

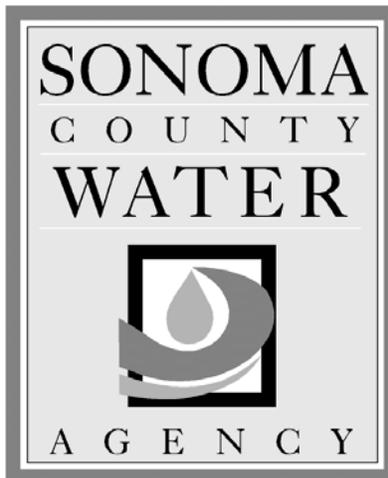
CONTRACT NO.
71-80-7 #1

PROJECT MANUAL

VOLUME 2

FOR

**Geothermal Heat Pump Retrofit
at 404 Aviation Boulevard, Santa Rosa, CA**



NOVEMBER 2009

DOCUMENT 00010

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STANDARD EDITION

(VOLUME 1)

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SPECIFICATIONS

DIVISION 1

GENERAL REQUIREMENTS

SECTION 01100

SUMMARY**PART 1 GENERAL****1.1 SUMMARY**

A. Section includes:

1. Summary of Work and Work Restrictions including:
 - a. Summary
 - b. Submittals
 - c. Work Covered By Contract Documents
 - d. Bid Items, Allowances, and Alternates
 - e. Work Under Other Contracts
 - f. Future Work
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 - o. Protection of Existing Structures and Underground Facilities
 - p. Permits
 - q. Rights-of-Way
 - r. Document Tracking
 - s. Products Ordered In Advance
 - t. Owner-Furnished Products

1.2 SUBMITTALS

A. Work Plans:

1. Utility Protection Plan

1.3 WORK COVERED BY CONTRACT DOCUMENTS

- A. Work comprises modifying Owner's heating, ventilating and air conditioning (HVAC) system at its administration office at 404 Aviation Boulevard in Santa Rosa, California from a conventional HVAC system to a geothermal heat pump system including, without limitation, construction of 120 vertical wells 400 feet deep for the geothermal ground loop heat exchanger, demolishing existing HVAC equipment, providing approximately 47 geothermal heat pumps, ductwork modifications, condenser water circulation system, Building Management System, electrical modifications, and appurtenant Work. Contract Documents fully describe the Work.
- B. The Work of this Contract comprises construction of all the Work indicated, described in the Specifications, or otherwise required by the Contract Documents.
- C. Unless provided otherwise in the Contract Documents, all risk of loss to Work covered by Contract Documents shall rest with Contractor until Final Acceptance of the Work.

- D. Cost of maintenance of systems and equipment prior to Final Acceptance will be considered as included in prices Bid and no direct or additional payment will be made therefor.

1.4 BID ITEMS, ALLOWANCES, AND ALTERNATES

- A. Any Bid item may be deleted from the Work and Contract Sum, in total or in part, prior to or after award of Contract without compensation in any form or adjustment of other Bid items or prices therefore.
- B. Payment of all items is subject to provisions of Contract Documents, including without limitation Section 01200 (Price and Payment Procedures).
- C. For all Bid items, furnish and install all Work, including connections to existing systems, indicated and described in Specifications and all other Contract Documents. Work and requirements applicable to each individual Bid item, or unit of Work, shall be deemed incorporated into the description of each Bid item (whether Lump Sum or Unit Price).
- D. Bid item descriptions (listed by Bid item number):
1. Bonds. The lump sum price paid under this item shall be full payment for furnishing bonds as required by Document 00700 (General Conditions).
 2. Insurance. The lump sum price paid under this item shall be full payment for furnishing insurance as required by Document 00700 (General Conditions).
 3. Safety Program. The lump sum price paid under this item shall be full payment for furnishing and implementing the Safety Program as required by Section 01540 (Site Security and Safety) and Document 00700 (General Conditions).
 4. Storm Water Pollution Prevention Plan. The lump sum price paid under this item shall be full payment for furnishing and implementing the Storm Water Pollution Prevention Plan as required by Section 01500 (Temporary Facilities and Controls).
 5. Mobilization/Demobilization. The lump sum price paid under this item shall be full payment for initial mobilization at Project commencement (50% to be paid then), and cleanup and demobilization at Final Completion (50% to be paid then).
 6. Demolition of Existing HVAC. The lump sum price paid under this item shall be full payment for demolition and removal of all existing rooftop AC units, ceiling VAV units, rooftop boiler, Building Management System (Metasys) components, electrical panels, power meters, switchboard components, emergency power manual transfer switch system, and associated mechanical and electrical appurtenances including but not limited to thermostats, controllers, cables, and wiring.
 7. Geothermal Heat Pumps. The lump sum price paid under this item shall be full payment for providing complete and operational geothermal heat pumps and related provisions including, but not limited to structural supports, ductwork connections, condenser water piping connections, valves, dampers, electrical, instrumentation, controls, and appurtenances.
 8. Mechanical Work. The lump sum price paid under this item shall be full payment for providing complete and operational mechanical system for the geothermal heat pump system including, but not limited to gravity ventilators, ductwork, dampers, diffusers, condenser water loop piping to each heat pump and to the ground loop header, valves, primary loop pumps, expansion tank, air separator, filters, chemical feeders, hydronic related materials, valves, fire smoke dampers, supports, hardware, and appurtenances.
 9. Building Management System. The lump sum price paid under this item shall be full payment for providing a complete Building Management System and associated appurtenances including but not limited to thermostats, controllers, cables, and wiring.

10. Geothermal Ground Loop Wells. The unit price paid under this item shall be full payment for providing geothermal ground loop wells including but not limited to drilling, grouting, piping, and spoils management of the vertical ground loop wells. For purposes of payment, this item will be measured by each well.
11. Geothermal Ground Loop Headers and Looping. The lump sum price paid under this item shall be full payment for providing geothermal ground loop pipe fittings, valves, trenchwork, headering, initial pressure test, piping up to the pump enclosure piping, manifolds, pressure/temperature gauges, and appurtenances.
12. Electrical Work. The lump sum price paid under this item shall be full payment for providing complete and operational electrical system for the new geothermal heat pump system including, but not limited to electrical switchboard modifications, electrical panels for heat pumps, wiring and conduit from panels to interior and exterior devices, power metering, and modifications to emergency power manual transfer switch system.
13. Power and Communications Conduits through Parking Lot. The lump sum price paid under this item shall be full payment for providing two 5 inch electrical power conduits and three 2 inch communications conduits from southwest corner of main building, across the parking lot, to the far west corner of the parking lot (adjacent to the gas vault). Price includes power and communications boxes and trenchwork.
14. Architectural and Structural Work. The lump sum price paid under this item shall be full payment for providing architectural and structural modifications to support the geothermal heat pump system including, but not limited to: Complete pump enclosure; Rooftop repairs, additions, or removals for any mechanical equipment, hydronic equipment, electrical equipment, or other rooftop alterations.
15. Repair t-bar. The unit price paid under this item shall be full payment for repairs or replacements to the T-bar system or ceiling tiles damaged or altered during construction. For purposes of payment, this item will be measured by square foot of ceiling surface area.
16. Civil Work. The lump sum price paid under this item shall be full payment for providing civil modifications to support the geothermal heat pump system including, but not limited to: Parking lot asphalt and concrete repairs or alterations at any locations where trenching, headering, drilling, or other activities occur as a result of providing the geothermal ground loop; Parking lot seal coat; Parking lot striping; Precast concrete vault and aluminum door for access to demonstration display borehole supply and return piping.
17. Starting, Adjusting, Commissioning, and Training. The lump sum price paid under this item shall be full payment for starting, adjusting, commissioning, training, testing, balancing, and adjusting of all mechanical, electrical, instrumentation, control, and hydronic systems for a complete and operations geothermal heat pump system including, but not limited to heat pump airside system, water side system, diffuser balancing, and primary hydronic pump balancing.
18. Installation, Operation, and Maintenance Manuals. The lump sum price paid under this item shall be full payment for furnishing installation, operation, and maintenance manuals as required by Section 01330 (Submittal Procedures).
19. All Other Work. The lump sum price paid under this item shall be full payment for all Work of Contract Documents other than Work separately provided for under other Bid items.

- E. Contingency Reserve.
 - 1. Costs authorized to be paid from the Contingency Reserve:
 - a. Cost to Contractor or Subcontractor for removal, as directed by Owner, of unforeseen underground manmade structures that interfere with construction and that require special equipment or additional labor, time, or equipment.
 - b. Cost to Contractor or Subcontractor for relocation or repair, as directed by Owner, of unforeseen underground utilities.
- F. Allowances: (N/A)
- G. Alternates: (N/A)

1.5 WORK UNDER OTHER CONTRACTS

- A. None expected.

1.6 FUTURE WORK

- A. None expected.

