lines, with cast end plates that exactly match extrusion profiles.
- E. Castings: smooth, free of pits, scales, gate marks, or blemishes.
- F. Spinings shall have 1/32" min. thickness, smooth, free of spinning lines or blow-back, with clean edges.
- G. Welds: Follow recommendations of American Welding Society. All welds continuous and free of spatter, residue, or warping.
- H. No light leaks visible in finished room. Ensure that downlight housings mounted in wood slat ceilings are not visible from below. Field paint exterior of housing with high temperature paint if necessary.
- I. Exposed end plates and joiners, with concealed fasteners.
- J. End-to-end mounted luminaires: Verify row configurations and provide joiners, aligning splines, and trims to suit.
- K. Hardware:
 - 1. Steel or aluminum interior luminaires: cadmium-plated hardware.
 - 2. Steel or aluminum exterior luminaires: stainless steel hardware.
 - 3. Stainless steel luminaires: stainless steel hardware.
 - 4. Copper alloy luminaires: brass hardware.
- L. Raceways: Where used for through wiring, luminaires must be approved for use as raceways.

2.4 RECESSED LUMINAIRES

- A. Point-source luminaires: provide pre-wired junction box and thermal protection, and provide slack wires to structure at two diagonal corners.
- B. Troffer luminaires: provide hold-down clip at each luminaire corner, and slack wires to structure as detailed on the drawings. The detail will take precedence.
- C. Verify ceiling construction details and provide luminaire housings and trims to suit.
- D. Non-accessible ceilings: Provide access to junction boxes, ballasts, transformers, and battery packs through luminaire apertures; no access panels in ceiling.
- E. Mounting frames: To prevent rusting, provide galvanized steel or cast aluminum frames for installation in damp locations or in plaster ceilings.
- F. Adjustable luminaires shall be provided with rotation and tilt locking devices.

2.5 PENDANTS

- A. Stem-mounted: 16 mm (5/8") max. o.d. stem with ball swivels at top (and bottom of linear luminaires) to permit 45 degree swing in any direction from vertical. Flat canopy to permit splice inspection after installation. Pendants must permit +/- 13 mm (1/2") threaded vertical adjustment after installation, leaving at least 6 mm (1/4") thread contact at all points.
- B. Provide internal safety cable from luminaire body to stud in outlet box.
- C. Cable-mounted: 1 X 7 strand 3/32" diameter stainless steel aircraft cable, factory crimped, independently tested and verified to exceed 1500 pounds.
 - 1. Verify mounting heights for each luminaire and provide cable lengths and coordinate cord lengths with manufacturer as required prior to ordering luminaires. Provide aircraft cable adjuster nipple with locking jaws.
- D. Supports: Carry luminaire weight to structure and provide horizontal bracing from suspension points to ceiling framing to prevent sideways shifting. Provide diagonal seismic restraint wires per code.

2.6 TRIMS

- A. Trims must fit tightly and be held in by gravity, spring clips, or mechanical fasteners. Trims must not drop out under normal conditions or seismic forces which do not exceed the design criteria of the building.
- B. Aluminum parabolic cones shall be smooth, properly shaped, with Alzak finish in colors as indicated.
 - 1. No hot spots or lamp images visible at angles shallower than lamp shielding angle.
 - 2. Self-flange cones must bend parallel to ceiling and cover ceiling hole without additional trim ring. Unpainted flange, shall have the same finish as cone interior.
 - 3. Cones and louvers for fluorescent luminaires must have permanent anti-iridescence treatment.
- C. Lenses, diffusers, and patterned glass: glass or virgin acrylic as noted, with patterns as noted.
 - 1. Finished thickness 2 mm (1/10") min. unless noted otherwise.
 - 2. Linear runs over 1200 mm (4'-0") long shall be in equal-length pieces.

2.7 FINISHES

- A. Steel Reflectors: Unless otherwise specified, the reflector surface finish shall be of synthetic white enamel or polyester powder coating. Finish shall show no indication of chipping, cracking, flaking or any other sign of loss of adhesion. The initial reflection factor shall be not less than 88 percent averaging 5 randomly selected points on the reflector. After 100 hours of exposure to the radiation of a glass enclosed carbon arc lamp, such as a Fade-O-Meters, the reflectance of the exposed portion shall not be less than 5 percent and finish shall show no appreciable color change. The carbon arc lamp shall be operated at appreciable color change. The carbon arc lamp shall be

operated at 13 plus or minus 0.5 amperes at 140 volts. The reflector shall be placed ten inches from the arc and the lamp so ventilated that the temperature of the exposed portion does not exceed 105 degrees F.

- B. Aluminum Reflectors: Reflecting surfaces shall be provided with either a specular or diffuse finish as indicated. Reflection factors shall be not less than 83 percent for specular reflecting surfaces. Each reflecting surface shall be protected by dense coating of oxide weighing not less than 5.0 milligrams per square inch, applied by an anodic process. The reflector shall be given a sealing treatment that will prevent staining of the reflecting surface when subjected to a stain test. All aluminum reflectors & louvers shall be a low iridescent equivalent to that provided by Coil Anodizers.
- C. Non-Reflecting Surfaces: Unless otherwise specified, the finish on all non-reflecting exterior surfaces shall be aluminum oxide or aluminum; white, gray or aluminum paint on steel; nickel or chromium plating on copper alloy. Fastening devices shall be nickel, chromium, cadmium or zinc plated. All painted surfaces shall be free of tears, star marks, blisters, pinholes, chipping and any other defects that may impair appearance or serviceability.

2.8 LAMPS

- A. Relamp luminaires or replace LED boards and power supplies at no cost to owner if lamps or LEDs exhibit color variation, flicker, or burn out within 90 days of substantial completion date.
- B. LEDs:
 - 1. LED quantity, wattage, and color temperature as specified for each LED luminaire.
 - 2. 3500 deg. K color temperature for interior luminaires, 3000 deg. K for exterior luminaires, unless otherwise specified.

2.9 DRIVERS AND TRANSFORMERS

- A. General:
 - 1. Verify input voltages and match to branch circuit voltages.
 - 2. Remote drivers or transformers: Provide suitable enclosures and mounting hardware, and install in accessible, ventilated locations.
 - a. Secondary wiring: provide number and size of conductors as required, with 3% max. voltage drop between transformer and last lamp.
 - b. Keep transformers at least 300 mm (12") apart and do not stack vertically.
- B. LED Drivers:
 - 1. High power factor, thermally-protected.
 - 2. Compatible with LED lamps being used.
 - 3. Capable of dimming LED source without perceptible flicker or stroboscopic effects.

2.10 EMERGENCY LIGHTING AND EXIT SIGNS

- A. Emergency lighting:

1. Provide lighting for paths of egress as required by Code.
- B. Emergency lighting to consist of wall or ceiling mounted (normally off) lamp head units with battery back-up for 90 minutes of egress lighting output.
- C. Description of Systems:
 1. Auxiliary battery packs mounted integral to luminaires shall provide no less than 1400 lumen output for a minimum of 90 minutes.
 2. Surface mounted luminaire with two (2) reflector-type LED lamps on emergency battery with 90 minute operation.
- D. Auxiliary Battery Pack/Ballasts for LED Luminaires:
 1. Pure lead or nickel-cadmium, sealed and maintenance-free.
 2. Automatic transfer to battery power if supply voltage drops below 75% of normal.
 3. Must provide at least 87-1/2% or rated battery voltage for 90 minutes minimum.
 4. Internal circuitry to provide continuous "trickle" charge and to prevent deep discharge below 80% of rated battery voltage.
 5. Full recharge within 24 hours after restoration of normal power.
 6. Charge indicator light visible and test switch operable without tools.
 7. Concealed inside luminaire or above ceiling, but replaceable through luminaire aperture.
 8. Designed to run one or two lamps per luminaire with minimum of 1400 lumen output.
 9. Acceptable manufacturers: Bodine, Dual-Lite, Emergi-Lite, Lithonia, Radiant, Siltron.
- E. Recessed emergency luminaire:
 1. Cold rolled steel housing.
 2. 12v sealed permanent magnet type motor with 30 yr. Service life.
 3. Solid state electronics.
 4. Integral test switch and pilot light to indicate charge rate.
 5. Acceptable manufacturers: Concealite.
- F. Exit signs shall be edge or back lit LED, surface-mounted on ceiling or wall, with integral battery packs as described above.
 1. Fabricated aluminum construction, no light leaks around canopy. Plain box, with no decorative trim.
 2. Letters shall be 20mm (3/4") stroke, 150 mm (6") high, with concealed knockouts for left or right arrows, brightness and evenness of illumination per code, green color.
 - a. Battery pack contained in basic luminaire housing. No add-on packs or canopies.
 - b. Green LED lamps located at interior perimeter for indirect illumination of stencil letters.
 - c. Provide finish as specified in the Luminaire Schedule.
 - d. Knock out the arrows as indicated on the plans.
- G. Emergency luminaires supplied by a separate emergency power source.
 1. For luminaires supplied by a separate emergency power source, provide "switched" control of the emergency designated lamps to allow complete "off" control when required by the user. The switched control shall include an automatic transfer feature to automatically turn "on" the emergency designated lamps upon the normal source power failure.

2. Automatic control function shall be provided using a UL 924 listed relay, LVS Inc. #EPC-A or equal, suitable for mounting in a standard 4" square j-box (min. 2.5" deep). Control relay shall provide automatic diagnostic test feature which shall maintain power to the emergency designated lamps for 15 seconds after the room is switched off via the respective light switch or control relay. Emergency designated lamps shall turn off after the 15 second test period and shall come back on when the control device is turned back on to restore full lighting to the space.
 3. Provide (1) control module per "switched" zone.
- H. Emergency luminaires supplied by a dimmer panel and/or emergency source.
1. For luminaires supplied by a dimmed power source, provide "dimmed" control of the emergency designated lamps to allow normal dimming control with the normal lamps. The dimmed control shall include an automatic transfer feature to automatically turn "on" the dimmed lamps to full light output upon the normal source power failure.
 2. Automatic transfer function shall be provided using a UL 924 listed relay, LVS Inc. #EPC-D (2-wire dimmed), #EPC-D-U (3-wired dimmed) or equal, suitable for mounting in a standard 4" square j-box (min. 2.5" deep).
 3. Provide (1) transfer module per "dimmed" zone.

2.11 WALL-BOX DIMMERS

- A. Provide dimmer controls as specified on the drawings and in Specifications Section 26 57 00.
- B. Ganging and Labeling:
1. Dimmers and matching switches in same location shall be installed in same gang box.
 2. Follow dimmer manufacturer's instructions for gang-box sizes. Do not break off fins on dimmers unless noted otherwise.
 - a. 1+1, 4+1, 7+1 installation: to gang an even number of small devices without breaking off fins, provide multi-gang box as indicated (1, 4, or 7 gangs) and provide additional single-gang box at end, with ears of single box 70 mm (2-3/4") o.c. from last set of ears on multi-gang box.
 - b. When rows of devices are stacked vertically space rows 230 mm (9") o.c. to allow heat dissipation.
 3. Provide Lutron multi-gang plates to cover each group of devices.
 4. Plates with "-NFB" in catalog number with no fins broken.
 5. Plates with "-FB" in catalog number: break off all interior fins on devices, but do not break off outside fins at either end of row.
 6. Nova-T: install aligning backplate (provided by Lutron with each multi-gang plate) between wall and devices.
 7. Labels: text as indicated 3 mm (1/8") high, all capital letters, engraved on device faceplate, filled with black paint and wiped clean.

2.12 OCCUPANCY SENSORS

- A. General
1. Wall switch sensors shall be capable of detection of occupancy at desktop level up to 300 square feet, and gross motion up to 1000 square feet.

2. Wall switch sensors shall accommodate loads from 0 to 800 watts at 120 volts; 0 to 1200 watts at 277 volts and shall have 180° coverage capability.
3. Wall switch products shall utilize Zero Crossing Circuitry which increases relay life, protects from the effects of inrush current, and increases sensor's longevity.
4. Wall switch sensors shall have no leakage current to load, in manual or in Auto/Off mode for safety purposes and shall have voltage drop protection.
5. Where specified, wall switch sensors shall provide a field selectable option to convert sensor operation from automatic-ON to manual-ON.
6. Where specified, vandal resistant wall switch sensors shall utilize a hard lens with a minimum 1.0mm thickness. Products utilizing a soft lens will not be considered.
7. Passive infrared sensors shall utilize Pulse Count Processing and Digital Signature Analysis to respond only to those signals caused by human motion.
8. Passive infrared sensors shall utilize mixed signal ASIC which provides high immunity to false triggering from RFI (hand-held radios) and EMI (electrical noise on the line), superior performance, and greater reliability.
9. Passive infrared sensors shall have a multiple segmented Lodif Fresnel lens, in a multiple-tier configuration, with grooves-in to eliminate dust and residue build-up.
10. Where specified, passive infrared and dual technology sensors shall offer daylighting foot-candle adjustment control and be able to accommodate dual level lighting.
11. Dual technology sensors shall be corner mounted to avoid detection outside the controlled area when doors are left open.
12. Dual technology sensors shall consist of passive infrared and ultrasonic technologies for occupancy detection. Products that react to noise or ambient sound shall not be considered.
13. Ultrasonic sensors shall utilize Advanced Signal Processing to adjust the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout controlled space.
14. Ultrasonic operating frequency shall be crystal controlled at 25 kHz within $\pm 0.005\%$ tolerance, 32 kHz within $\pm 0.002\%$ tolerance, or 40 kHz $\pm 0.002\%$ tolerance to assure reliable performance and eliminate sensor cross-talk. Sensors using multiple frequencies are not acceptable.
15. All sensors shall be capable of operating normally with electronic ballasts, PL lamp systems and rated motor loads.
16. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.
17. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Settings shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.
18. In the event of failure, a bypass manual override shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly or control shall divert to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.
19. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.
20. Where specified, sensor shall have an internal additional isolated relay with Normally Open, Normally Closed and Common outputs for use with HVAC control, Data Logging and other control options. Sensors utilizing separate components or specially modified units to achieve this function are not acceptable.

21. All sensors shall have UL rated, 94V-0 plastic enclosures.
- B. Circuit Control Hardware - CU
 1. Control Units - For ease of mounting, installation and future service, control unit(s) shall be able to externally mount through a 1/2" knock-out on a standard electrical enclosure and be an integrated, self-contained unit consisting internally of an isolated load switching control relay and a transformer to provide low-voltage power. Control unit shall provide power to a minimum of two (2) sensors.
 2. Relay Contacts shall have ratings of:
 - a. 13A - 120 VAC Tungsten
 - b. 20A - 120 VAC Ballast
 - c. 20A - 277 VAC Ballast
 3. Control wiring between sensors and controls units shall be Class II, 18-24 AWG, stranded U.L. Classified, PVC insulated or TEFLON jacketed cable suitable for use in plenums, where applicable.
 4. Minimum acceptable wire gauge from the circuit control hardware relays shall be #14 AWG.
- C. Acceptable Manufacturers
 1. The Watt Stopper, or Pre-Approved Equal: For pre-approval, provide all the information listed under "submittals" a minimum of ten (10) working days prior to initial bid date.
 2. The listing of any manufacturer as "acceptable" does not imply automatic approval. It is the sole responsibility of the Contractor to ensure that any price quotations received and submittals made are for sensors that meet or exceed the specifications and the requirements of the contract documents.
 3. Products
 - a. All products shall be Watt Stopper product numbers:
 - 1) Ceiling sensors: WT-605, WT-600, WT-1105, WT-1100, WT-2205, WT-2200, WT-2250, WT-2255, W-500A, W-1000A, W-2000A, W-2000H, WPIR, DT-200, DT-205, CX-100, CX-105, CI-200, CI-205
 - 2) Wall sensors: WI-200, WS-120/277, WA-100, WD-170, WD-180, WD-270, WD-280
 - 3) Power and Slave Packs: B120E-P, B277E-P, C120E-P, C277E-P, S120/277-P, AT-120, AT-277

PART 3 - EXECUTION

3.1 PREPARATION

- A. Architectural Reflected Ceiling Plans and Elevations shall govern exact location and mounting conditions for all luminaires. Contractor shall coordinate luminaire mounting and compatibility with ceiling construction and other trades.
- B. Coordinate work with other trades. Location of lighting has priority over location of new framing (except major structural members), ducts, diffusers, sprinklers, speakers, smoke detectors, and other obstructions.
- C. If obstructions are encountered which prevent installation of luminaires according to drawings, notify Architect immediately and do not proceed until conflict has been resolved.

- D. Coordinate the location of luminaires in mechanical or unfinished spaces. Locations shown on Drawings may be adjusted by the Contractor to suit conditions. Install luminaires to avoid obstructions and maximize light output, 2100 mm (7'-0") min. mounting height.
- E. In Elevator Machine Rooms, locate the luminaires so that the illumination level at the floor is not less than 200 lx (19 fc). Illuminate areas in front of and behind (if accessible) controllers, machines and other elevator equipment.
- F. In Elevator Pits, locate the luminaires so that the illumination level at the pit floor is not less than 100 lx (10 fc).
- G. Coordinate the location of any exposed conduit used to feed luminaires with the Architect prior to installation.

3.2 INSTALLATION

- A. General:
 - 1. Contractor shall be responsible for handling and installation of luminaires including all supports, hangers and hardware necessary for a complete installation. Luminaires shall be clean, plumb, level in straight lines, without distortion. Luminaires must be installed so they do not shift during relamping or adjustment. Remedy any light leaks which may develop after installation of recessed or enclosed luminaires.
 - 2. Install luminaires at locations and heights as indicated, in accordance with luminaire manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation", NEMA standards, and with recognized industry practices to ensure that luminaires fulfill requirements.
 - 3. Point-source luminaires shall be located as dimensioned, or in center of tile or on tile joint as drawn; 6 mm (1/4") max. off-center tolerance.
 - 4. Linear luminaires shall have 3 mm (1/8") max. horizontal or vertical alignment variation in any 5 m (16-ft.) portion of run.
 - 5. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torqueing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Std. 486 A and B, and the National Electrical Code.
 - 6. Clean luminaires of dirt and construction debris upon completion of installation. Clean fingerprints and smudges from lenses.
 - 7. Remove and replace luminaires that may have been damaged during construction at no additional cost to the Owner.
 - 8. Protect installed luminaires from damage during remainder of construction period.
 - 9. Provide equipment grounding connections for luminaires as indicated. Tighten connections to comply with tightening torques specified in UL 486 A to assure permanent and effective grounds.
 - 10. Install luminaires, lamps, lenses, etc., after building is enclosed, weather tight and environmental conditions are nominally the same as expected for the complete spaces. All lenses, glass, reflectors, and refractors shall be clean and free of chips, cracks, and scratches.

11. All wall mounted luminaires and all ceiling mounted surface luminaires including exit lights shall be fed through a luminaire Stud/Hickey/Nipple assembly and with provisions to prevent luminaire turning.
 12. Installation of exit signs shall be coordinated with other trades to ensure signs are visible as intended.
 13. All junction box cover plates for the lighting branch circuit system shall be clearly marked with a permanent ink felt pen identifying the branch circuit and control relay (panel number, circuit number, lighting control cabinet designation and control relay number) contained in the box.
 14. Provide permanently affixed adhesive labels with machine printed lettering (min. 1/8" high) at junction boxes serving luminaires that are supplied by (2) electrical sources (i.e. normal and emergency lighting). Label to read "CAUTION - This luminaire is powered by (2) separate sources. The normal power source breaker and the emergency power source breaker must be turned off before servicing this luminaire."
- B. Recessed Luminaires:
1. The contractor shall verify the fire rating of the ceiling system and wall in which the luminaires are to be mounted. Where luminaires are installed in fire rated ceilings or walls, provide fire rated enclosures around and over luminaires to maintain ceiling fire rating. No additional cost shall be allowed for failure to include such enclosures and installation in the bid.
 2. Holes for Recessed Point-Source Luminaires: Cut holes to follow luminaire housings exactly so no gaps will be visible after trims are installed.
 3. Install bottom of housing aligned with finished ceiling.
 4. Keep ceiling insulation at least 75 mm (3") away from luminaires. Exception: luminaires with insulated contact (IC) rating shall be permitted to be in contact with insulation.
 5. Install trims after painting of spaces. Install trims tightly, with no gaps or light leaks.
 6. Seismic restraints: Provide and install slack wires and hold-down clips per code.
 7. Wallwashers:
 - a. Orient wallwasher housings according to manufacturer's instructions to maximize brightness on the upper portion of the wall.
- C. Ceiling-Mounted and Pendant Luminaires:
1. Provide support for outlet boxes and suspension points so luminaires can be installed securely, including seismic supports per code.
 - a. Luminaire weight less than 23 kg (50 lb) at each suspension point: hang from strap or stud on outlet box, or at non-feed points, provide 1/4"-20 stud projecting 20 mm (3/4") below ceiling.
 - b. Luminaire weight 23 kg (50 lb) or more at each suspension point: hang directly from structure, either independent of outlet box or from stud extending through outlet box to structure, unless the outlet box is listed for not less than the weight to be supported. Boxes used as the sole support of luminaires weighing more than 50 pounds must be listed and marked by the manufacturer with the maximum weight.
 2. Pendants:
 - a. Provide horizontal bracing from suspension points to ceiling framing to prevent sideways shifting.
 - b. Provide diagonal seismic restraint wires above ceiling per code.

- c. Furnish suspended luminaires with universal joint type hanger canopy (and longitudinal sway adapter at each stem connection point for linear luminaires), to permit 45 degree swivel on 360 degree circle from Nadir at canopy (and 45 degree longitudinal movement at sway adapter).
 - d. Luminaires over 450 mm (18") wide shall be provided with supports at all corners.
 - e. Install pendants plumb and level.
 - f. Verify luminaire weights and provide backing in ceiling as required.
- D. Wall-Mounted Luminaires:
- 1. Mounting heights shown on Drawings are measured from finished floor to centerline of outlet box or recessed housing, unless otherwise noted.
 - 2. Verify luminaire weights and provide backing in wall as required. Luminaires must not droop or tilt away from wall.
 - 3. Wet locations: install sealant between luminaire and outlet box.
 - 4. In circulation areas, wall-mounted luminaires must not project more than 100 mm (4") from wall if mounted above 685 mm (27") and below 2030 mm (80").

3.3 LIGHTING CONTROLS

- A. Install controls so that all operable parts are at 48 inches (1220 mm) maximum height.
- B. Lighting controls to include occupancy sensors in most spaces (for local control) and relay system lighting control for larger common spaces as indicated on the drawings.
- C. Occupancy sensors shall initially be set as follows:
 - 1. Maximum sensitivity.
 - 2. Maximum time delay (or 30 minutes).
 - 3. Manual-on operation.
 - 4. Automatic off operation.
 - 5. Aim all adjustable sensors to properly cover room areas.
- D. Timeclock System shall initially be set to control the low voltage relays as per the Relay Panel Schedule LCP.
 - 1. Assign all interior relays to an automatic off sweep, with flick warn (except those noted as "NL"). Off time shall be set to an Owner-determined time in the evening, after dark or normal business operations.
 - 2. Off signals to may originate from BAS system, which shall be inter-connected to the Lighting Control System where indicated on the drawings.
 - 3. Assign all interior relays noted as "NL" to be on 24 hours per day. No automatic relay operation.
 - 4. Assign "after hours" and "Weekend / Holiday" hours to match normal business calendar and times.
 - 5. All interior relays shall be allowed to be overridden by use of the local dataline switches for a maximum of 2 hours (per Title 24) when used after hours or on Weekends / Holidays. If used during these times, automatic shut-off shall re-activate at the end of the 2-hour period.
 - 6. All interior relays shall be allowed to be overridden by use of the local dataline switches when used during normal business hours. Standard timeclock operation shall resume with the next scheduled timeclock function for each relay.

7. Assign all exterior relays for automatic on operation with the astro-dial feature, set to 30 minutes before sunset. Latitude = 37.5 degrees North / Longitude = 122 degrees West.
8. Assign exterior relays noted as "astro-on, astro-off" for automatic off operation with the astro-dial feature, set to 30 minutes after sunrise. Latitude and Longitude as noted above.
9. Assign exterior relays noted as "astro-on, timeclock-off" for automatic off operation with the normal timeclock feature, set to an owner determined time in the late evening.
10. Assign exterior relays noted as "NL" or "On All Night" for astro-dial operation, for automatic on 30 minutes before sunset and automatic off 30 minutes after sunrise.

3.4 DELIVERY, STORAGE, & HANDLING:

- A. Deliver luminaires in factory-fabricated containers or wrappings, which properly protect luminaires from damage. Inspect luminaires immediately upon delivery to ensure correct shipment without damage.
- B. Store luminaires in original packaging. Store inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity, laid flat and blocked off ground.
- C. Handle luminaires carefully to prevent damage, breaking, and scoring of finishes. Do not install damaged units or components; replace with new. Protection wrapping on louvered (parabolic) luminaires shall not be removed until luminaires are ready for operation.

3.5 SEQUENCING AND SCHEDULING:

- A. General:
 1. Coordinate with other work including wires/cables, electrical boxes and fittings, and raceways, to properly interface installation of luminaires with other work.
 2. Sequence lighting installation with other work to minimize possibility of damage and soiling during remainder of construction.