1.7 WORK SEQUENCE

- A. Construct Work in stages and at times to accommodate Owner operation requirements during the construction period; coordinate construction schedule and operations with Owner.
- B. Special operational constraints include the following:
 - 1. General process shutdowns: Notify Owner in writing at least 2 Business Days prior to the need for a shutdown of any of the existing process or system. Certify that all materials, equipment, and personnel are available to perform the Work requiring the shutdown. Owner may verify this certification. Owner forces will perform shutdowns of existing systems. Limit shutdowns to 8 hours maximum, unless otherwise approved by Owner. Timing of shutdowns will be at Owner's discretion.
 - a. The Contractor is limited to a total of five eight-hour shutdowns for the Project. Only one shutdown is allowed in any seven-Day period.
 - b. Plan and organize work to minimize number and length of shutdowns.
 - 2. Minimum space heating and cooling requirements: Sequence work such that all the building interior zones have adequate space conditioning with existing or new equipment during normal work hours of 6 a.m. to 6 p.m. Monday through Friday.
 - a. Indoor air temperature shall not exceed 80 degrees F.
 - b. Indoor air temperature shall not drop below 60 degrees F.
- C. Special Work requirements include sequencing the Work as follows:
 - 1. Put all acoustical tiles removed for Work back in place by 5 a.m. each Business Day.
 - 2. Cover all office furniture, equipment, floors, partitions, etc. when performing indoor work.
 - 3. Maintain indoor office cleanliness to preconstruction levels by 5 a.m. each workday.
 - 4. Provide all new HVAC electrical panels before demolishing existing HVAC electrical panels.
 - 5. Clean, flush, and pressure test ground loop and primary condenser water loop prior to connecting new heat pumps to the condenser water piping in accordance with Section 15181 (Hydronic Piping and Specialties) and Section 15600 (Ground Heat Exchanger).
 - 6. Do not demolish any existing air handling units until new heat pumps are installed, functioning, and ready to serve the zones being served.
 - 7. Unless otherwise noted, new heat pumps may be temporarily operated by recirculating space conditioned air only and no outside air by closing new damper to outside air duct,

- until new gravity ventilator is provided. Notify Owner if this temporary operation, so that Owner can modify operation of existing air handling units.
8. Provide new heat pumps HP28, HP36 to HP47 which replace existing Bryant and Trane units AC1 to AC14.
 9. Demolish existing Bryant and Trane units AC1 to AC4 and AC6 to AC14
 10. Demolish existing Bryant and Trane units AC5, only when gravity ventilator GV3 can be provided over the same weekend.
 11. Provide gravity ventilator GV3.
 12. After providing heat pumps with outside air, perform the following:
 - a. Clean, flush, and pressure test all interior piping in accordance with Section 15181 (Hydronic Piping and Specialties).
 - b. Perform electrical, instrumentation, and control testing in accordance with Section 16441 (Switchboards) and Section 16442 (Panelboards).
 - c. Start-up and adjust HVAC systems for in accordance with Section 01750 (Starting and Adjusting), Section 15950 (HVAC Systems: Balancing and Testing), and Section 15900 (Building Management System).
 13. Provide new heat pumps HP1 to HP18, HP24 which replace existing Carrier unit AC1.
 14. Demolish existing Carrier unit AC1, only when gravity ventilator GV1 can be provided over the same weekend.
 15. Provide gravity ventilator GV1.
 16. After providing heat pumps with outside air, perform the following:
 - a. Clean, flush, and pressure test all interior piping in accordance with Section 15181 (Hydronic Piping and Specialties).
 - b. Perform electrical, instrumentation, and control testing in accordance with Section 16441 (Switchboards) and Section 16442 (Panelboards).
 - c. Start-up and adjust HVAC systems for in accordance with Section 01750 (Starting and Adjusting), Section 15950 (HVAC Systems: Balancing and Testing), and Section 15900 (Building Management System).
 17. Provide new heat pumps HP19 to HP23, HP25 to HP27, 29 to HP35 which replace existing Carrier unit AC2.
 18. Demolish existing Carrier unit AC2, only when gravity ventilator GV2 can be provided over the same weekend.
 19. Provide gravity ventilator GV2.
 20. After providing heat pumps with outside air, perform the following:
 - a. Clean, flush, and pressure test all interior piping in accordance with Section 15181 (Hydronic Piping and Specialties).
 - b. Perform electrical, instrumentation, and control testing in accordance with Section 16441 (Switchboards) and Section 16442 (Panelboards).
 - c. Start-up and adjust HVAC systems for in accordance with Section 01750 (Starting and Adjusting), Section 15950 (HVAC Systems: Balancing and Testing), and Section 15900 (Building Management System).
 21. Demolish existing Carrier unit AC3, boiler hot water system, parapets, and Metasys building management system.
 22. Test and balance all new HVAC systems in accordance with Section 15950 (HVAC Systems: Balancing and Testing).

1.8 WORK DAYS AND HOURS

A. Work Days and hours:

1. Outdoor Work: Monday-Friday inclusive, 6:00 a.m.-7:00 p.m. local time.
 2. Indoor Work: Thursday 6 p.m. through Monday 5 a.m. local time. Restrict operations to no more than 5,000 square feet until 6 p.m. on Fridays.
- B. Work at the Site on holidays or outside of the times listed in paragraph 1.8A above is not permitted, unless Contractor requests otherwise from Owner in writing at least 48 hours in advance and Owner approves in its sole discretion.
- C. Contractor will not be permitted to schedule utility shutdowns on Fridays.

1.9 SHUTDOWN FOR DISCOVERY OF CULTURAL RESOURCES

- A. If discovery is made of items of historical, archaeological, or paleontological interest, immediately cease all Work in the area of discovery. Archaeological indicators may include, but are not limited to, dwelling sites, locally darkened soils, stone implements or other artifacts, fragments of glass or ceramics, animal bones, human bones, and fossils. After cessation of excavation, immediately contact Owner. Do not resume Work until authorization is received from Owner. When resumed, excavation or other activities shall be as directed by Owner.

1.10 COOPERATION OF CONTRACTOR AND COORDINATION WITH OTHER WORK

- A. Coordinate with Owner and any Owner forces, or other contractors and forces, as required by Document 00700 (General Conditions), Article 6.
- B. Employ a full-time coordinator to constantly review Contract Documents, submittals, changes, and prepare overlay drawings as necessary to avoid conflicts, errors, omissions and untimely construction.

1.11 PARTIAL OCCUPANCY/UTILIZATION REQUIREMENTS

- A. Allow Owner to take possession of and use any completed or partially completed portion of the Work during the progress of the Work as soon as is possible without interference to the Work.
- B. Possession, use of Work, and placement and installation of equipment by Owner shall not in any way evidence the completion of the Work or any part of it.
- C. Contractor shall not be held responsible for damage to the occupied part of the Work resulting from Owner occupancy.
- D. Make available, in areas occupied, on a 24-hour per day and 7-day per week basis if required, any utility services, heating, and cooling in condition to be put in operation at the time of occupancy.
1. Responsibility for operation and maintenance of said equipment shall remain with Contractor.
 2. Make, and Owner shall certify, an itemized list of each piece of equipment so operated with the date operation commences.
 3. Itemized list noted above shall be basis for commencement of warranty period for equipment.
 4. Owner shall pay for utility cost arising out of occupancy by Owner during construction.
- E. Use and occupancy by Owner prior to acceptance of Work does not relieve Contractor of its responsibility to maintain insurance and bonds required under the Contract until entire Work is completed and accepted by Owner.
- F. Prior to date of Final Acceptance of the Work by Owner, all necessary repairs or renewals in Work or part thereof so used, not due to ordinary wear and tear, but due to Defective materials or workmanship or to operations of Contractor, shall be made at expense of Contractor, as required in Document 00700 (General Conditions).

- G. Use by Owner of Work or part thereof as contemplated by this Section 01100 shall in no case be construed as constituting acceptance of Work or any part thereof. Such use shall neither relieve Contractor of any responsibilities under Contract, nor act as waiver by Owner of any of the conditions thereof.
- H. Owner may specify in the Contract Documents that portions of the Work, including electrical and mechanical systems or separate structures, shall be substantially completed on dates described in paragraph 1.7 of this Section 01100, if any, prior to Substantial Completion of all of the Work. Notify Owner in writing when Contractor considers any such part of the Work ready for its intended use and Substantially Complete and request Owner to issue a Certificate of Substantial Completion for that part of the Work.

1.12 CONTRACTOR USE OF SITE

- A. Confine operations at Site to areas permitted by Contract Documents, permits, ordinances, and laws.
- B. Do not unreasonably encumber Site with materials or equipment.
- C. Assume full responsibility for protection and safekeeping of products stored on premises.
- D. Move any stored products that interfere with operations of Owner or other contractor.
- E. Coordinate parking, storage, staging, and Work areas with Owner.
- F. Do not store construction materials in the Dripline of any tree.
- G. Access is available to the Site from Aviation Boulevard.
- H. Contractor shall contact Owner at least 2 Business Days prior to entering the building and performing Work to allow Owner to arrange access into the building.