3.6 PROJECT CLOSEOUT

- A. Clean luminaires and remove plaster and paint spatters.
- B. Clean fingerprints and dust from downlight reflectors. Refer to manufacturer's instructions.
- C. Verify that luminaires and controls are working at time of final acceptance by Owner.
 1. Repair or replace lighting control devices that are inoperable.
 2. Repair or replace LED modules or entire LED luminaires that are inoperable.
 3. Repairs and/or replacements shall be at no additional cost to the Owner.
- D. Test emergency lighting system for 90 minutes in presence of Owner's representative, check each luminaire for proper operation at end of 90-minute test, then recharge for 24 hours and briefly test each luminaire again for proper operation.

- E. Install and aim adjustable lighting as directed by Architect.
 - 1. Provide personnel, lifts, ladders, and walkie-talkies as required.
 - 2. Aiming will occur at night, outside of normal working hours, at times as approved by the Architect.
- F. Prepare two copies of a Lighting Systems Maintenance Manual consisting of the following in a hardcover binder. Deliver to Architect. After review, Architect will deliver one copy to Owner.
 - 1. One complete set of approved submittals, including product data and shop drawings.
 - 2. Luminaire cleaning instructions, including chemicals to be used or avoided.
 - 3. Instructions for code-required testing and maintenance of emergency lighting system.

END OF SECTION

SECTION 26 57 00

LOW VOLTAGE LIGHTING CONTROL SYSTEM

PART 1 - GENERAL**1.1 SYSTEM DESCRIPTION**

- A. Furnish all labor, materials, apparatus, tools, equipment transportation, temporary construction and commissioning services as indicated on the Drawings or described in these Specifications and as required to make a complete working facility lighting control system.
- B. Integrated Low Voltage Lighting Control System:
 - 1. The low voltage lighting control system shall consist of switches, digital occupancy sensors, daylighting sensors, room controllers, relay panels, wireless network bridges, wireless border routers, and LMCS system configuration software.
 - 2. The system shall accept program changes from the LMCS system configuration software for date and time, location, holidays, event scheduling, button binding and group programming.
- C. Requirements are indicated in Section 26 27 00 for raceways and electrical boxes and fittings required for installation of control equipment and wiring.
- D. Provide CBC 2022 compliant seismic installation. See Section 26 05 00 for all certification and submittal requirements.

1.2 INCORPORATED DOCUMENTS

- A. Sections 26 05 00, 26 27 00, 26 51 01 and 26 56 01 apply to all Work in this Section.
- B. Integrated Automation Control of HVAC- Integrated Automation. Building integrator shall provide integration of the lighting control system with Building Automation Systems.
- C. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of lighting control equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer Qualifications: Installer shall be one who is experienced in performing the Work of this Section, and who has specialized in installation of Work similar to that required for this project.
- C. Component Pre-testing: All components and assemblies are to be factory pre-tested prior to installation.

- D. System Support: Factory applications engineers shall be available for telephone support.
- E. NEC Compliance: Comply with NEC as applicable to electrical wiring Work.
- F. NEMA Compliance: Comply with applicable portions of NEMA standards pertaining to types of electrical equipment and enclosures.
- G. UL Approvals: Remote panels are to be UL listed under UL 916 Energy Management Equipment and/or UL 508 Industrial Control Equipment.
- H. CSA Approvals: Remote panels are to be CSA listed.
- I. FCC Emissions: All assemblies are to be in compliance with FCC emissions Standards specified in Part 15 Subpart J for commercial and residential application.
- J. All System components shall be California Title 24 compliant, where applicable.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 33 00 and 26 05 00.
- B. Submit under provisions of Sections 01 33 00 and 26 05 00.
 - 1. Bill of Materials: Complete list of all parts needed to fully install selected System components.
 - 2. Shop Drawings: Submit dimensional Drawings of all lighting control system components and accessories.
 - 3. One Line Diagram: Submit a one-line diagram of the system configuration.
 - 4. Typical Wiring Diagrams: Submit typical wiring diagrams for all components including, but not limited to, relay panels, relays, room controllers, digital low voltage switches, digital occupancy sensors, digital daylighting controls, and border routers.

1.5 MANUFACTURERS

- A. Integrated Low Voltage Lighting Control System:
 - 1. The basis of the specified system is the Watt Stopper Digital Lighting Management (DLM) or an equal. Any other system to be considered must submit descriptive information 10 days prior to bid.
- B. Prior approval does not guarantee final approval by the electrical engineer. The contractor shall be completely responsible for providing a system meeting this specification in its entirety. All deviations from this specification must be listed and individually signed off by the engineer.
- C. The Owner reserves the right to reject a proposed substitution based on his agent's professional judgment as to the utility, visual appropriateness, or finish of substitutions.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials in Manufacturer's original, unopened, undamaged packages with intact identification labels.

- B. Storage and Protection: Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation

1.7 GUARANTEE AND WARRANTIES

- A. All Work performed under this Section must be guaranteed to be free of defects in products or workmanship for one year after date of acceptance by Owner, unless noted otherwise in General Conditions.
- B. Products Warranty: Manufacturer shall provide a 5 year limited warranty on products within this installation, except where otherwise noted, and consisting of a one for one device replacement.

PART 2 - PRODUCTS

2.1 DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM

- A. Equipment Required: Lighting Control and Automation system as defined under this section covers the following equipment.
 - 1. Digital Lighting Management (DLM) local network: Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.
 - 2. Wireless Network Bridge and Border Router: Provides Wireless Network Bridges that automatically create BACnet objects for all DLM devices on their local network (room) and communicate that information over a standalone wireless mesh 6LoWPAN network to a Border Router. The Border Router manages the formation and communication of the mesh network, and provides an ethernet network connection to upstream intelligent devices, such as a Segment Manager.
 - 3. Programming and Configuration Software: Optional PC-native application capable of accessing DLM control parameters within a room, for the local network, via a USB adapter, or globally, for many segment networks simultaneously, via BACnet/IP communication.
- B. Local Network LMRJ-Series: DLM local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building.
 - 1. Digital room devices connect to the local network using pre-terminated Cat 5e cables with RJ-45 connectors, which provide both data and power to room devices. Systems that utilize RJ-45 patch cords but do not provide serial communication data from individual end devices are not acceptable.
 - 2. If manufacturer's pre-terminated Cat5e cables are not used for the installation each cable must be individually tested and observed by authorized service representative following installation.

2.2 DIGITAL SWITCHES / DIMMERS

- A. Description
 - 1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration. Wall switches shall include the following features

2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
 3. Configuration LED indicator light on each switch that blinks to indicate data transmission.
 4. Load/Scene Status LED indicator light on each switch button with the following characteristics:
 - a. Bi-level LED
 - b. Dim locator level indicates power to switch
 - c. Bright status level indicates that load or scene is active
 5. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.
 6. All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.
 7. Two RJ-45 ports for connection to DLM local network.
 8. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration shall be required to achieve multi-way switching.
 9. Switches shall be constructed of non-breakable Lexan on all exposed parts and shall include a matching screwless Lexan wall plate.
 10. Individual buttons shall be custom engraved with a maximum of 15 characters (including spaces) on two lines, where shown on plans.
 11. Multiple digital switches wired to control the same relay or relay group shall indicate the same status automatically.
- B. WattStopper product numbers: LMSW-210, LMSW-211, LMSW-220, LMSW-222, LMSW-241, LMSW-250.
- C. Description
1. Intelligent digital switching shall be operating on the DLM Category 5e local network. Switches shall be available in single, dual, quad, or octal (1-button, 2-button, 4-button, or 8-button) designs. All devices shall mount in a standard single-gang box
 2. Each button in a switch can be individually programmed. Programming is done by the LMCT-100 handheld configuration tool. Each button can control any one of the following options:
 - a. Any individual relay in any single panel.
 - b. Any group of relays in any single panel.
 - c. Any group of relays in the system.
- D. Features
1. Each switch shall also include a locator light illuminating the switch for easy location in the dark.

2.3 DIGITAL OCCUPANCY SENSORS

- A. Description
1. Digital Occupancy Sensors - Self-configuring, digitally addressable and calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.

2.4 DIGITAL PHOTOSENSORS

A. Description

1. Digital Photosensors - Single-zone closed loop, multi-zone open loop and dual-loop daylighting sensors with two-way active infrared (IR) communications can provide switching, bi-level, tri-level or dimming control for daylight harvesting.

2.5 DIGITAL DIMMING / SWITCHING ROOM CONTROLLERS

A. Description

1. Digital controllers for lighting and plug loads automatically bind the room loads to the connected devices in the space without commissioning or the use of any tools. Room and plug load controllers shall be provided to match the room lighting and plug load control requirements. The controllers will be simple to install, and will not have dip switches or potentiometers, or require special configuration for standard Plug n' Go applications. The control units will include the following features.
2. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
3. Simple replacement - Using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf.
4. Multiple room controllers connected together in a local network must automatically prioritize each room controller, without requiring any configuration or setup, so that loads are sequentially assigned using room controller device ID's from highest to lowest.
5. Device Status LEDs to indicate:
 - a. Data transmission
 - b. Device has power
 - c. Status for each load
 - d. Configuration status
 - e. Quick installation features including:
 - 1) Standard junction box mounting
 - 2) Quick low voltage connections using standard RJ-45 patch cable
 - f. Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:
 - 1) Turn on to 100%
 - 2) Remain off
 - 3) Turn on to last level
 - g. Each load shall be configurable to operate in the following sequences based on occupancy:
 - 1) Auto-on/Auto-off (Follow on and off)
 - 2) Manual-on/Auto-off (Follow off only)
 - h. The polarity of each load output shall be reversible, via digital configuration, so that on is off and off is on.
 - i. BACnet object information shall be available for the following objects:
 - 1) Load status
 - 2) Electrical current
 - 3) Total watts per controller
 - 4) Schedule state - normal or after-hours

- 5) Demand response control and cap level
 - 6) Room occupancy status
 - 7) Total room lighting and plug loads watts
 - 8) Total room watts/sq ft
 - 9) Force on/off all loads
 - j. UL 2043 plenum rated
 - k. Manual override and LED indication for each load
 - l. Dual voltage (120/277 VAC, 60 Hz), or 347 VAC, 60 Hz (selected models only). 120/277 volt models rated for 20A total load, derating to 16A required for some dimmed loads (forward phase dimming); 347 volt models rated for 15A total load; plug load controllers carry application-specific UL 20 rating for receptacle control.
 - m. Zero cross circuitry for each load
 - n. All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.
- B. On/Off Room Controllers shall include:
- 1. One or two relay configuration
 - 2. Efficient 150 mA switching power supply
 - 3. Three RJ-45 DLM local network ports with integral strain relief and dust cover
 - 4. WattStopper product numbers: LMRC-101, LMRC-102
- C. On/Off/Dimming enhanced Room Controllers shall include:
- 1. Real time current monitoring
 - 2. Multiple relay configurations
 - a. One, two or three relays (LMRC-21x series)
 - b. One or two relays (LMRC-22x series)
 - c. Efficient 250 mA switching power supply
 - d. Four RJ-45 DLM local network ports with integral strain relief and dust cover
 - e. One dimming output per relay
 - 1) 0-10V Dimming - Where indicated, one 0-10 volt analog output per relay for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting. (LMRC-21x series)
 - 2) Line Voltage, Forward Phase Dimming - Where indicated, one forward phase control line voltage dimming output per relay for control of compatible two-wire or three-wire ballasts, LED drivers, MLV, forward phase compatible ELV, neon/cold cathode and incandescent loads. (LMRC-22x series)
 - 3) Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected ballast or driver.
 - 4) The LED level indicators on bound dimming switches shall utilize this new maximum and minimum trim.
 - 5) Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100% dimming range defined by the minimum and maximum calibration trim.
 - 6) Calibration and trim levels must be set per output channel.

- 7) Devices that set calibration or trim levels per controller are not acceptable.
 - 8) All configuration shall be digital. Devices that set calibration or trim levels per output channel via trim pots or dip-switches are not acceptable.
 - f. Each load shall have an independently configurable preset on level for Normal Hours and After Hours events to allow different dimmed levels to be established at the start of both Normal Hours and After Hours events.
 - g. Fade rates for dimming loads shall be specific to bound switch buttons, and the load shall maintain a default value for any bound buttons that do not specify a unique value.
 - h. The following dimming attributes may be changed or selected using a wireless configuration tool:
 - 1) Establish preset level for each load from 0-100%
 - 2) Set high and low trim for each load
 - 3) Set lamp burn in time for each load up to 100 hours
 - i. Override button for each load provides the following functions:
 - 1) Press and release for on/off control
 - 2) Press and hold for dimming control
 - j. WattStopper product numbers: LMRC-211, LMRC-212, LMRC-213, LMRC-221, LMRC-222
- D. Plug Load Room Controllers shall include:
- 1. One relay configuration with additional connection for unswitched load
 - 2. Configurable additive time delay to extend plug load time delay beyond occupancy sensor time delay (e.g. a 10 minute additive delay in a space with a 20 minute occupancy sensor delay ensures that plug loads turn off 30 minutes after the space is vacated).
 - 3. Factory default operation is Auto-on/Auto-off, based on occupancy
 - 4. Real time current monitoring of both switched and un-switched load (LMPL-201 only)
 - 5. Efficient switching power supply
 - a. 150mA (LMPL-101)
 - b. 250mA (LMPL-201)
 - c. RJ-45 DLM local network ports
 - 1) Three RJ-45 ports (LMPL-101)
 - 2) Four RJ-45 ports (LMPL-201)
 - d. WattStopper product numbers: LMPL-101, LMPL-201.

2.6 LMCP LIGHTING CONTROL PANELS AND LMZC ZONE CONTROLLER

- A. Hardware: Provide LMCP lighting control panels in the locations and capacities as indicated on the Drawing and schedules. Each panel shall be of modular construction and consist of the following components:
- 1. Enclosure/Tub shall be NEMA 1, sized to accept an interior with 1 - 8 relays, 1 - 24 relays and 6 four-pole contactors, or 1 - 48 relays and 6 four-pole contactors.
 - 2. Cover shall be configured for surface or flush wall mounting of the panel as indicated on the plans. LMCP panel cover shall have a hinged and lockable door with restricted access to line voltage section of the panel.
 - 3. Interior assembly shall be supplied as a factory assembled component specifically designed and listed for field installation. Interior construction shall provide total isolation of high voltage (Class 1) wiring from low voltage (Class 2) wiring within

the assembled panel. Interior assembly shall include intelligence boards, power supply, DIN rails for mounting optional Class 2 control devices, and individually replaceable latching type relays. Panel interiors shall include the following features:

- a. Removable, plug-in terminal blocks with connections for all low voltage terminations.
 - b. Individual terminal block, override pushbutton, and LED status light for each relay.
 - c. Direct wired switch inputs associated with each relay shall support 2-wire momentary switches only.
 - d. Digital inputs (four RJ-45 jacks) shall support 1-, 2-, 3-, 4-, and 8-button digital switches; digital IO modules capable of receiving 0-5V or 0-10V analog photocell inputs; digital IO modules capable of receiving momentary or maintained contact closure inputs or analog sensor inputs; digital daylighting sensors; and digital occupancy sensors. Inputs are divided into two separate digital networks, each capable of supplying 250mA to connected devices.
 - e. True relay state shall be indicated by the on-board LED and shall be available to external control devices and systems via BACnet.
 - f. Automatically sequenced operation of relays to reduce impact on the electrical distribution system when large loads are controlled simultaneously.
 - g. Group and pattern control of relays shall be provided through a simple keypad interface from a handheld IR programmer. Any set of relays can be associated with a group for direct on/off control or pattern (scene) control via a simple programming sequence using the relay override pushbuttons and LED displays for groups 1-8 or a handheld IR programmer for groups 1-99.
 - h. Relay group status shall be provided through LED indicators for groups 1-8 and via BACnet for groups 1-99. A solid LED indicates that the last group action called for an ON state and relays in the group are on or in a mixed state.
4. Single-pole latching relays with modular plug-in design. Relays shall provide the following ratings and features:
- a. Electrical:
 - 1) 30 amp ballast at 277V
 - 2) 20 amp ballast at 347V
 - 3) 20amp tungsten at 120V
 - 4) 30 amp resistive at 347V
 - 5) 1.5 HP motor at 120V
 - 6) 14,000 amp short circuit current rating (SCCR) at 347V
 - 7) Relays shall be specifically UL 20 listed for control of plug-loads
 - b. Mechanical:
 - 1) Replaceable, 1/2 inch KO mounting with removable Class 2 wire harness.
 - 2) Actuator on relay housing provides manual override and visual status indication, accessible from Class 2 section of panel.
 - 3) Dual line and load terminals each support two #14 - #12 solid or stranded conductors.
 - 4) Tested to 300,000 mechanical on/off cycles.
5. Isolated low voltage contacts provide for true relay status feedback and pilot light indication.
6. Power supply shall be a multi-voltage transformer assembly with rated power to supply all electronics, occupancy sensors, switches, pilot lights, and photocells as

- necessary to meet the project requirements. Power supply to have internal over-current protection with automatic reset and metal oxide varistor protection.
7. Where indicated, lighting control panels designated for control of emergency lighting shall be provided with factory installed provision for automatic by pass of relays controlling emergency circuits upon loss of normal power. Panels shall be properly listed and labeled for use on emergency lighting circuits and shall meet the requirements of UL924 and NFPA 70 - Article 700.
 8. Integral system clock shall provide scheduling capabilities for panel-only projects without DLM segment networks or BAS control.
 - a. Each panel shall include digital clock capability able to issue system wide automation commands to up to 11 other panels for a total of 12 tnetworked lighting control panels. Clock shall provide capability for up to 254 independent schedule events per panel for each of the ninety-nine system wide channel groups.
 - b. Clock capability of each panel shall support the time-based energy saving requirements of applicable local energy codes.
 - c. Clock module shall provide astronomic capabilities, time delays, blink warning, daylight savings, and holiday functions and will include a battery back up for clock function and program retention in non-volatile FLASH memory. Clocks that require multiple events to meet local code lighting shut off requirements shall not be allowed.
 - d. Clock capability of each panel shall operate on a basis of ON/OFF or Normal Hours/After Hours messages to automation groups that implement pre-configured control scenarios. Scenarios shall include:
 - 1) Scheduled ON / OFF
 - 2) Manual ON / Scheduled OFF
 - 3) Astro ON / OFF (or Photo ON / OFF)
 - 4) Astro and Schedule ON / OFF (or Photo and Schedule ON / OFF)
 - e. User interface shall be a portable IR handheld remote control capable of programming any panel in the system (LMCT-100)
 - f. Clock capability of each panel shall employ non-volatile memory and shall retain user programming and time for a minimum of 10 years.
 - g. Schedules programmed into the clock of any one panel shall be capable of executing panel local schedule or Dark/Light (photocell or Astro) events for that panel in the event that global network communication is lost. Lighting control panels that are not capable of executing events independently of the global network shall not be acceptable.
 9. Lighting control panel can operate as a stand-alone system, or can support schedule, group, and photocell control functions, as configured in a Segment Manager controller, via a segment network connection.
 10. Lighting control panel shall support digital communications to facilitate the extension of control to include interoperation with building automation systems and other intelligent field devices. Digital communications shall be RS485 MS/TP-based using the BACnet protocol.
 - a. Panel shall have provision for an individual BACnet device ID and shall support the full 222 range (0 - 4,193,304). The device ID description property shall be writable via the network to allow unique identification of the lighting control panel on the network.
 - b. Panel shall support MS/TP MAC addresses in the range of 0 - 127 and baud rates of 9600k, 38400k, 76800k, and 115.2k bits per second.

- c. Lighting control relays shall be controllable as binary output objects in the instance range of 1 - 64. The state of each relay shall be readable and writable by the BAS via the object present value property.
 - d. Lighting control relays shall report their true on/off state as binary input objects in the instance range of 1 - 64.
 - e. The 99 group Normal Hours/After Hours control objects associated with the panel shall be represented by binary value objects in the instance range of 201 - 299. The occupancy state of each channel group shall be readable and writable by the BAS via the object present value property. Commanding 1 to a channel group will put all relays associated with the channel into the normal hours mode. Commanding 0 or NULL shall put the relays into the after hours mode.
 - f. Setup and commissioning of panel shall not require manufacturer-specific software or a computer. All configuration of the lighting control panel shall be performed using standard BACnet objects or via the handheld IR programming remote. Provide BACnet objects for panel setup and control as follows:
 - 1) Binary output objects in the instance range of 1 - 64 (one per relay) for on/off control of relays.
 - 2) Binary value objects in the instance range of 1 - 99 (one per channel) for normal hours/after hours schedule control.
 - 3) Binary input objects in the instance range of 1 - 64 (one per relay) for reading true on/off state of the relays.
 - 4) Analog value objects in the instance range of 101 - 199 (one per channel group) shall assign a blink warn time value to each channel. A value of 5 shall activate the blink warn feature for the channel and set a 5-minute grace-time period. A value of 250 shall activate the sweep feature for the channel and enable the use of sweep type automatic wall switches.
 - g. Description property for all objects shall be writable via the network and shall be saved in non-volatile memory within the panel.
 - h. BO and BV 1 - 99 objects shall support BACnet priority array with a relinquish default of off and after hours respectively. Prioritized writes to the channel BV objects shall propagate prioritized control to each member relay in a way analogous to the BACnet Channel object described in addendum aa. (<http://www.bacnet.org/Addenda/Add-135-2010aa.pdf>)
 - i. Panel-aggregate control of relay Force Off at priority 2 shall be available via a single BV5 object. Force On at priority 1 shall be available via a single BV4 object.
 - j. Lockout of all digital switch buttons connected to a given panel shall be command-able via a single BV2 object. The lock status of any connected switch station shall be represented as BV101-196.
11. In addition to the LMCP Relay Panels, an LMZC Zone Controller panel shall be available for zero-relay applications. The panel is designed for applications where LMFC-011 Fixture Controllers or other distributed load controllers are used to switch and/or dim the controlled loads. Key similarities to and differences from the LMCP panel design shall include:
- a. Use the same intelligence board as the LMCP relay panel.
 - b. Shall not include relay driver boards or relays.
 - c. Have a removable interior section to facilitate installation, and a Tub/Cover. Cover is for surface mounting applications only.

- d. Tub shall have two interior KOs to allow installation of LMPB-100 Power Boosters. Each installed Power Booster can provide an additional 150 mA for either of the two available DLM local networks provided by the LMZC.
 - e. All programming and networking (whether DLM Local Network and/or Segment Network) capabilities in the LMZC Zone Controller shall be similar to capabilities for LMCP relay panels, except for functions designed for panel-mounted HDR relays.
- 12. To aid in project start up, if LMFC Fixture Controllers are connected to an LMZC Zone Controller, Plug n' Go automatic configuration will establish a unique sequence of operation so that all LMFC-controlled fixtures will turn on to 50 percent output when any digital occupancy sensor detects motion.
 - 13. WattStopper Product Number: Relay Panels: LMCP8, LMCP24 or LMCP48, Zone Controller: LMZC-301.

2.7 CONFIGURATION TOOLS

- A. A wireless configuration tool facilitates optional customization of DLM local networks using two-way infrared communications, while PC software connects to each local network via a USB interface.
- B. Features and functionality of the wireless configuration tool shall include but not be limited to:
 - 1. Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30 feet.
 - 2. High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.
 - 3. Must be able to read and modify parameters for room controllers, occupancy sensors, wall switches, daylighting sensors, network bridges and relay panels, and identify room devices by type and serial number.
 - 4. Save up to eight occupancy sensor setting profiles, and apply profiles to selected sensors.
 - 5. Temporarily adjust light level of any load(s) on the local network, and incorporate those levels in scene setting. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
 - 6. Adjust or fine-tune daylighting settings established during auto-configuration, and input light level data to complete configuration of open loop daylighting controls.
 - 7. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
 - 8. Verify status of building level network devices.
- C. WattStopper Product Numbers: LMCT-100, LMCI-100/LMCS-100

2.8 DLM WIRELESS NETWORK (ROOM TO ROOM NETWORK).

- A. Communication between the Wireless Network In-Room Bridges LMBC-650 and the Wireless Network Border Router and Master Border Router LMBR-650 shall meet the following specifications:
 - 1. The communication between the Wireless Bridges and the Border Router shall be via a standalone wireless mesh network that does not require interface with any other wireless network in the space. The mesh network shall allow

communication between all rooms as long as they are within 100' of another connected room.

2. The Wireless Bridges shall communicate over a 6LoWPAN 2.4 GHz IEEE 802.15.4 network and use AES 128 bit Key Encryption for network security.
3. In addition to IEEE IPV6, the Border Router shall have available Constrained Application Protocol (CoAP), Routing Protocol for Low Power Networks (RPL), and Stateless Multicast RPL Forwarding (SMRF).
4. The wireless protocol shall allow BACnet communication to be transported transparently between the Network Bridge and any front end BAS device.
5. Features of the Wireless Border Router shall be:
 - a. The Wireless Border Router shall manage the formation and configuration of the 6LoWPAN wireless mesh network, and provide connectivity via wired 10/100 Ethernet to a local area network that may include a LMSM Segment Manager or Building BAS System.
 - b. Border Router shall provide key information about the health of the mesh network in the form of signal quality, device status, network status, and other real-time network information such as energy monitoring.
 - c. The LMBR-650 shall have dual internal omni-directional antennas with diversity to ensure reliable communication with Wireless Network Bridges, and provide a user interface for set up and configuration.
 - d. Include an internal MicroSD card and a Real-time clock with supercap back-up. Border Router shall get power for operation via a 120V outlet (in non-plenum applications) and a dedicated DLM LMPB-100 Power Booster connected to a Cat 5e to DC barrel connector (for plenum applications).