1.13 AIR QUALITY STANDARDS

- A. Ensure that idling time for all heavy equipment is minimized to reduce on-Site emissions.
- B. Maintain equipment in good mechanical condition.
- C. Cover trucks hauling dirt.
- D. Limit dust emissions during periods of high winds (greater than 15 miles per hour).
- E. Replace ground cover in disturbed areas as soon as possible.
- F. Enclose, cover, water, or apply soil binders to exposed stockpiles.
- G. Remove earth tracked onto neighboring paved roads at least once daily.
- H. Limit equipment speed to 10 miles per hour in unpaved areas.

1.14 CONSTRUCTION STAKING AND MONUMENT PROTECTION

- A. N/A

1.15 PROTECTION OF EXISTING STRUCTURES AND UNDERGROUND FACILITIES

- A. The Drawings may indicate existing above- and below-grade structures, drainage lines, storm drains, sewers, water lines, gas lines, electrical lines, and other similar items and Underground Facilities that are known to Owner.
 1. At least 2 Business Days, or as otherwise noted, prior to commencement of excavation, notify the owners of the following Underground Facilities:
 - a. Sewer lines: Agency, Service Center, Phone: (707) 521-1892
 - b. Gas lines: Pacific Gas & Electric, Phone: 1 (800) 743-5000
 - c. Water lines: Town of Windsor, Phone: (707) 838-1004
 - d. Telephone conduit: AT&T, Phone: Common Ground Alliance, 811
- B. Where overhead service to a structure, known to receive service, does not exist, then underground service shall be assumed to exist.
- C. Attention is also directed to the existence of overhead power and telephone lines.

- D. Perform potholing using hand or mechanical vacuum methods within 24 inches (in any direction) of the Underground Facilities. This may be done on an area-by-area basis, but shall be accomplished at least 7 Days in advance of the date of construction within such area.
- E. No attempt has been made to locate utilities on Owner's property such as sprinkler irrigation systems. Contact the Owner prior to construction.
- F. In addition to reporting, if a utility is damaged, Contractor shall take appropriate action as provided in Document 00700 (General Conditions).
- G. Additional compensation or extension of time on account of utilities not indicated or otherwise brought to Contractor's attention including reasonable action taken to protect or repair damage shall be determined as provided in Document 00700 (General Conditions).
- H. Provide Utility Protection Plan, including:
 - 1. Indication of all utilities that are expected to conflict with Work, including proposed pothole locations.
 - 2. Proposed measures to protect active utilities from damage and removal of inactive utilities, as necessary.
 - 3. Proposed measures to be taken in the event an active utility is damaged or broken due to Contractor's activities.

1.16 PERMITS

- A. Permits, agreements, or written authorizations that are known by Owner to apply to this Project are listed below:
 - 1. *State Water Resources Control Board (SWRCB), Order No. 99 - 08 - DWQ, National Pollutant Discharge Elimination System (NPDES), General Permit No. CAS000002, Waste Discharge Requirements (WDRs) for Discharges of Storm Water Runoff Associated with Construction Activity (General Permit).* Owner will file a Notice of Intent with SWRCB to obtain coverage under the General Permit. Contractor shall provide the Storm Water Pollution Prevention Plan, as described in Section 01500 (Temporary Facilities and Controls), in support of the Notice of Intent. A copy of the WDRs is included at the end of this Section 01100.
 - 2. *Cal/OSHA Permit.* Obtain, as applicable, permit(s) as required by Cal/OSHA for the following:
 - a. Construction of trenches or excavations that are five feet or more in depth and into which a person is required to descend.
 - b. Construction or demolition of any building, structure, or scaffolding for falsework more than three stories high, or the equivalent height (36 feet).
 - c. Erection or dismantling of vertical shoring systems more than three stories high, or the equivalent height (36 feet).
 The local Cal/OSHA district office is located at:
 1221 Farmers Lane, Suite 300
 Santa Rosa, CA 95405
 Phone: (707) 576-2388
 - 3. *County of Sonoma Building/Electrical/Well Permit.* Owner has obtained the necessary permits from PRMD for the Work under this Contract requiring a permit. Copies of the permits are included at the end of this Section 01100. The Inspection Record Card(s) will be furnished to Contractor for posting at the Site.

- B. All other permits that may be required, including, but not limited to, mechanical, fire prevention, irrigation, grading, slope protection, tree cutting, dechlorinated water discharge, and flushing water discharge have not been applied for and shall be obtained by Contractor.
- C. Applicable permit fees will be reimbursed to the extent specified in Document 00700 (General Conditions).
- D. Furnish copies of Contractor-obtained permits to Owner.

1.17 RIGHTS-OF-WAY

- A. Owner owns the Project right-of-way as indicated.
- B. Owner has obtained a permit-to-enter for temporary parking and construction access on 400 and 402 Aviation Boulevard. A copy of the permit-to-enter is included at the end of this Section 01100. Contractor is cautioned that the permit-to-enter expires on July 31, 2010.

1.18 DOCUMENT TRACKING

- A. Owner will maintain a computerized document control system to monitor the generation, status, and filing of documents. Documents such as, but not limited to, Contracts, Cost Proposals, Change Orders (proposed and approved), Meeting Minutes, Schedules and Reports, Payment Applications, certificates of insurance, Safety Reports, Requests for Information, Requests for Substitutions, correspondence, communications, notices, Submittals, transmittals, and logs shall be submitted electronically for Owner to control the documents using the computerized system. Owner will use the computerized system to track and manage all documents on the Project, after Notice to Proceed, to the greatest extent possible.
- B. Provide all Project documents to Owner in electronic format with a minimum of one hard copy, unless otherwise required by the Contract Documents. If file size prohibits electronic transmittal, submit to Owner on compact disk (CD).
- C. Provide electronic format documents in portable document format (PDF), unless otherwise required by the Contract Documents or directed in writing by Owner.

PART 2 PRODUCTS

2.1 PRODUCTS ORDERED IN ADVANCE

- A. As provided in Section 01200 (Price and Payment Procedures), paragraph 1.5E, and subject to all other provisions of the Contract Documents, Owner will pay for the following materials and equipment prior to incorporation into the Work:
 - 1. Materials:
 - a. None
 - 2. Equipment:
 - a. None

2.2 OWNER-FURNISHED PRODUCTS

- A. Owner-Furnished Products:
 - 1. None
- B. Owner's Responsibilities:
 - 1. Arrange for and deliver Owner-reviewed Shop Drawings, Product Data, and Samples, to Contractor.
 - 2. Arrange and pay for delivery to Site.
 - 3. On delivery, inspect products jointly with Contractor.

4. Submit claims for transportation damage and replace damaged, Defective, or deficient items.
 5. Arrange for manufacturers' warranties, inspections, and service.
- C. Contractor's Responsibilities:
1. Review Owner-reviewed Shop Drawings, Product Data, and Samples.
 2. Receive and unload products at Site; inspect for completeness or damage jointly with Owner.
 3. Handle, store, install, and finish products.
 4. Repair or replace items damaged after receipt.
 5. Install into Project per Contract Documents.

PART 3 EXECUTION - NOT USED

END OF SECTION

OWNER PERMITS FOLLOW THIS PAGE

STATE WATER RESOURCES CONTROL BOARD (SWRCB)
ORDER NO. 99 - 08 - DWQ
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES)
GENERAL PERMIT NO. CAS000002

WASTE DISCHARGE REQUIREMENTS (WDRS)
FOR
DISCHARGES OF STORM WATER RUNOFF ASSOCIATED WITH CONSTRUCTION ACTIVITY

The State Water Resources Control Board finds that:

1. Federal regulations for controlling pollutants in storm water runoff discharges were promulgated by the U.S. Environmental Protection Agency (USEPA) on November 16, 1990 (40 Code of Federal Regulations (CFR) Parts 122, 123, and 124). The regulations require discharges of storm water to surface waters associated with construction activity including clearing, grading, and excavation activities (except operations that result in disturbance of less than five acres of total land area and which are not part of a larger common plan of development or sale) to obtain an NPDES permit and to implement Best Available Technology Economically Achievable (BAT) and Best Conventional Pollutant Control Technology (BCT) to reduce or eliminate storm water pollution.

On December 8, 1999 federal regulations promulgated by USEPA (40CFR Parts 9, 122, 123, and 124) expanded the NPDES storm water program to include storm water discharges from municipal separate storm sewer systems (MS4s) and construction sites that were smaller than those previously included in the program. Federal regulation 40 CFR § 122.26(b)(15) defines small construction activity as including clearing, grading, and excavating that result in land disturbance of equal to or greater than one acre or less than five acres or is part of a larger common plan of development or sale. Permit applications for small construction activities are due by March 10, 2003.