2.9 NETWORK BRIDGE

- A. The network bridge module connects a DLM local network to a BACnet-compliant segment network for communication between rooms, relay panels and a segment manager or BAS. Each local network shall include a network bridge component to provide a connection to the local network room devices. The network bridge shall use industry standard BACnet MS/TP network communication and an optically isolated EIA/TIA RS-485 transceiver.
 1. The network bridge shall be provided as a separate module connected on the local network through an available RJ-45 port.
 2. Provide Plug n' Go operation to automatically discover room devices connected to the local network and make all device parameters visible to the segment manager via the segment network. No commissioning shall be required for set up of the network bridge on the local network.
 3. The network bridge shall automatically create standard BACnet objects for selected room device parameters to allow any BACnet-compliant BAS to include lighting control and power monitoring features as provided by the DLM room devices on each local network. BACnet objects will be created for the addition or replacement of any given in-room DLM device for the installed life of the system. Products requiring that an application-specific point database be loaded to create or map BACnet objects are not acceptable. Systems not capable of providing BACnet data for control devices via a dedicated BACnet Device ID and physical MS/TP termination per room are not acceptable. Standard BACnet objects shall be provided as follows:
 - a. Read/write the normal or after hours schedule state for the room

- b. Read the detection state of each occupancy sensor
- c. Read the aggregate occupancy state of the room
- d. Read/write the On/Off state of loads
- e. Read/write the dimmed light level of loads
- f. Read the button states of switches
- g. Read total current in amps, and total power in watts through the room controller
- h. Read/write occupancy sensor time delay, PIR sensitivity and ultrasonic sensitivity settings
- i. Activate a preset scene for the room
- j. Read/write daylight sensor fade time and day and night setpoints
- k. Read the current light level, in footcandles, from interior and exterior photosensors and photocells
- l. Set daylight sensor operating mode
- m. Read/write wall switch lock status
- n. Read watts per square foot for the entire controlled room
- o. Write maximum light level per load for demand response mode
- p. Read/write activation of demand response mode for the room
- q. Activate/restore demand response mode for the room

B. WattStopper product numbers: LMBC-300

2.10 SEGMENT MANAGER

- A. For networked applications, the Digital Lighting Management system shall include at least one segment manager to manage network communication. It shall be capable of serving up a graphical user interface via a standard web browser utilizing either unencrypted TCP/IP traffic via a configurable port (default is 80) or 256 bit AES encrypted SSL TCP/IP traffic via a configurable port (default is 443).
- B. Each segment manager shall have integral support for at least three segment networks. Segment networks may alternately be connected to the segment manager via external routers and switches, using standard Ethernet structured wiring. Each router shall accommodate one segment network. Provide the quantity of routers and switches as shown on the plans.
- C. Operational features of the Segment Manager shall include the following:
 - 1. Connection to PC or LAN via standard Ethernet TCP/IP via standard Ethernet TCP/IP with the option to use SSL encrypted connections for all traffic.
 - 2. Easy to learn and use graphical user interface, compatible with Internet Explorer 8, or equal browser. Shall not require installation of any lighting control software to an end-user PC.
 - 3. Log in security capable of restricting some users to view-only or other limited operations.
 - 4. Automatic discovery of DLM devices and relay panels on the segment network(s). Commissioning beyond activation of the discovery function shall not be required to provide communication, monitoring or control of all local networks and lighting control panels.
 - 5. After discovery, all rooms and panels shall be presented in a standard navigation tree format. Selecting a device from the tree will allow the device settings and operational parameters to be viewed and changed by the user.

6. Ability to view and modify room device operational parameters. It shall be possible to set device parameters independently for normal hours and after hours operation including sensor time delays and sensitivities, and load response to sensor including Manual-On or Auto-On.
 7. Ability to set up schedules for rooms and panels, view and override current status of panel channels and relays, and assign relays to groups. Schedules shall automatically set controlled zones or areas to either a normal hours or after hours mode of operation. Support for a minimum of 100 unique schedules, each with up to four time events per day. Support for annual schedules, holiday schedules and unique date-bound schedules.
 8. Ability to group rooms and loads for common control by schedules, switches or network commands.
 9. Ability to monitor connected load current and display power consumption for areas equipped with room controllers incorporating the integral current monitoring feature.
 10. Provide capabilities for integration with a BAS via BACnet protocol. At a minimum, the following points shall be available to the BAS via BACnet IP connection to the segment manager: room occupancy state; room schedule mode; room switch lock control; individual occupancy sensor state; room lighting power; room plug-load power; load ON/OFF state; load dimming level; panel channel schedule state; panel relay state; and Segment Manager Group schedule state control.
 11. The Segment Manager shall allow access and control of the overall system database via Native Niagara AX FOX connectivity. Systems that must utilize a Tridium Niagara controller in addition to the programming, scheduling and configuration server are not acceptable.
- D. Segment Manager shall support multiple DLM rooms as follows:
1. Support up to 120 network bridges and 900 digital in-room devices (LMSM-3E).
 2. Support up to 300 network bridges and 2,200 digital in room devices, connected via network routers and switches (LMSM-6E).
- E. Segment Manager shall provide single point of integration to the Building Management System (BMS) via BACnet/IP. The lighting control system shall provide an export table to transfer room/device data to the BMS system. Data provided in the export table will be confirmed in the pre-installation meeting referred to in Section 3.02-B. Time based scheduling shall remain a function of the lighting control system unless all scheduling is coordinated with the building management system. The export table is limited to the BACnet objects listed in section 2.08-A-3. The lighting control manufacture is recommending the following BACnet objects be included as a minimum standard in the export table:
1. Occupancy state of the room
 2. On/Off state of loads in each room
 3. Total power in watts through the load controller
 4. Read watts per square foot for the entire controlled room
 5. Current light level in foot-candles from interior and exterior photosensors
- F. WattStopper Product Numbers: LMSM-3E, LMSM-6E, NB-ROUTER, NB-SWITCH, NB-SWITCH-8, NB-SWITCH-16.

2.11 WIRELESS NETWORK BRIDGES AND BORDER ROUTER

- A. Wireless Network Bridges connect to a DLM local network (room) and use IEEE 802.15.4 6LoWPAN for communication between rooms and to a Border Router that oversees the formation and configuration of the wireless network. Each local network shall include a wireless network bridge that connects to the other DLM devices on the local network, and a group of Wireless Bridges shall connect to a Border Router.
- B. Features of the Wireless Network Bridges shall be as follows:
 - 1. Network bridge shall be provided as a separate module connected on the local network through an available RJ-45 port.
 - 2. Wireless Bridges provide Plug n' Go operation to automatically discover room devices connected to the local network and make all device parameters visible to the Border Router via the wireless network. No commissioning shall be required for set up of the network bridge on the local network.
 - 3. Wireless Bridges shall incorporate dual internal omni-directional antennas with diversity to provide wide and robust communication, and so the antennas will be protected against accidental contact with other objects in the space.
 - 4. Two LEDs shall be included on the bridge to provide feedback about the local network (red) and wireless network (blue) health.
 - 5. Wireless Network bridge shall automatically create standard BACnet objects for selected DLM devices to allow any BACnet-compliant BAS to include lighting control and power monitoring features as provided by the DLM devices on each local network. BACnet objects will be created for the addition or replacement of any given DLM device for the installed life of the system. Products requiring that an application-specific point database be loaded to create or map BACnet objects are not acceptable. Systems not capable of providing BACnet data for control devices via a dedicated BACnet Device ID per room are not acceptable. Standard BACnet objects shall be provided as follows:
 - a. Read/write the normal or after hours schedule state for the room
 - b. Read the detection state of each occupancy sensor
 - c. Read the aggregate occupancy state of the room
 - d. Read/write the On/Off state of loads
 - e. Read/write the dimmed light level of loads
 - f. Read the button states of switches
 - g. Read total current in amps, and total power in watts through the load controller
 - h. Read/write occupancy sensor time delay, PIR sensitivity and ultrasonic sensitivity settings
 - i. Activate a preset scene for the room
 - j. Read/write daylight sensor fade time and day and night setpoints
 - k. Read the current light level, in foot-candles, from interior and exterior photosensors and photocells
 - l. Set daylight sensor operating mode
 - m. Read/write wall switch lock status
 - n. Read watts per square foot for the entire controlled room
 - o. Write maximum light level per load for demand response mode
 - p. Read/write activation of demand response mode for the room
 - q. Activate/restore demand response mode for the room

- C. Features of the Wireless Border Router shall be:
1. The Wireless Border Router shall manage the formation and configuration of the 6LoWPAN wireless mesh network, and provide connectivity via wired 10/100 Ethernet to a local area network that may include a LMSM Segment Manager or Building BAS System.
 2. Border Router shall provide key information about the health of the mesh network in the form of signal quality, device status, network status, and other real-time network information such as energy monitoring.
 3. The LMBR-600 shall have dual internal omni-directional antennas with diversity to ensure reliable communication with Wireless Network Bridges, and provide a user interface for set up and configuration.
 4. Include an internal MicroSD card and a Real-time clock with supercap back-up. Border Router shall get power for operation via a 120V outlet (in non-plenum applications) and a dedicated DLM LMPB-100 Power Booster connected to a Cat 5e to DC barrel connector (for plenum applications).
- D. Communication between the Wireless Network Bridges and the Border Router
1. The communication between the Wireless Bridges and the Border Router shall be via a standalone wireless mesh network that does not require interface with any other wireless network in the space. The mesh network shall allow communication between all rooms as long as they are within 100' of another connected room.
 2. The Wireless Bridges shall communicate over a 6LoWPAN 2.4 GHz IEEE 802.15.4 network and use AES 128 bit Key Encryption for network security.
 3. In addition to IEEE IPV6, the Border Router shall have available Constrained Application Protocol (CoAP), Routing Protocol for Low Power Networks (RPL), and Stateless Multicast RPL Forwarding (SMRF).
 4. The wireless protocol shall allow BACnet communication to be transported transparently between the Network Bridge and any front end BAS devices such as the LMSM Segment Manager.
- E. WattStopper product numbers: Wireless Network Bridge LMBC-650, Wireless Border Router LMBR-650.

2.12 PROGRAMMING, CONFIGURATION AND DOCUMENTATION SOFTWARE

- A. PC-native application for optional programming of detailed technician-level parameter information for all DLM products, including all parameters not accessible via BACnet and the handled IR configuration tool. Software must be capable of accessing room-level parameter information locally within the room when connected via the optional LMCI-100 USB programming adapter, or globally for many segment networks simultaneously utilizing standard BACnet/IP communication.
- B. Additional parameters exposed through this method include but are not limited to:
1. Occupancy sensor detection LED disable for performance and other aesthetic spaces where blinking LEDs present a distraction.
 2. Six occupancy sensor action behaviors for each controlled load, separately configurable for normal hours and after hours modes. Modes include: No Action, Follow Off Only, Follow On Only, Follow On and Off, Follow On Only with Override Time Delay, Follow Off Only with Blink Warn Grace Time, Follow On and Off with Blink Warn Grace Time.

3. Separate fade time adjustments per load for both normal and after hours from 0 - 4 hours.
 4. Configurable occupancy sensor re-trigger grace period from 0 - 4 minutes separate for both normal hours and after hours.
 5. Separate normal hours and after hours per-load button mode with modes including: Do nothing, on only, off only, on and off.
 6. Load control polarity reversal so that on events turn loads off and vice versa.
 7. Per-load DR (demand response) shed level in units of percent.
 8. Load output pulse mode in increments of 1second.
 9. Fade trip point for each load for normal hours and after hours that establishes the dimmer command level at which a switched load closes its relay to allow for staggered On of switched loads in response to a dimmer.
- C. Generation of reports at the whole file, partial file, or room level. Reports include but are not limited to:
1. Device list report: All devices in a project listed by type.
 2. Load binding report: All load controller bindings showing interaction with sensors, switches, and daylighting.
 3. BACnet points report: Per room Device ID report of the valid BACnet points for a given site's BOM.
 4. Room summary report: Device manifest for each room, aggregated by common BOM, showing basic sequence of operations.
 5. Device parameter report: Per-room lists of all configured parameters accessible via hand held IR programmer for use with O&M documentation.
 6. Scene report: All project scene pattern values not left at defaults (i.e. 1 = all loads 100%, 2 = all loads 75%, 3 = all loads 50%, 4 = all loads 25%, 5-16 = same as scene 1).
 7. Occupancy sensor report: Basic settings including time delay and sensitivity(ies) for all occupancy sensors.
- D. Network-wide programming of parameter data in a spreadsheet-like programming environment including but not limited to the following operations:
1. Set, copy/paste an entire project site of sensor time delays.
 2. Set, copy/paste an entire project site of sensor sensitivity settings.
 3. Search based on room name and text labels.
 4. Filter by product type (i.e. LMRC-212) to allow parameter set by product.
 5. Filter by parameter value to search for product with specific configurations.
- E. Network-wide firmware upgrading remotely via the BACnet/IP network.
1. Mass firmware update of entire rooms.
 2. Mass firmware update of specifically selected rooms or areas.
 3. Mass firmware upgrade of specific products.
- F. WattStopper Product Number: LMCS-100, LMCI-100

PART 3 - EXECUTION

3.1 PREPARATION

- A. Do not begin installation until measurements have been verified and work areas have been properly prepared.

- B. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PRE-INSTALLATION MEETING

- A. Manufacturer shall provide a factory authorized representative to provide a functional overview of the lighting control system prior to products being installed.
 - 1. Discuss functionality and integration of all products per design requirements.
 - 2. Confirm location of occupancy sensors and photocells as required.
 - 3. Confirm low voltage control wires meet specification.
 - 4. Explain adjustment options and verify specification requirements for each device.
- B. Convene meeting two weeks prior to commencing work of this section to coordinate integration of lighting control system to building management system. Meeting to be attended by electrical contractor, mechanical contractor, general contractor, system installer if not electrical contractor, factory authorized representative and IT manager from facility.
 - 1. Review integration requirements in this section of specification
 - 2. Confirm responsibilities of network terminations for electrical and mechanical system
 - 3. Review information to be exchanged between system and delivery method of data
 - 4. Identify scope of the integration including but not limited to the following use cases:
 - a. Scheduling
 - b. Demand Response
 - c. Normal hours vs. after hours adjustments of device parameters
 - d. Identify points in export table to monitor and control
 - 1) Occupancy State
 - 2) Power usage in room
 - 3) Daylight status/footcandle level

3.3 INSTALLATION

- A. Install system in accordance with the approved system shop drawings and manufacturer's instructions.
- B. Install no wireless devices within 10'-0" radius of the border router, including Wattstopper wireless network bridges and third-party devices such as wi-fi access points, security systems, RFID tagging equipment, etc. Coordinate this requirement with the general contractor and all trades.
- C. Install all room/area devices using manufacturer's factory-tested Cat 5e cable with pre-terminated RJ-45 connectors.
 - 1. If pre-terminated cable is not used for room/area wiring, each field-terminated cable shall be tested following installation and testing results submitted to the Manufacturer's Representative for approval prior to proceeding with the Work.
 - 2. If fixtures have internal DLM Control Modules, ensure that they are also connected with Cat 5e cable.

3. Install all room to room network devices using manufacturer-supplied LM-MSTP network wire or wireless devices. Network wire substitution is not permitted and may result in loss of product warranty.
 4. Low voltage wiring topology must comply with manufacturer's specifications.
 5. Route network wiring as indicated on the Drawings as closely as possible. Document final wiring location, routing and topology on as built drawings.
- D. All line voltage connections shall be tagged to indicate circuit and switched legs.
- E. Test all devices to ensure proper communication.
- F. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings. Adjust time delay so that controlled area remains lighted while occupied.
- G. Provide written or computer-generated documentation on the configuration of the system including room by room description including:
1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
 2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
 3. Load Parameters (e.g. blink warning, etc.)
- H. Post start-up tuning - Adjust sensor time delays and sensitivities to meet the Owner's requirements 30 days from beneficial occupancy. Provide a detailed report to the Architect / Owner of post start-up activity.
- I. Tighten all panel Class I conductors from both circuit breaker and to loads to torque ratings as marked on enclosure UL label.
- J. All Class II cabling shall enter enclosures from within low-voltage wiring areas and shall remain within those areas. No Class I conductors shall enter a low-voltage area.
- K. Run separate neutrals for any phase dimmed branch load circuit. Different types of dimming loads shall have separate neutral.
- L. Verify all non-panel-based lighting loads to be free from short circuits prior to connection to room controllers.
- M. Lighting Control Relay Panels:
1. Digital Switches and/or photocells shall be mounted in the spaces as indicated on the Drawings. Each low voltage wire shall be labeled clearly indicating which relay panel it connects to. All relays and switches shall be tested after installation to confirm proper operation and the loads recorded on the directory card in each panel.
 2. The relay panels shall be mounted in electrical closets as indicated on the Drawings. The numbered relays in the panel shall be wired to control the power to each load as indicated on the Panel Wiring Schedules included in the Drawings. All power wiring shall be identified with the circuit breaker number controlling the load. If multiple circuit breaker panels are feeding into a relay panel, wires shall clearly indicate the originating panel's designation.

3.4 PROGRAMMING

- A. Perform the following inspections and prepare reports.

1. Verify Class I and II wiring connections are terminated properly by validating system performance.
2. Set IP addresses and other network settings of system front end hardware per facilities IT instructions.
3. Verify / complete task programming for all switches, dimmers, time clocks, and sensors.
4. Verify that the control of each space complies with the Sequence of Operation.
5. Correct any system issues and retest..

3.5 SYSTEM STARTUP

- A. The Manufacturer shall provide a factory authorized technician to commission and confirm proper installation and operation of all system components.
- B. Contractor shall provide system documentation after the equipment has been installed:
 1. Lighting control operational summary sheet.
 2. Programming record sheet.
 3. System Installation and Operation Manual shall be provided to the owner.

3.6 TRAINING

- A. Manufacturer shall provide factory authorized application engineer to train Owner personnel in the operation and programming of the lighting control system for the first (2) two days of occupancy; then (1) one week later, and again (1) month later.

3.7 PRODUCT SUPPORT AND SERVICE

- A. Factory telephone support shall be available at no cost to the Owner following acceptance. Factory assistance shall consist of assistance in solving application issues pertaining to the control equipment.

3.8 TESTS

- A. Test under provisions of Section 26 05 00 and 26 08 00.
- B. The Owner shall be notified at least three working days in advance of the Contractor's proposed date of the tests to permit scheduling, and to permit witnessing of the tests. The Contractor shall furnish the Owner with three copies of the results of the tests.
- C. Circuits: The Contractor shall test each circuit, all controllers, and components of the system for proper operation. The Contractor shall furnish the Owner with three copies of the test results.
- D. Operating Test: Contractor shall operate the system in the presence of the Owner proving the proper operation of the system and all components.

END OF SECTION

SECTION 27 00 00

TELECOMMUNICATIONS SYSTEM

PART 1 - GENERAL**1.1 DESCRIPTION**

- A. This project includes the provisions for and installation of a complete telecommunications system pathways and wiring infrastructure system for the building, including all terminations, testing, and all related passive components required for operation.

1.2 WORK INCLUDED

- A. Work included in this Section: All materials, labor, equipment, services, and incidentals necessary to install the work as shown on the drawings and as specified hereinafter, including, but not limited to the work listed below.
- B. Provide and install new and functional data communication system station cabling and all necessary passive components, to allow full operation of the new wiring infrastructure system upon completion. All existing system station cables, jacks, faceplates, and related connections shall remain as-is, unless otherwise noted. New cabling and jacks to be provided for renovated areas as shown on the plans.
- C. The installation shall include all twisted pair copper, conduit, copper interconnect / patching equipment, copper connectors, splices, copper patch cords / jumpers, wiring blocks, data outlets, wi-fi access points, and any other equipment specified herein.
- D. The installation shall not include any active network components such as routers, switches, hubs, fiber optic transceivers, wireless communications system transceivers, antennae, base stations and concentrators or servers, which shall be supplied by the owner.
- E. Upon completion of the installation, this contractor shall test all new copper pathways and record the test results as specified herein. Test results must be delivered to the owner upon completion of project
- F. The scope of work under this Section shall include any other work as might reasonably be implied as required, even though not specifically mentioned herein or shown on the drawings.
- G. Provide CBC 2019 compliant seismic installation. See Section 26 05 00 for all certification and submittal requirements.

1.3 RELATED WORK

- A. Division 1 - General Requirements.
- B. Division 9 - Finishes.
- C. Section 26 05 00 - Basic Electrical Requirements

- D. Section 26 27 00 - Basic Electrical Materials & Methods
- E. Equipment and work provided by the owner's network integrator, including owner provided network servers, switches, hubs, optical fiber transceivers, routers, wireless communication system equipment, etc.

1.4 INCORPORATED DOCUMENTS

- A. Requirements of the General Conditions, supplementary conditions, and Division 1 Sections apply to the work of this section, unless modified herein.
- B. Published specifications, standard tests or recommended methods of trade, industry or government organizations shall apply to work of this section where cited by abbreviations noted below, unless modified herein.
 - 1. National Electrical Code, latest edition, (NEC), Article 800
 - 2. ANSI/TIA-568.0-D - Generic Communications Cabling for Customer Premises
 - 3. Underwriters' Laboratories, Inc. (UL), UL 1459, UL 1863.
 - 4. ANSI/TIA-568.1-D "Commercial Building Communications Cabling Standard"
 - 5. ANSI/TIA-569-D "Telecommunications Pathways and Spaces"
 - 6. ANSI/TIA-568-C.2-1. "Balanced Twisted-Pair Telecommunications Cabling and Components Standard"
 - 7. ANSI/TIA-606-B.1 - Administration Standard for the Commercial Telecommunications Infrastructure
 - 8. ANSI/TIA-607-C - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
 - 9. ANSI/TIA-862-B - Structured Cabling Infrastructure Standard for Intelligent Building Systems
 - 10. BICSI - TDMM, Building Industries Consulting Services International, Telecommunications Distribution Methods Manual (TDMM)
 - 11. IEEE 802.3 "Carrier Sense Multiple Access With Collision Detection".
 - 12. IEEE 802.11b "Wireless Network standard"
 - 13. Owner's telecommunications Standards and Requirements.

1.5 CONTRACTOR QUALIFICATIONS

- A. Contractor must possess a valid state Contractor's License and must have successfully performed at least three projects of similar scope, within two years of the date of this bid. Proof of performance shall be in the form of reference sheets, which shall include a brief description of the project, the beginning and ending contract price, the project foreman or superintendent's name, and the name, address, and telephone number of a project contact.
- B. Contractor must have been in business and in the business of installing telecommunications systems, continuously, for a period of at least three years, prior to the date of this bid.

1.6 SUBMITTALS

- A. General: Comply with the requirements of Section 26 05 00 - Submittals.

- B. Submit complete list of all items of materials to be furnished, and installed to the owner for compliance review prior to purchasing the materials. Submittals shall include:
 - 1. Complete bill of materials and equipment, including a complete listing of the characteristics of the equipment as specified.
 - 2. One line diagram indicating all system connections, all closet locations, rack arrangements, cabinets, and workstation outlets.
 - 3. Rack and communications cabinet layouts and dimensions.
 - 4. Samples of proposed cable markers and labeling, and patch panel labeling and color-coding.
 - 5. List of instrumentation to be used for system testing, including certificate of manufacturer's calibration.
 - 6. ¼ scale plan of all telecommunications rooms and closets, indicating proposed layout of all equipment and cable trays, troughs, and runways.
 - 7. Manufacturer's warranty application for the indicated project.
 - 8. Schedule of work completion coordinated with the General Contractor.
- C. Submit Contractor's qualifications as outlined in Section 1.5 above.
- D. Submit "as-built" record drawings at the completion of the installation and testing.
- E. The Contractor shall submit all testing documentation prior to acceptance of the work by the Owner.

1.7 GENERAL REQUIREMENTS

- A. From the MDF, twisted-pair copper cables shall be routed to each new data outlet location, and to each new wireless antenna location, as indicated on the drawings.
 - 1. The wiring system shall be provided and installed per TIA / EIA-568 wiring topology and shall be Category 6A rated.
 - 2. Unshielded twisted pair (UTP) cable, installed for high-speed data application, shall not exceed 295 feet in length between terminations.
- B. Terminations:
 - 1. All data and voice cables and wireless communications cables shall be terminated on modular patch panels.
 - 2. All active equipment will be provided and installed by the owner.
- C. The MDF will also house active data distribution equipment provided by the owner, possibly including but not limited to local area network hubs and switches, optical fiber transceivers, wireless communication systems base stations and concentrations routers, and servers. This Contractor shall coordinate with Owner's network integrator to ensure that data rack and cabinet layouts fully accommodate all owner-provided equipment.