2. This General Permit regulates pollutants in discharges of storm water associated with construction activity (storm water discharges) to surface waters, except from those areas on Tribal Lands; Lake Tahoe Hydrologic Unit; construction projects which disturb less than one acre, unless part of a larger common plan of development or sale; and storm water discharges which are determined ineligible for coverage under this General Permit by the California Regional Water Quality Control Boards (RWQCBs). Attachment 1 contains addresses and telephone numbers of each RWQCB office.
3. This General Permit does not preempt or supersede the authority of local storm water management agencies to prohibit, restrict, or control storm water discharges to separate storm sewer systems or other watercourses within their jurisdiction, as allowed by State and Federal law.
4. To obtain authorization for proposed storm water discharges to surface waters, pursuant to this General Permit, the landowner (discharger) must submit a Notice of Intent (NOI) with a vicinity map and the appropriate fee to the SWRCB prior to commencement of construction activities. In addition, coverage under this General Permit shall not occur until the applicant develops a Storm Water Pollution Prevention Plan (SWPPP) in accordance with the requirements of Section

A of this permit for the project. For proposed construction activity conducted on easements or on nearby property by agreement or permission, or by an owner or lessee of a mineral estate (oil, gas, geothermal, aggregate, precious metals, and/or industrial minerals) entitled to conduct the activities, the entity responsible for the construction activity must submit the NOI and filing fee and shall be responsible for development of the SWPPP.

5. If an individual NPDES Permit is issued to a discharger otherwise subject to this General Permit or if an alternative General Permit is subsequently adopted which covers storm water discharges regulated by this General Permit, the applicability of this General Permit to such discharges is automatically terminated on the effective date of the individual permit or the date of approval for coverage under the subsequent General Permit.
6. This action to adopt an NPDES permit is exempt from the provisions of the California Environmental Quality Act (Public Resources Code Section 21100, et seq.) in accordance with section 13389 of the California Water Code.
7. The SWRCB adopted the California Ocean Plan, and the RWQCBs have adopted and the SWRCB has approved Water Quality Control Plans (Basin Plans). Dischargers regulated by this General Permit must comply with the water quality standards in these Basin Plans and subsequent amendments thereto.
8. The SWRCB finds storm water discharges associated with construction activity to be a potential significant sources of pollutants. Furthermore, the SWRCB finds that storm water discharges associated with construction activities have the reasonable potential to cause or contribute to an excursion above water quality standards for sediment in the water bodies listed in Attachment 3 to this permit.
9. It is not feasible at this time to establish numeric effluent limitations for pollutants in storm water discharges from construction activities. Instead, the provisions of this General Permit require implementation of Best Management Practices (BMPs) to control and abate the discharge of pollutants in storm water discharges.
10. Discharges of non-storm water may be necessary for the completion of certain construction projects. Such discharges include, but are not limited to: irrigation of vegetative erosion control measures, pipe flushing and testing, street cleaning, and dewatering. Such discharges are authorized by this General Permit as long as they (a) do comply with Section A.9 of this General Permit, (b) do not cause or contribute to violation of any water quality standard, (c) do not violate any other provision of this General Permit, (d) do not require a non-storm water permit as issued by some RWQCBs, and (e) are not prohibited by a Basin Plan. If a non-storm water discharge is subject to a separate permit adopted by a RWQCB, the discharge must additionally be authorized by the RWQCB permit.
11. Following adoption of this General Permit, the RWQCBs shall enforce the provisions herein including the monitoring and reporting requirements.
12. Following public notice in accordance with State and Federal laws and regulations, the SWRCB in a public meeting on June 8, 1998, heard and considered all comments. The SWRCB has prepared written responses to all significant comments.

13. This Order is an NPDES permit in compliance with section 402 of the Clean Water Act (CWA) and shall take effect upon adoption by the SWRCB provided the Regional Administrator of the USEPA has no objection. If the USEPA Regional Administrator objects to its issuance, the General Permit shall not become effective until such objection is withdrawn.
14. This General Permit does not authorize discharges of fill or dredged material regulated by the U.S. Army Corps of Engineers under CWA section 404 and does not constitute a waiver of water quality certification under CWA section 401.
15. The Monitoring Program and Reporting Requirements are modified in compliance with a judgment in the case of San Francisco BayKeeper, et al. v. State Water Resources Control Board. The modifications include sampling and analysis requirements for direct discharges of sediment to waters impaired due to sediment and for pollutants that are not visually detectable in runoff that may cause or contribute to an exceedance of water quality objectives.
16. Storm water discharges associated with industrial activity that are owned or operated by municipalities serving populations less than 100,000 people are no longer exempt from the need to apply for or obtain a storm water discharge permit. A temporary exemption, which was later extended by USEPA, was provided under section 1068(c) of the Intermodal Surface Transportation and Efficiency Act (ISTEA) of 1991. Federal regulation 40 CFR § 122.26(e)(1)(ii) requires the above municipalities to submit permit application by March 10, 2003.
17. This permit may be reopened and modified to include different monitoring requirements for small construction activity than for construction activity over five (5) acres.

IT IS HEREBY ORDERED that all dischargers who file an NOI indicating their intention to be regulated under the provisions of this General Permit shall comply with the following:

A. DISCHARGE PROHIBITIONS:

1. Authorization pursuant to this General Permit does not constitute an exemption to applicable discharge prohibitions prescribed in Basin Plans, as implemented by the nine RWQCBs.
2. Discharges of material other than storm water which are not otherwise authorized by an NPDES permit to a separate storm sewer system (MS4) or waters of the nation are prohibited, except as allowed in Special Provisions for Construction Activity, C.3.
3. Storm water discharges shall not cause or threaten to cause pollution, contamination, or nuisance.
4. Storm water discharges regulated by this General Permit shall not contain a hazardous substance equal to or in excess of a reportable quantity listed in 40 CFR Part 117 and/or 40 CFR Part 302.

B. RECEIVING WATER LIMITATIONS:

1. Storm water discharges and authorized nonstorm water discharges to any surface or ground water shall not adversely impact human health or the environment.
2. The SWPPP developed for the construction activity covered by this General Permit shall be designed and implemented such that storm water discharges and authorized nonstorm water discharges shall not cause or contribute to an exceedance of any applicable water quality standards contained in a Statewide Water Quality Control Plan and/or the applicable RWQCB's Basin Plan.
3. Should it be determined by the discharger, SWRCB, or RWQCB that storm water discharges and/or authorized nonstorm water discharges are causing or contributing to an exceedance of an applicable water quality standard, the discharger shall:
 - a. Implement corrective measures immediately following discovery that water quality standards were exceeded, followed by notification to the RWQCB by telephone as soon as possible but no later than 48 hours after the discharge has been discovered. This notification shall be followed by a report within 14-calender [sic] days to the appropriate RWQCB, unless otherwise directed by the RWQCB, describing (1) the nature and cause of the water quality standard exceedance; (2) the BMPs currently being implemented; (3) any additional BMPs which will be implemented to prevent or reduce pollutants that are causing or contributing to the exceedance of water quality standards; and (4) any maintenance or repair of BMPs. This report shall include an implementation schedule for corrective actions and shall describe the actions taken to reduce the pollutants causing or contributing to the exceedance.
 - b. The discharger shall revise its SWPPP and monitoring program immediately after the report to the RWQCB to incorporate the additional BMPs that have been and will be implemented, the implementation schedule, and any additional monitoring needed.
 - c. Nothing in this section shall prevent the appropriate RWQCB from enforcing any provisions of this General Permit while the discharger prepares and implements the above report.

C. SPECIAL PROVISIONS FOR CONSTRUCTION ACTIVITY:

1. All dischargers shall file an NOI and pay the appropriate fee for construction activities conducted at each site as required by Attachment 2: Notice of Intent--General Instructions.
2. All dischargers shall develop and implement a SWPPP in accordance with Section A: Storm Water Pollution Prevention Plan. The discharger shall implement controls to reduce pollutants in storm water discharges from their construction sites to the BAT/BCT performance standard.
3. Discharges of non-storm water are authorized only where they do not cause or contribute to a violation of any water quality standard and are controlled through implementation of appropriate BMPs for elimination or reduction of pollutants. Implementation of appropriate BMPs is a condition for authorization of non-storm water discharges. Non-storm water discharges and the BMPs appropriate for their control must be described in the SWPPP. Wherever feasible, alternatives which do not

result in discharge of nonstorm water shall be implemented in accordance with Section A.9. of the SWPPP requirements.

4. All dischargers shall develop and implement a monitoring program and reporting plan in accordance with Section B: Monitoring Program and Reporting Requirements.
5. All dischargers shall comply with the lawful requirements of municipalities, counties, drainage districts, and other local agencies regarding discharges of storm water to separate storm sewer systems or other watercourses under their jurisdiction, including applicable requirements in municipal storm water management programs developed to comply with NPDES permits issued by the RWQCBs to local agencies.
6. All dischargers shall comply with the standard provisions and reporting requirements contained in Section C: Standard Provisions.
7. The discharger may terminate coverage for a portion of the project under this General Permit when ownership of a portion of this project has been transferred or when a phase within this multi-phase project has been completed. When ownership has transferred, the discharger must submit to its RWQCB a Change of Information Form (COI) Attachment 4 with revised site map and the name, address and telephone number of the new owner(s). Upon transfer of title, the discharger should notify the new owner(s) of the need to obtain coverage under this General Permit. The new owner must comply with provisions of Sections A. 2. (c) and B. 2. (b) of this General Permit. To terminate coverage for a portion of the project when a phase has been completed, the discharger must submit to its RWQCB a COI with a revised map that identifies the newly delineated site.
8. The discharger may terminate coverage under this General Permit for a complete project by submitting to its RWQCB a Notice of Termination Form (NOT), and the post-construction BMPs plan according to Section A.10 of this General Permit. Note that a construction project is considered complete only when all portions of the site have been transferred to a new owner; or the following conditions have been met:
 - a. There is no potential for construction related storm water pollution,
 - b. All elements of the SWPPP have been completed,
 - c. Construction materials and waste have been disposed of properly,
 - d. The site is in compliance with all local storm water management requirements, and
 - e. A post-construction storm water management plan is in place as described in the site's SWPPP.
9. This General Permit expires five years from the date of adoption.

D. REGIONAL WATER QUALITY CONTROL BOARD (RWQCB) AUTHORITIES:

1. RWQCBs shall:
 - a. Implement the provisions of this General Permit. Implementation of this General Permit may include, but is not limited to requesting the submittal of SWPPPs, reviewing SWPPPs, reviewing monitoring reports, conducting compliance inspections, and taking enforcement actions.
 - b. Issue permits as they deem appropriate to individual dischargers, categories of dischargers, or dischargers in a geographic area. Upon issuance of such permits by a RWQCB, the affected dischargers shall no longer be regulated by this General Permit.

2. RWQCBs may require, on a case-by-case basis, the inclusion of an analysis of potential downstream impacts on receiving waterways due to the permitted construction.
3. RWQCBs may provide information to dischargers on the development and implementation of SWPPPs and monitoring programs and may require revisions to SWPPPs and monitoring programs.
4. RWQCBs may require dischargers to retain records for more than three years.
5. RWQCBs may require additional monitoring and reporting program requirements including sampling and analysis of discharges to water bodies listed in Attachment 3 to this permit. Additional requirements imposed by the RWQCB should be consistent with the overall monitoring effort in the receiving waters.
6. RWQCBs may issue individual NPDES permits for those construction activities found to be ineligible for coverage under this permit.

CERTIFICATION

The undersigned, Administrative Assistant to the Board, does hereby certify that the foregoing is a full, true, and correct copy of an order duly and regularly adopted at a meeting of the State Water Resources Control Board held on August 19, 1999.

AYE: James M. Stubchaer
 Mary Jane Forster
 John W. Brown
 Arthur G. Baggett, Jr.

NO: None

ABSENT: None

ABSTAIN: None

_____/s/_____
 Maureen Marché
 Administrative Assistant to the Board

SECTION A: STORM WATER POLLUTION PREVENTION PLAN

1. Objectives

A Storm Water Pollution Prevention Plan (SWPPP) shall be developed and implemented to address the specific circumstances for each construction site covered by this General Permit. The SWPPP shall be certified in accordance with the signatory requirements of section C, Standard Provision for Construction Activities (9). The SWPPP shall be developed and amended or revised, when necessary, to meet the following objectives:

- a. Identify all pollutant sources including sources of sediment that may affect the quality of storm water discharges associated with construction activity (storm water discharges) from the construction site, and
- b. Identify non-storm water discharges, and
- c. Identify, construct, implement in accordance with a time schedule, and maintain Best Management Practices (BMPs) to reduce or eliminate pollutants in storm water discharges and authorized nonstorm water discharges from the construction site during construction, and
- d. Develop a maintenance schedule for BMPs installed during construction designed to reduce or eliminate pollutants after construction is completed (post-construction BMPs).
- e. Identify a sampling and analysis strategy and sampling schedule for discharges from construction activity which discharge directly into water bodies listed on Attachment 3. (Clean Water Act Section 303(d) [303(d)] Water Bodies listed for Sedimentation).
- f. For all construction activity, identify a sampling and analysis strategy and sampling schedule for discharges that have been discovered through visual monitoring to be potentially contaminated by pollutants not visually detectable in the runoff.

2. Implementation Schedule

- a. For construction activity commencing on or after adoption of this General Permit, the SWPPP shall be developed prior to the start of soil-disturbing activity in accordance with this Section and shall be implemented concurrently with commencement of soil-disturbing activities.
- b. Existing permittees engaging in construction activities covered under the terms of the previous General Construction Permit SWPPP (WQ Order No. 92-08-DWQ) shall continue to implement their existing SWPPP and shall implement any necessary revisions to their SWPPP in accordance with this Section of the General Permit in a timely manner, but in no case more than 90-calender [sic] days from the date of adoption of this General Permit.
- c. For ongoing construction activity involving a change of ownership of property, the new owner shall review the existing SWPPP and amend if necessary, or develop a new SWPPP within 45-calender [sic] days.
- d. Existing permittees shall revise their SWPPP in accordance with the sampling and analysis modifications prior to August 1, 2001. For ongoing construction activity involving a change of ownership the new owner shall review the existing SWPPP and amend the sampling and analysis strategy, if required, within 45 days. For construction activity commencing after the date of adoption, the SWPPP shall be developed in accordance with the modification language adopted.

3. Availability

The SWPPP shall remain on the construction site while the site is under construction during working hours, commencing with the initial construction activity and ending with termination of coverage under the General Permit.

4. Required Changes

- a. The discharger shall amend the SWPPP whenever there is a change in construction or operations which may affect the discharge of pollutants to surface waters, ground waters, or a municipal separate storm sewer system (MS4). The SWPPP shall also be amended if the discharger violates any condition of this General Permit or has not achieved the general objective of reducing or eliminating pollutants in storm water discharges. If the RWQCB determines that the discharger is in violation of this General Permit, the SWPPP shall be amended and implemented in a timely manner, but in no case more than 14-calendar days after notification by the RWQCB. All amendments should be dated and directly attached to the SWPPP.
- b. The RWQCB or local agency with the concurrence of the RWQCB may require the discharger to amend the SWPPP.

5. Source Identification

The SWPPP shall include: (a) project information and (b) pollutant source identification combined with an itemization of those BMPs specifically chosen to control the pollutants listed.

- a. **Project Information**
 - (1) The SWPPP shall include a vicinity map locating the project site with respect to easily identifiable major roadways, geographic features, or landmarks. At a minimum, the map must show the construction site perimeter, the geographic features surrounding the site, and the general topography.
 - (2) The SWPPP shall include a site map(s) which shows the construction project in detail, including the existing and planned paved areas and buildings.
 - (a) At a minimum, the map must show the construction site perimeter; existing and proposed buildings, lots, roadways, storm water collection and discharge points; general topography both before and after construction; and the anticipated discharge location(s) where the storm water from the construction site discharges to a municipal storm sewer system or other water body.
 - (b) The drainage patterns across the project area must clearly be shown on the map, and the map must extend as far outside the site perimeter as necessary to illustrate the relevant drainage areas. Where relevant drainage areas are too large to depict on the map, map notes or inserts illustrating the upstream drainage areas are sufficient.
 - (c) Temporary on-site drainages to carry concentrated flow shall be selected to comply with local ordinances, to control erosion, to return flows to their natural drainage courses, and to prevent damage to downstream properties.

3. Information presented in the SWPPP may be represented either by narrative or by graphics. Where possible, narrative descriptions should be plan notes. Narrative descriptions which do not lend themselves to plan notes can be contained in a separate document which must be referenced on the plan.

b. Pollutant Source and BMP Identification

The SWPPP shall include a description of potential sources which are likely to add pollutants to storm water discharges or which may result in nonstorm water discharges from the construction site. Discharges originating from off-site which flow across or through areas disturbed by construction that may contain pollutants should be reported to the RWQCB.