1.8 FUNCTION AND OPERATION

- A. The function of the data communications cable system is to transmit data signals from a central location to multiple individual data outlet locations. Upon completion of the work outlined in this specification, the entire cable system, including cable, and communications outlets shall be tested to (and meet) Category 6A compliance.

1. Horizontal UTP Category 6A 23AWG copper cabling system shall be guaranteed to exceed all TIA-568-C.2 link and channel performance requirements and be capable of supporting 10G Base-T (802.3an) and ISO/IEC 11801 Class EA applications for a total distance of 100 meters with equipment cords. System shall be guaranteed to meet all Cat 6A requirements for short links and channels down to a 10 foot link (5 meter channel) with a guaranteed 4 dB margin of Alien Crosstalk.

1.9 GUARANTEE

- A. The Cabling System shall meet the performance requirements of the ANSI/TIA/EIA-568-C.2 standard. The warranty on the material, services, and operation of the cabling system to this specification must be for a period of at least 15 years. The connecting hardware shall have a lifetime extended warranty against defects in material and workmanship.
- B. The warranty must include the following statements regarding the cabling system:
 1. "Will support and conform to TIA/EIA-568-C.2 specifications covering any current or future application which supports transmission over a properly constructed horizontal cabling system premises network which meets the channel and/or basic link performance as described in TIA/EIA-568-C".
 2. "Will be free from defects in material or faulty workmanship for the entire warranty period".
 3. The Contractor shall apply for a warranty from the manufacturer within 60 days from end of project. In order to achieve a warranty the contractor must be in good standing with current training records on file.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Copper Cable
 1. BerkTek, Superior Essex, Avaya, Siecor, or equal
- B. Copper Patch Panels and Devices
 1. Ortronics, Leviton, Avaya, Ortronics, Siemon, or equal
- C. Cabinets and Racks
 1. Ortronics, ESW (Encore), Leviton, Homaco, Chatsworth, or equal
- D. Firestopping
 1. STI (Specified Technologies, Inc.), 3M, or equal

2.2 SYSTEM PERFORMANCE

- A. Category 6A (CAT6A) Unshielded Twisted Pair (UTP) Systems
 1. Category 6A 23AWG UTP copper cabling system shall be guaranteed to exceed all TIA-568 link and channel performance requirements and be capable of supporting 10G Base-T (802.3an) and ISO/IEC 11801 Class EA applications for a total distance of 100 meters with equipment cords. System shall be guaranteed to

meet all CAT6A requirements for short links and channels down to a 10 foot link (5 meter channel) with a guaranteed 5 dB margin of Alien Crosstalk.

2. Basis of Design is Berk-Tek Leviton Technologies CX6850 Cat6A Premium UTP System, or approved equal.
3. Category 6A Performance Parameters, headroom over TIA-568 standard:

INSERTION LOSS	NEXT	PSNEXT	ACR-F (ELFEXT)	PSACR-F (ESELFEXT)
3%	5DB	6DB	10DB	10DB

RETURN LOSS	ACR-N	PSACR	PSANEXT	PSAACR-F
4DB	7DB	7DB	5DB	11DB

A. Connectors

1. Provide mission-critical, modular-type, information connectors/outlets (jacks) for 24-23 AWG copper cable. These connectors shall be individual snap-in style, and exceed compliance with TIA-568 specifications. The connectors shall comply with the following:
 - a. Shall be 8-position 8-conductor (8P8C) "RJ45"-style modular jack, Category 6A (CAT6A), with IDC terminals, T568A/B wiring scheme (use T568B), and utilize a non-punchdown simplified manual termination style.
 - b. Shall be encased in a die-cast housing to protect from potential EMI/RFI, and utilize a universal Keystone-style insertion footprint as the manufacturer's main "flagship" line of products.
 - c. CAT6A connectors shall exceed all component performance requirements for Augmented Category 6 in the ANSI/TIA-568 standard, as well as Class EA requirements as described in ISO/IEC 11801, from 1 MHz to 500 MHz to support the IEEE 802.3an standard for 10GBASE-T network performance.
 - d. Shall be tested by an Independent testing body such as Intertek (ETL) for component compliance (i.e. "Component rated") to ANSI/TIA-568 and for POE+ applications. Test results shall be published and publicly available without special request.

2.3 MATERIALS

A. Copper Cable:

1. Horizontal distribution cable in conduit shall consist of four unshielded twisted pairs, #23 AWG, BerkTek Lanmark Cat. 6A type CMR or equal, with the following characteristics: Cable shall be characterized to 750 MHz and UL/ETL Listed by the Manufacturer printed on the cable jacket and package, as well as Intertek (ETL) Verified to TIA-568 Category 6A and ISO/IEC 11801 Class EA requirements for channel, link and component performance to support IEEE 10GBASE-T (802.3an) networks.
2. Horizontal distribution cable, where not installed in conduit in plenum spaces, shall be plenum rated and consist of four unshielded twisted pairs, #23 AWG, BerkTek Lanmark Cat. 6A type CMP or equal, with the following characteristics: Cable shall be characterized to 750 MHz and UL/ETL Listed by the Manufacturer

printed on the cable jacket and package, as well as Intertek (ETL) Verified to TIA-568 Category 6A and ISO/IEC 11801 Class EA requirements for channel, link and component performance to support IEEE 10GBASE-T (802.3an) networks..

3. Horizontal cable shall meet the following requirements.
 - a. Cable jacket marking: Must be legible and shall contain the following information:
 - 1) Manufacturer's name.
 - 2) Copper conductor gauge.
 - 3) Pair counts.
 - 4) UL and CSA listing.
 - 5) Manufacturer's trademark.
 - 6) Category rating.
 - 7) Sequential foot markings, in 2-foot increments.
 - b. Telecom station (and wireless antenna) cable jacket shall be blue with black lettering and shall be in 1000-foot boxes.
 - c. The jacket for telecom cabling serving AV devices and equipment shall be yellow with black lettering and shall be in 1000-foot boxes.
 - d. Type CMR cable shall be solid annealed copper with polyolefin insulation round design with flexible web separator with flame retardant PVC jacket.
 - e. Type CMP cable shall be same as Type CMR except with type FEP insulation.
4. Data Equipment Inter-Connect patch Cords: Four twisted-pair stranded, Category 6A, 24 AWG copper conductors. Individual conductors PVC jacketed. Each conductor provided with unique color code. Manufacturer terminated on each end with Ortronics or Systimax Category 6A 8-pin / 8-position modular plug to be pinned as per EIA / TIA 568 C. Connector plug shall be polarized to prevent polarity reversal or split pairs, and shall be factory-marked to indicate top of connector. Inter-connect cord shall be UL listed.
5. The Contractor shall complete data interconnects between patch panels and Owner-provided active network electronics.
6. Lengths as required running from the data station cable terminations to the ports on equipment mounted in any rack position. Minimum length shall be 5 feet.
7. Contractor to assist Owner to perform all voice cross-connects.
 - a. Minimum performance specifications:
 - 1) Cross-connect wire used on "voice" (telephone) cross-connects must meet the EIA/TIA 568 B impedance, attenuation and NEXT requirements for Category 3 horizontal cable.

B. Data Outlets

1. Cable termination hardware shall be individual; Category 6A rated Leviton (or equal) jacks. The listed product shall have the following characteristics:
 - a. One eight-position, eight-conductor jack (non-keyed), TIA/EIA-568-C Compliant, wired to T568B, Leviton category 6A.
 - b. The cover of the information outlet shall be labeled above the jack. The number on the outlet jacks shall coincide with the identification requirements listed in Part 3 of this Section below.
 - c. The color of all general use jacks shall be blue.
 - d. The color of all jacks at AV-related devices or racks shall be yellow.
 - e. The color of all faceplates and blank inserts or visible mounting plates shall match the adjacent power or signal outlet covers on the project (provided under another Section).

- f. The devices at outlets and the devices in the patch panels shall be of the same manufacturer and same type.
- g. See Drawings for number of jacks at each outlet, jack arrangement, and mounting type.
 - 1) The 8-pin 8-position jacks at terminal blocks and at each 4-pair termination shall be labeled with laser-printed polyester self-laminating wrap-around labels.
 - (a) Eight-pin 8-position jack label-faceplates;
 - (1) All labels shall be polyester and white in color;
 - (2) All labels shall be 1.80-inch in width and 0.375-inch in length;
 - (3) Labels shall have an adhesive backing;
 - (4) Labels shall be attached to the faceplate by adhesive and clipping in behind the snap in clear plastic cover;
 - (5) Labels shall be laser printed with the labeling scheme as specified;
 - (6) Labels shall be Panduit Pan-CODE Laser Labels (PLL) part EFPL-1, Leviton LabelWare, or equal.
 - (7) Terminal block designation strip:
 - (8) All labels shall be polyester;
 - (9) Labels shall be white in color for 4-pai data station cable terminations, located within a blue plastic label holder;
 - (10) Labels shall be attached to the designation strip provided with the blue plastic holders;
 - (11) All labels shall be 7.88 inches in width and 0.50 inches in length;
 - (12) Labels shall have an adhesive backing;
 - (13) Labels shall be laser-printed with the labeling scheme as specified;
 - (14) Labels shall be Panduit Pan-CODE Laser Labels (PLL) part number PLL-22-Y3-1, Leviton LabelWare, or equal.
 - (15) Labeling for all cable, jacks, and other elements of the telecom cabling system shall follow TIA/EIA-606 Standards. Provide color-coded labels for all wiring blocks as follows:
 - (16) Interface to Site Cabling - Brown
 - (17) Interface to Equipment Cabling - Purple
 - (18) Interface to Horizontal Cabling - Blue
 - (19) Interface to Telephone Company - Green

C. Termination Hardware at IDF (Voice and Data)

1. All cables installed for voice and data application shall be terminated in rack-mounted modular patch panels and the entire installation shall be in compliance with TIA/EIA-568-D Category 6A requirements.
2. Patch panels shall be Leviton Category 6A discrete port-type. Port panels shall be certified by the manufacturer as suitable for 1000 Mbps data transmission. Patch panels shall be manufactured of aluminum or steel.
3. Wire management hardware shall be Leviton Versi-Duct 49265 Series, or equal, installed at both the top and the bottom and between each patch panel and along the sides of the rack for patch cable routing and management.
4. Wire managers shall be of sufficient width and depth to permit orderly routing of all patch cables at one hundred percent utilization.
5. Patch panels shall be mounted on equipment racks. Panels shall be affixed to the rack by at least four (4) screws. The screws shall be of the correct size and thread configuration for the holes in the rack. They shall be tightened to the extent that they hold the equipment firmly to the rack, without distorting the equipment or stripping the threads.
6. Patch panel quantity of ports as noted on the drawings.

PART 3 - EXECUTION

3.1 CABLE AND WIRE INSTALLATION:

- A. This contractor shall be responsible for the provision and installation of all telecom cables including all supports, hangers, and hardware necessary for a complete installation. Under no circumstances shall cables be laid on the suspended ceiling. This contractor shall be responsible for providing and installing all necessary cable support hardware to meet Category 6A requirements. Refer also to Section 26 27 00 Basic Materials & Methods:
 1. T-Bar Suspended Ceilings: Copper station cabling may be run outside of conduits when routed above T-Bar suspended ceilings. Cables installed in this fashion are to be run horizontally in bundles and tied down neatly suspended from J-hooks, and well clear of any light fixtures or other electrical appliances that may affect data transmissions.
- B. At the existing IDF cables are to be segregated by type, neatly tied together, properly dressed, and routed to the patch panels. All cables shall be tagged.
- C. Cable distances from patch panels to data outlet shall not exceed 295 feet. This contractor is responsible to ensure the distance specified is not exceeded.
- D. Care shall be exercised in routing both station and backbone/tie cables so as to avoid areas where sources of high levels of EMI (such as electric motors, transformers and fluorescent lighting fixtures) may exist. Maintain a minimum distance of 12" for voltages of 3KVA or less and 36" separation for voltage of 5KVA and more from these sources when run parallel. Cross at 90-degree angles where crossing must occur.
- E. Each station cable shall be "home run" (no splices or cross connection points) between jacks and patch panels.
- F. All openings or raceway transitions through firewalls and floors shall utilize UL listed fire-rated penetrations.