The SWPPP shall:

- (1) Show drainage patterns and slopes anticipated after major grading activities are completed. Runoff from off-site areas should be prevented from flowing through areas that have been disturbed by construction unless appropriate conveyance systems are in place. The amount of anticipated storm water run-on must be considered to determine the appropriateness of the BMPs chosen. Show all calculations for anticipated storm water run-on, and describe all BMPs implemented to divert off-site drainage described in section A. 5 a. (2) (c) around or through the construction project.
- (2) Show the drainage patterns into each on-site storm water inlet point or receiving water. Show or describe the BMPs that will protect operational storm water inlets or receiving waters from contaminated discharges other than sediment discharges, such as, but not limited to: storm water with elevated pH levels from contact with soil amendments such as lime or gypsum; slurry from sawcutting of concrete or asphalt ;washing of exposed aggregate concrete; concrete rinse water; building washing operations; equipment washing operations; minor street washing associated with street delineation; and/or sealing and paving activities occurring during rains.
- (3) Show existing site features that, as a result of known past usage, may contribute pollutants to storm water, (e.g., toxic materials that are known to have been treated, stored, disposed, spilled, or leaked onto the construction site). Show or describe the BMPs implemented to minimize the exposure of storm water to contaminated soil or toxic materials.
- (4) Show areas designated for the (a) storage of soil or waste, (b) vehicle storage and service areas, (c) construction material loading, unloading, and access areas, (d) equipment storage, cleaning, and maintenance areas.
- (5) Describe the BMPs for control of discharges from waste handling and disposal areas and methods of on-site storage and disposal of construction materials and construction waste. Describe the BMPs designed to minimize or eliminate the exposure of storm water to construction materials, equipment, vehicles, waste storage areas, or service areas. The BMPs described shall be in compliance with Federal, State, and local laws, regulations, and ordinances.
- (6) Describe all post-construction BMPs for the project, and show the location of each BMP on the map. (Post-construction BMPs consist of permanent features

- designed to minimize pollutant discharges, including sediment, from the site after construction has been completed.) Also, describe the agency or parties to be the responsible party for long-term maintenance of these BMPs.
- (7) Show the locations of direct discharge from the construction site into a Section 303(d) list water body. Show the designated sampling locations in the receiving waters, which represent the prevailing conditions of the water bodies upstream of the construction site discharge and immediately downstream from the last point of discharge.
 - (8) Show the locations designated for sampling the discharge from areas identified in Section A. 5. b. (2), (3), and (4) and Section A. 5. c. (1) and (2). Samples shall be taken should visual monitoring indicate that there has been a breach, malfunction, leakage, or spill from a BMP which could result in the discharge in storm water of pollutants that would not be visually detectable, or if storm water comes into contact with soil amendments or other exposed materials or contamination and is allowed to be discharged. Describe the sampling procedure, location, and rationale for obtaining the uncontaminated sample of storm water.

c. Additional Information

- (1) The SWPPP shall include a narrative description of pollutant sources and BMPs that cannot be adequately communicated or identified on the site map. In addition, a narrative description of preconstruction control practices (if any) to reduce sediment and other pollutants in storm water discharges shall be included.
- (2) The SWPPP shall include an inventory of all materials used and activities performed during construction that have the potential to contribute to the discharge of pollutants other than sediment in storm water. Describe the BMPs selected and the basis for their selection to eliminate or reduce these pollutants in the storm water discharges.
- (3) The SWPPP shall include the following information regarding the construction site surface area: the size (in acres or square feet), the runoff coefficient before and after construction, and the percentage that is impervious (e.g., paved, roofed, etc.) before and after construction.
- (4) The SWPPP shall include a copy of the NOI, and the Waste Discharge Identification (WDID) number. Should a WDID number not be received from the SWRCB at the time construction commences, the discharger shall include proof of mailing of the NOI, e.g., certified mail receipt, copy of check, express mail receipt, etc.
- (5) The SWPPP shall include a construction activity schedule which describes all major activities such as mass grading, paving, lot or parcel improvements at the site and the proposed time frame to conduct those activities.
- (6) The SWPPP shall list the name and telephone number of the qualified person(s) who have been assigned responsibility for prestorm, poststorm, and storm event BMP inspections; and the qualified person(s) assigned responsibility to ensure full compliance with the permit and implementation of all elements of the SWPPP, including the preparation of the annual compliance evaluation and the elimination of all unauthorized discharges.

6. Erosion Control

Erosion control, also referred to as “soil stabilization,” is the most effective way to retain soil and sediment on the construction site. The most efficient way to address erosion control is to preserve existing vegetation where feasible, to limit disturbance, and to stabilize and revegetate disturbed areas as soon as possible after grading or construction.

Particular attention must be paid to large mass-graded sites where the potential for soil exposure to the erosive effects of rainfall and wind is great. Mass graded construction sites may be exposed for several years while the project is being built out. Thus, there is potential for significant sediment discharge from the site to surface waters.

At a minimum, the discharger/operator must implement an effective combination of erosion and sediment control on all disturbed areas during the rainy season. These disturbed areas include rough graded roadways, slopes, and building pads. Until permanent vegetation is established, soil cover is the most cost-effective and expeditious method to protect soil particles from detachment and transport by rainfall. Temporary soil stabilization can be the single-most important factor in reducing erosion at construction sites. The discharger shall consider measures such as: covering with mulch, temporary seeding, soil stabilizers, binders, fiber rolls or blankets, temporary vegetation, permanent seeding, and a variety of other measures.

The SWPPP shall include a description of the erosion control practices, including a time schedule, to be implemented during construction to minimize erosion on disturbed areas of a construction site. The discharger must consider the full range of erosion control BMPs. The discharger must consider any additional site-specific and seasonal conditions when selecting and implementing appropriate BMPs. The above listed erosion control measures are examples of what should be considered and are not exclusive of new or innovative approaches currently available or being developed.

- a. The SWPPP shall include:
 - (1) An outline of the areas of vegetative soil cover or native vegetation onsite which will remain undisturbed during the construction project.
 - (2) An outline of all areas of soil disturbance including cut or fill areas which will be stabilized during the rainy season by temporary or permanent erosion control measures, such as seeding, mulch, or blankets, etc.
 - (3) An outline of the areas of soil disturbance, cut, or fill which will be left exposed during any part of the rainy season, representing areas of potential soil erosion where sediment control BMPs are required to be used during construction.
 - (4) A proposed schedule for the implementation of erosion control measures.
- b. The SWPPP shall include a description of the BMPs and control practices to be used for both temporary and permanent erosion control measures.
- c. The SWPPP shall include a description of the BMPs to reduce wind erosion at all times, with particular attention paid to stock-piled materials.

7. Stabilization

- (1) All disturbed areas of the construction site must be stabilized. Final stabilization for the purposes of submitting a NOT is satisfied when:

-All soil disturbing activities are completed AND EITHER OF THE TWO FOLLOWING CRITERIA ARE MET:

-A uniform vegetative cover with 70 percent coverage has been established OR:

-equivalent stabilization measures have been employed. These measures include the use of such BMPs as blankets, reinforced channel liners, soil cement, fiber matrices, geotextiles, or other erosion resistant soil coverings or treatments.

- (2) Where background native vegetation covers less than 100 percent of the surface, such as in arid areas, the 70 percent coverage criteria is adjusted as follows: If the native vegetation covers 50 percent of the ground surface, 70 percent of 50 percent ($.70 \times .50 = .35$) would require 35 percent total uniform surface coverage.

8. Sediment Control

The SWPPP shall include a description or illustration of BMPs which will be implemented to prevent a net increase of sediment load in storm water discharge relative to preconstruction levels. Sediment control BMPs are required at appropriate locations along the site perimeter and at all operational internal inlets to the storm drain system at all times during the rainy season. Sediment control practices may include filtration devices and barriers (such as fiber rolls, silt fence, straw bale barriers, and gravel inlet filters) and/or settling devices (such as sediment traps or basins). Effective filtration devices, barriers, and settling devices shall be selected, installed and maintained properly. A proposed schedule for deployment of sediment control BMPs shall be included in the SWPPP. These are the most basic measures to prevent sediment from leaving the project site and moving into receiving waters. Limited exemptions may be authorized by the RWQCB when work on active areas precludes the use of sediment control BMPs temporarily. Under these conditions, the SWPPP must describe a plan to establish perimeter controls prior to the onset of rain.

During the nonrainy season, the discharger is responsible for ensuring that adequate sediment control materials are available to control sediment discharges at the downgrade perimeter and operational inlets in the event of a predicted storm. The discharger shall consider a full range of sediment controls, in addition to the controls listed above, such as straw bale dikes, earth dikes, brush barriers, drainage swales, check dams, subsurface drain, sandbag dikes, fiber rolls, or other controls. At a minimum, the discharger/operator must implement an effective combination of erosion and sediment control on all disturbed areas during the rainy season.

If the discharger chooses to rely on sediment basins for treatment purposes, sediment basins shall, at a minimum, be designed and maintained as follows:

Option 1: Pursuant to local ordinance for sediment basin design and maintenance, provided that the design efficiency is as protective or more protective of water quality than Option 3.

OR

Option 2: Sediment basin(s), as measured from the bottom of the basin to the principal outlet, shall have at least a capacity equivalent to 3,600 cubic feet of storage per acre draining into the sediment basin. The length of the basin shall be more than twice the width of the basin. The length is determined by measuring the distance

between the inlet and the outlet; and the depth must not be less than three feet nor greater than five feet for safety reasons and for maximum efficiency.

OR

Option 3: Sediment basin(s) shall be designed using the standard equation:

$$A_s = 1.2Q/V_s$$

Where: A_s is the minimum surface area for trapping soil particles of a certain size; V_s is the settling velocity of the design particle size chosen; and $Q = C \times I \times A$ where Q is the discharge rate measured in cubic feet per second; C is the runoff coefficient; I is the precipitation intensity for the 10-year, 6-hour rain event and A is the area draining into the sediment basin in acres. The design particle size shall be the smallest soil grain size determined by wet sieve analysis, or the fine silt sized (0.01mm) particle, and the V_s used shall be 100 percent of the calculated settling velocity.

The length is determined by measuring the distance between the inlet and the outlet; the length shall be more than twice the dimension as the width; the depth shall not be less than three feet nor greater than five feet for safety reasons and for maximum efficiency (two feet of storage, two feet of capacity). The basin(s) shall be located on the site where it can be maintained on a year-round basis and shall be maintained on a schedule to retain the two feet of capacity;

OR

Option 4: The use of an equivalent surface area design or equation, provided that the design efficiency is as protective or more protective of water quality than Option 3.

A sediment basin shall have a means for dewatering within 7-calendar days following a storm event. Sediment basins may be fenced if safety (worker or public) is a concern.

The outflow from a sediment basin that discharges into a natural drainage shall be provided with outlet protection to prevent erosion and scour of the embankment and channel.

The discharger must consider any additional site-specific and seasonal conditions when selecting and designing sediment control BMPs. The above listed sediment control measures are examples of what should be considered and are not exclusive of new or innovative approaches currently available or being developed.

The SWPPP shall include a description of the BMPs to reduce the tracking of sediment onto public or private roads at all times. These public and private roads shall be inspected and cleaned as necessary. Road cleaning BMPs shall be discussed in the SWPPP and will not rely on the washing of accumulated sediment or silt into the storm drain system.

9. Non-Storm Water Management

Describe all non-storm water discharges to receiving waters that are proposed for the construction project. Non-storm water discharges should be eliminated or reduced to the extent feasible. Include the locations of such discharges and descriptions of all BMPs designed for the control of pollutants in such discharges. Onetime discharges shall be monitored during the

time that such discharges are occurring. A qualified person should be assigned the responsibility for ensuring that no materials other than storm water are discharged in quantities which will have an adverse effect on receiving waters or storm drain systems (consistent with BAT/BCT), and the name and contact number of that person should be included in the SWPPP document.

Discharging sediment-laden water which will cause or contribute to an exceedance of the applicable RWQCB's Basin Plan from a dewatering site or sediment basin into any receiving water or storm drain without filtration or equivalent treatment is prohibited.

10. Post-Construction Storm Water Management

The SWPPP shall include descriptions of the BMPs to reduce pollutants in storm water discharges after all construction phases have been completed at the site (Post-Construction BMPs). Post-Construction BMPs include the minimization of land disturbance, the minimization of impervious surfaces, treatment of storm water runoff using infiltration, detention/retention, biofilter BMPs, use of efficient irrigation systems, ensuring that interior drains are not connected to a storm sewer system, and appropriately designed and constructed energy dissipation devices. These must be consistent with all local post-construction storm water management requirements, policies, and guidelines. The discharger must consider site-specific and seasonal conditions when designing the control practices. Operation and maintenance of control practices after construction is completed shall be addressed, including short-and long-term funding sources and the responsible party.

11. Maintenance, Inspection, and Repair

The SWPPP shall include a discussion of the program to inspect and maintain all BMPs as identified in the site plan or other narrative documents throughout the entire duration of the project. A qualified person will be assigned the responsibility to conduct inspections. The name and telephone number of that person shall be listed in the SWPPP document. Inspections will be performed before and after storm events and once each 24-hour period during extended storm events to identify BMP effectiveness and implement repairs or design changes as soon as feasible depending upon field conditions. Equipment, materials, and workers must be available for rapid response to failures and emergencies. All corrective maintenance to BMPs shall be performed as soon as possible after the conclusion of each storm depending upon worker safety.

For each inspection required above, the discharger shall complete an inspection checklist. At a minimum, an inspection checklist shall include:

- a. Inspection date.
- b. Weather information: best estimate of beginning of storm event, duration of event, time elapsed since last storm, and approximate amount of rainfall (inches).
- c. A description of any inadequate BMPs.
- d. If it is possible to safely access during inclement weather, list observations of all BMPs: erosion controls, sediment controls, chemical and waste controls, and non-storm water controls. Otherwise, list result of visual inspection at relevant outfall, discharge point, or downstream location and projected required maintenance activities.

- e. Corrective actions required, including any changes to SWPPP necessary and implementation dates.
- f. Inspectors name, title, and signature.

The dischargers shall prepare their inspection checklists using the inspection checklist form provided by the SWRCB or RWQCB or on forms that contain the equivalent information.

12. Training

Individuals responsible for SWPPP preparation, implementation, and permit compliance shall be appropriately trained, and the SWPPP shall document all training. This includes those personnel responsible for installation, inspection, maintenance, and repair of BMPs. Those responsible for overseeing, revising, and amending the SWPPP shall also document their training. Training should be both formal and informal, occur on an ongoing basis when it is appropriate and convenient, and should include training/workshops offered by the SWRCB, RWQCB, or other locally recognized agencies or professional organizations.

13. List of Contractors/Subcontractors

The SWPPP shall include a list of names of all contractors, (or subcontractors) and individuals responsible for implementation of the SWPPP. This list should include telephone numbers and addresses. Specific areas of responsibility of each subcontractor and emergency contact numbers should also be included.

14. Other Plans

This SWPPP may incorporate by reference the appropriate elements of other plans required by local, State, or Federal agencies. A copy of any requirements incorporated by reference shall be kept at the construction site.

15. Public Access

The SWPPP shall be provided, upon request, to the RWQCB. The SWPPP is considered a report that shall be available to the public by the RWQCB under section 308(b) of the Clean Water Act.

16. Preparer Certification

The SWPPP and each amendment shall be signed by the landowner (discharger) or his representative and include the date of initial preparation and the date of each amendment.

SECTION B: MONITORING PROGRAM AND REPORTING REQUIREMENTS

1. Required Changes

The RWQCB may require the discharger to conduct additional site inspections, to submit reports and certifications, or perform sampling and analysis.

2. Implementation

- a. The requirements of this Section shall be implemented at the time of commencement of construction activity (see also Section A. 2. Implementation Schedule). The discharger is responsible for implementing these requirements until construction activity is complete and the site is stabilized.
- b. For ongoing construction activity involving a change in ownership of property covered by this General Permit, the new owner must complete a NOI and implement the requirements of this Section concurrent with the change of ownership. For changes of information, the owner must follow instructions in C. 7. Special Provisions for Construction Activity of the General Permit.

3. Site Inspections

Qualified personnel shall conduct inspections of the construction site prior to anticipated storm events, during extended storm events, and after actual storm events to identify areas contributing to a discharge of storm water associated with construction activity. The name(s) and contact number(s) of the assigned inspection personnel shall be listed in the SWPPP. Pre-storm inspections are to ensure that BMPs are properly installed and maintained; post-storm inspections are to assure that the BMPs have functioned adequately. During extended storm events, inspections shall be required each 24-hour period. Best Management Practices (BMPs) shall be evaluated for adequacy and proper implementation and whether additional BMPs are required in accordance with the terms of the General Permit (see language in Section A. 11. Maintenance, Inspection, and Repair). Implementation of nonstorm water discharge BMPs shall be verified and their effectiveness evaluated. One time discharges of non-storm water shall be inspected when such discharges occur.

4. Compliance Certification

Each discharger or qualified assigned personnel listed by name and contact number in the SWPPP must certify annually that construction activities are in compliance with the requirements of this General Permit and the SWPPP. This Certification shall be based upon the site inspections required in Item 3 of this Section. The certification must be completed by July 1 of each year.

5. Noncompliance Reporting

Dischargers who cannot certify compliance, in accordance with Item 4 of this Section and/or who have had other instances of noncompliance excluding exceedances of water quality standards as defined in section B. 3. Receiving Water Limitations Language, shall notify the appropriate RWQCB within 30 days. Corrective measures should be implemented immediately following discovery that water quality standards were exceeded. The notifications shall identify the noncompliance event, including an initial assessment of any impact caused by the event; describe the actions necessary to achieve compliance; and include a time schedule subject to the modifications by the RWQCB indicating when compliance will be achieved.

Noncompliance notifications must be submitted within 30-calendar days of identification of noncompliance.