- G. No more than (2) 90-degree bends shall be allowed on all conduit runs for the horizontal voice/data cabling system, without an intermediate pullbox or junction box.
- H. Station cable terminations.
 - 1. Cable pair twists of Category 6A Cable shall be maintained within 0.5-inch of the point of termination. Under no circumstances shall cable pairs be untwisted or otherwise altered prior to termination.
 - 2. Do not bend Category 6A station cables to a radius of less than 4 times the cable diameter - approximately 2-inches.
 - 3. Allow slack in Category 6A cable bundles at entrances and exits of conduit sleeves and at transitions from "J" hooks to cable trays. Do not exceed maximum 25 pounds of pulling tension on cabling. Never pull cables tight at cable tray transitions; doing so may damage the cables by crimping them on the cable tray side of the bundles.
 - 4. Keep the cable evenly distributed within the cable tray. Do not allow the cables or bundles to be pulled tight against the splines or to be unevenly balanced on one side of the tray.
 - 5. Bundles of station cable in floor slots shall not exceed 2.5 inches in diameter, and shall be spaced 4 inches apart for proper fire stopping of the floor slot.
 - 6. Bundles of station cable in 4-inch floor sleeves shall not exceed a 39 percent fill.
- I. Where copper cable enter an equipment room, it shall be affixed to the backboard via "D" Rings and cable ties. All cable shall be neatly bundled, combed, and tied. All exposed cable runs shall be horizontal or vertical, and bends shall comply with manufacturer required minimum cable bending radii.
- J. Provide (1) patch cable for each activated jack on the project. Lengths shall be 5ft. minimum. Patch cords shall be factory tested to ensure compliance with current standards.
- K. Labeling: Labeling shall include, but not be limited to:
 - 1. Labeling telecommunications outlet faceplates;
 - 2. Labeling station cables;
 - 3. Labeling terminal blocks;
 - 4. Labeling of telecommunications equipment racks.
 - 5. Labeling of telecommunications pathways, including conduits, steel wire cable trays, cable runway and pullboxes;
 - 6. The intent of the final labeling is to allow the Owner or persons contracted by the Owner to identify any part of the structured cabling system through physical identification of the components and their related components at the specified access point without the use of electrical, electronic or mechanical means of identification.

3.2 GROUNDING SYSTEM AND CONDUCTORS

- A. Bonding and Grounding:
 - 1. Communication bonding and grounding shall be in accordance with the NEC and NFPA. Guidelines of ANSI/TIA-607-C shall be followed. Horizontal cables shall be grounded in compliance with ANSI/NFPA 70 and local requirements and practices. Horizontal equipment includes cross connect frames, patch panels and racks, active telecommunication equipment and test apparatus and equipment.

B. Telecommunications Bonding Backbone:

1. Provide a Telecommunications Bonding Backbone utilizing a minimum #6 AWG bonding conductor (or as shown on drawings) that provides direct bonding between equipment rooms and telecommunications closets. Connect this bonding backbone cable to the main grounding electrode system at the electric service switchboard.
2. Provide a copper ground bar at each telecommunications equipment room or rack location, connected to the bonding backbone.
3. Provide a #6 AWG stranded copper cable from each ground bar to each adjacent rack or cable trays system.

3.3 LIGHTNING PROTECTION BLOCKS**A. Protection:**

1. Provide protection blocks at each building entry for copper site cable terminations; as manufactured by Circa, or equal.
2. Provide sufficient capacity for protections of all pairs.
3. Materials: As indicated on the Drawings.

3.4 FIRE AND SMOKE PARTITION PENETRATIONS

- A. Conduit sleeves shall be provided as part of this contract as a means of routing cables through fire-rated walls and floors. Openings in sleeves and conduits used for system cables and those that remain (empty) spare shall be sealed with an approved fireproof, removable sagging material at completion. Sleeves, which pass vertically from floor to floor, shall be sealed in a similar manner using an approved re-enterable system. Additional penetrations through rated assemblies, necessary for passage of voice/data wiring, shall be made using an approved method and permanently sealed after installation of cables. UL systems must be available for each firestop penetration and included in the submittal. All firestop products must be readily available at local electrical and/or telecom distribution outlets.

3.5 COPPER CABLE TESTING AND DOCUMENTATION

- A. Cabling systems shall meet or exceed the electrical and transmission characteristics of the systems specified.
- B. Cable segments and links shall be tested from both ends of the cable for each of the construction phases. (Verify that cable labeling matches at both ends).
- C. The system shall not be considered certified until the tester has acknowledged that the performance of the physical layer of the system has been fully tested and is operational at the completion of the installation phase.
- D. After the installation is complete, in addition to any other required testing as described herein, and at such times as the Owner or Architect directs, the Contractor shall be present while the Owner conducts an operating test for approval. The installation shall be demonstrated to be in accordance with the requirements of this specification. Any defects revealed shall be corrected promptly at the Contractor's expense and the tests performed again.

- E. After review of the completed test results, the Owner reserves the right to retest the installed cables, utilizing the Contractor's tester and the Contractor's labor.
- F. Equipment Manufacturer's Factory Test
 - 1. Each cable and equipment manufacturer shall factory test their respective products being installed on this project and provide test reports at time of delivery. Provide separate respective test reports indicating that they meet or exceed the latest applicable TIA/EIA Standards and technical bulletins.
 - 2. All other products relative to this specification shall be tested to its respective industry strictest standards.
 - 3. Each manufacturer shall factory test their respective cable or equipment provided to this project at several lower frequency levels, including the minimum and maximum frequency level indicated herein. The test reports shall indicate test results for at least five equal incremental frequency levels including the maximum required.
 - a. Field Testing Equipment: Submit during shop drawing review on the testing equipment to be utilized on this project. Tester shall be a Level IV device or better and configured to the specific cable installed. The installer shall test all cables installed under this Section.
 - 1) Unshielded Twisted Pair Testing Equipment:
 - (a) The cable tester shall have a wide variety of preprogrammed cable types as an integral part of its testing system and have the ability to test cables less than 6 feet (6ft.) from the test point.
 - (1) Testing shall be accomplished using level III or higher field tester that is loaded with the most current version of test software by the manufacturer of the test equipment.
 - (2) Provide factory calibration report of field test equipment.
 - 2) Testing Procedures:
 - (a) Testing shall conform to TIA-568 standards.
 - (b) Testing shall be to the Permanent Link Test Parameters.
 - (c) Test each pair and shield of each cable for opens, shorts, grounds, and pair reversal. Correct grounded and reversed pairs. Examine open and shorted pairs to determine if problem is caused by improper termination. If termination is proper, tag bad pairs at both ends and note on termination sheets.
 - (d) Test each UTP cable and passive components. Provide certification that entire installation of UTP cabling, equipment and jacks are NRTL certified meeting or exceeding a minimum of category performance specified on all four pairs of conductors.
 - (e) Tests shall be based on each pair of conductors and not the aggregate multiple pair results.
 - (f) Test all installed cable segments end-to-end, from the telecommunications room horizontal patch panel/cross connect block panel to each work area outlet and from each telecommunications room backbone patch panel/cross-connect block panel to respective main cross connect, and from the work area outlet to the main cross-connect (through patch cables or cross- connect wiring) with a Signal Injector, Graphical Link Testing Meter and Time Domain Reflectometer (TDR) for compliance to

latest TIA performance requirements, as well as NEXT, ELFEXT, structural return loss, alternating power sum, opens, shorts, continuity, cable length, and characteristic impedance.

- (g) Provide report indicating failures and what actions were taken to ensure a passing horizontal cable and its terminations. Any cable failing the certification test (Fail, Fail* or, Pass*) must have remedial work done to provide a full pass test result; Remediation may include re-termination or replacement of the cable, which fails. Cables passing within tolerance only (Conditional Pass*) will not be accepted.
- 3) Test results:
 - (a) The test results information for each link shall be recorded in the memory of the field tester upon completion of the test. The tester shall be capable of storing test data in either internal or external memory. The external media used shall be left to the discretion of the user.
 - (b) Test results saved by the tester shall be transferred into a Windows based database utility that allows for maintenance, inspection and archiving of these test records. A guarantee must be made that the measurement results are transferred to the PC unaltered as well as any printed reports generated from the software application.
 - (c) Optional formats of data reporting are: comma separated variable (.csv), Portable Document File (.pdf) or compatible, plain text (.txt), or hypertext markup language (.html/.htm).
 - (d) Test Results shall include the following:
 - (1) Applicable room number of jack location (room number per Contract Documents)
 - (2) Applicable Telecommunications Room number
 - (3) Circuit I.D. number with corresponding jack identifier
 - (4) Wire Map - shall include the following:
 - (5) Continuity to the remote end
 - (6) Shorts between any two or more conductors
 - (7) Crossed pairs
 - (8) Reversed pairs
 - (9) Split pairs
 - (10) Any other mis-wiring
 - (11) Length
 - (12) Insertion Loss
 - (13) Near-end Crosstalk (NEXT) Loss
 - (14) PS-NEXT (Power Sum Near End Cross Talk)
 - (15) ELFEXT (Equal Level Far End Cross Talk)

- (16) PS-ELFEXT (Power Sum Equal Level Far End Cross Talk)
- (17) Propagation Delay
- (18) Delay Skew
- (19) Return loss

3.6 TRAINING AND PATCHING

- A. The Contractor shall provide a minimum of (1) person for a minimum of (8) man-hours beginning with the first scheduled move-in date to train Owner personnel in maintenance and repair of cabling system. This technician shall also assist the Owner in patching telecom services throughout the facility during the move-in period. It is at this time that all Owner-provided connectivity for voice and data services will be provided to the Contractor. Patching of the station assignments between the Owner's services demark shall also be considered part of this Contractor's work.

3.7 ACCEPTANCE

- A. Prior to acceptance all the following conditions must be met:
 - 1. As required the Contractor shall make submittals and deficiencies or rejected submittals shall be corrected.
 - 2. All specified cable management devices including cable ladder, steel wire cable tray, 2-sided vertical rack cabling sections, horizontal ring panels shall be installed as indicated and specified. All parts not installed shall be inventoried and provided to the Owner in the manufacturer's packaging.
 - 3. All seismic bracing shall be in place.
 - 4. All specified station cabling with associated termination components, labeling and fire stopping shall be installed properly. Any component not installed shall be inventoried and provided to the Owner in the manufacturer's packaging; loose miscellaneous parts shall not be accepted.
 - 5. Terminal blocks shall be clean and free of trimmed or cut-off copper pairs, sheaths, armors, cable lubricants or any other disposables used in the installation of the station cables.
 - 6. All station cables shall be neatly dressed behind the terminal blocks in the IDF.
 - 7. All required submittals indicated in this Specification Section shall be made by the Contractor, and any deficiencies or rejected submittals shall be corrected.
 - 8. Any deficiencies and punch list items shall be corrected.
 - 9. All as-built documentation shall be complete, reviewed and provided to the Owner.
- B. Acceptance of the telecommunications system by the Owner shall be based on the result of testing, functionality, and the receipt of documentation and warranty. With regard to testing, Contractor shall provide two technicians, equipped with the specified test equipment, to do random test verification in the presence of, and at the direction of, an Owner designated representative. Verification testing shall not exceed 20% of the cable plant, provided cables tested are verified to be 100% compliant, per requirements previously stated. If more than 5% of cables tested during the verification process fail, Owner reserves the right to have the entire cable plant

retested, at the Contractor's expense, and in the presence of an Owner-designated representative.

3.8 RECORD DRAWINGS

- A. The project record drawings shall show the types, locations, cable numbers and pair counts of installed twisted-pair cable:
 - 1. Cable routing and numbers.
- B. The project record drawings shall show the types and locations of installed equipment racks.

END OF SECTION

SECTION 32 17 00**PAVEMENT MARKINGS**

PART 1 - GENERAL**1.1 SUMMARY****A. Section Includes:**

1. Pavement Striping and Symbols.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM) Test Methods B 117, C 501, C 1028, D 543, D 570, D 638, D 695, D 790, G 151, G 155, and E 84.
- B. American Association of State Highway and Transportation Officials (AASHTO): Test Method AASHTO-H20.
- C. California Code of Regulations (CCR 2019) Title 24 Part 1 and Part 2.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's literature.

PART 2 - PRODUCTS**2.1 MATERIALS**

- A. Pavement Striping and Symbols Marking Paint: Latex water based emulsion traffic marking paint, ready mixed, and complying with FS-TT-P-1952, with drying time of less than 45 minutes.
 1. Color: Uniform throughout complying with the following:
 - a. Red for "KEEP CLEAR" block lettering

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. Examine the areas and conditions under which Work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.
- B. Pavement Striping and Symbols:
 1. Apply in accordance with manufacturer's latest published requirements, specifications and details.

2. Do not apply marking paint when weather is foggy or rainy, or ambient or pavement temperatures are below 40 deg. F., nor when such conditions are anticipated during eight hours after application.
3. Allow concrete pavement to cure for 28 days and be dry before starting pavement marking.
4. Apply paint with mechanical equipment.
5. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
6. Apply marking paint straight and uniform.
7. Apply symbols where shown on the Drawings.
8. Apply fire lane markings in accordance with local Fire Marshall Requirements. Use approved stencils for lettering.

END OF SECTION