6. Monitoring Records

Records of all inspections, compliance certifications, and noncompliance reporting must be retained for a period of at least three years from the date generated. With the exception of noncompliance reporting, dischargers are not required to submit these records.

7. Monitoring Program for Sedimentation/Siltation

Dischargers of storm water associated with construction activity that directly enters a water body listed in Attachment 3 shall conduct a sampling and analysis program for the pollutants (sedimentation/siltation or turbidity) causing the impairment. The discharger shall monitor for the applicable parameter. If the water body is listed for sedimentation or siltation, samples should be analyzed for Settleable Solids (ml/l) and Total Suspended Solids (mg/l). Alternatively or in addition, samples may be analyzed for suspended sediment concentration according to ASTM D3977-97. If the water body is listed for turbidity, samples should be analyzed for turbidity (NTU). Discharges that flow through tributaries that are not listed in Attachment 3 or that flow into Municipal Separate Storm Sewer Systems (MS4) are not subject to these sampling and analysis requirements. The sampling and analysis parameters and procedures must be designed to determine whether the BMPs installed and maintained prevent discharges of sediment from contributing to impairment in receiving waters.

Samples shall be collected during the first two hours of discharge from rain events which result in a direct discharge to any water body listed in Attachment 3. Samples shall be collected during daylight hours (sunrise to sunset). Dischargers need not collect more than four (4) samples per month. All samples shall be taken in the receiving waters and shall be representative of the prevailing conditions of the water bodies. Samples shall be collected from safely accessible locations upstream of the construction site discharge and immediately downstream from the last point of discharge.

For laboratory analysis, all sampling, sample preservation, and analyses must be conducted according to test procedures under 40 CFR Part 136. Field samples shall be collected and analyzed according to the specifications of the manufacturer of the sampling devices employed. Portable meters shall be calibrated according to manufacturer's specification. All field and/or laboratory analytical data shall be kept in the SWPPP document, which is to remain at the construction site at all times until a Notice of Termination has been submitted and approved.

8. Monitoring Program for Pollutants Not Visually Detectable in Storm Water

A sampling and analysis program shall be developed and conducted for pollutants which are not visually detectable in storm water discharges, which are or should be known to occur on the construction site, and which could cause or contribute to an exceedance of water quality objectives in the receiving water. Pollutants that should be considered for inclusion in this sampling and analysis program are those identified in Sections A.5.b. and A.5.c.

Construction materials and compounds that are not stored in water-tight containers under a water-tight roof or inside a building are examples of materials for which the discharger may have to implement sampling and analysis procedures. The goal of the sampling and analysis is to determine whether the BMPs employed and maintained on site are effective in preventing

the potential pollutants from coming in contact with storm water and causing or contributing to an exceedance of water quality objectives in the receiving waters. Examples of construction sites that may require sampling and analysis include: sites that are known to have contaminants spilled or spread on the ground; sites where construction practices include the application of soil amendments, such as gypsum, which can increase the pH of the runoff; or sites having uncovered stockpiles of material exposed to storm water. Visual observations before, during, and after storm events may trigger the requirement to collect samples. Any breach, malfunction, leakage, or spill observed which could result in the discharge of pollutants to surface waters that would not be visually detectable in storm water shall trigger the collection of a sample of discharge. Samples shall be collected at all discharge locations which drain the areas identified by the visual observations and which can be safely accessed. For sites where sampling and analysis is required, personnel trained in water quality sampling procedures shall collect storm water samples. A sufficiently large sample of storm water that has not come in contact with the disturbed soil or the materials stored or used on-site (uncontaminated sample) shall be collected for comparison with the discharge sample. Samples shall be collected during the first two hours of discharge from rain events that occur during daylight hours and which generate runoff.

The uncontaminated sample shall be compared to the samples of discharge using field analysis or through laboratory analysis. Analyses may include, but are not limited to, indicator parameters such as: pH, specific conductance, dissolved oxygen, conductivity, salinity, and TDS.

For laboratory analysis, all sampling, sample preservation, and analyses must be conducted according to test procedures under 40 CFR Part 136. Field discharge samples shall be collected and analyzed according to the specifications of the manufacturer of the sampling devices employed. Portable meters shall be calibrated according to manufacturer's specification. All field and/or analytical data shall be kept in the SWPPP document, which is to remain at the construction site at all times until a *Notice of Termination* has been submitted and approved.

SECTION C: STANDARD PROVISIONS FOR CONSTRUCTION ACTIVITY

1. Duty to Comply

The discharger must comply with all of the conditions of this General Permit. Any permit noncompliance constitutes a violation of the Clean Water Act (CWA) and the Porter-Cologne Water Quality Control Act and is grounds for enforcement action and/or removal from General Permit coverage.

The discharger shall comply with effluent standards or prohibitions established under Section 307(a) of the CWA for toxic pollutants within the time provided in the regulations that establish these standards or prohibitions, even if this General Permit has not yet been modified to incorporate the requirement.

2. General Permit Actions

This General Permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the discharger for a General Permit modification, revocation and reissuance, or

termination, or a notification of planned changes or anticipated noncompliance does not annul any General Permit condition.

If any toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is promulgated under Section 307(a) of the CWA for a toxic pollutant which is present in the discharge and that standard or prohibition is more stringent than any limitation on the pollutant in this General Permit, this General Permit shall be modified or revoked and reissued to conform to the toxic effluent standard or prohibition and the dischargers so notified.

3. Need to Halt or Reduce Activity Not a Defense

It shall not be a defense for a discharger in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this General Permit.

4. Duty to Mitigate

The discharger shall take all responsible steps to minimize or prevent any discharge in violation of this General Permit, which has a reasonable likelihood of adversely affecting human health or the environment.

5. Proper Operation and Maintenance

The discharger shall at all times properly operate and maintain any facilities and systems of treatment and control (and related appurtenances) which are installed or used by the discharger to achieve compliance with the conditions of this General Permit and with the requirements of Storm Water Pollution Prevention Plans (SWPPP). Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. Proper operation and maintenance may require the operation of backup or auxiliary facilities or similar systems installed by a discharger when necessary to achieve compliance with the conditions of this General Permit.

6. Property Rights

This General Permit does not convey any property rights of any sort or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor does it authorize any infringement of Federal, State, or local laws or regulations.

7. Duty to Provide Information

The discharger shall furnish the RWQCB, State Water Resources Control Board, or USEPA, within a reasonable time, any requested information to determine compliance with this General Permit. The discharger shall also furnish, upon request, copies of records required to be kept by this General Permit.

8. Inspection and Entry

The discharger shall allow the RWQCB, SWRCB, USEPA, and/or, in the case of construction sites which discharge through a municipal separate storm sewer, an authorized representative of the municipal operator of the separate storm sewer system receiving the discharge, upon the presentation of credentials and other documents as may be required by law, to:

- a. Enter upon the discharger's premises at reasonable times where a regulated construction activity is being conducted or where records must be kept under the conditions of this General Permit;
- b. Access and copy at reasonable times any records that must be kept under the conditions of this General Permit;
- c. Inspect at reasonable times the complete construction site, including any off-site staging areas or material storage areas, and the erosion/sediment controls; and
- d. Sample or monitor at reasonable times for the purpose of ensuring General Permit compliance.

9. Signatory Requirements

- a. All Notice of Intents (NOIs), Notice of Terminations (NOTs), SWPPPs, certifications, and reports prepared in accordance with this Order submitted to the SWRCB shall be signed as follows:
 - (1) For a corporation: by a responsible corporate officer. For the purpose of this Section, a responsible corporate officer means: (a) a president, secretary, treasurer, or vice president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation, or (b) the manager of the construction activity if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures;
 - (2) For a partnership or sole proprietorship: by a general partner or the proprietor, respectively; or
 - (3) For a municipality, State, Federal, or other public agency: by either a principal executive officer, ranking elected official, or duly authorized representative. The principal executive officer of a Federal agency includes the chief executive officer of the agency or the senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., Regional Administrator of USEPA).
- b. All SWPPPs, reports, certifications, or other information required by the General Permit and/or requested by the RWQCB, SWRCB, USEPA, or the local storm water management agency shall be signed by a person described above or by a duly authorized representative. A person is a duly authorized representative if:
 - (1) The authorization is made in writing by a person described above and retained as part of the SWPPP; or
 - (2) The authorization specifies either an individual or a position having responsibility for the overall operation of the construction activity, such as the position of manager, operator, superintendent, or position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may

thus be either a named individual or any individual occupying a named position).

- c. If an authorization is no longer accurate because a different individual or position has responsibility for the overall operation of the construction activity, a new authorization must be attached to the SWPPP prior to submittal of any reports, information, or certifications to be signed by the authorized representative.

10. Certification

Any person signing documents under Section C, Provision 9 above, shall make the following certification:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, to the best of my knowledge and belief, the information submitted is, true, accurate, and complete.

I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

11. Anticipated Noncompliance

The discharger will give advance notice to the RWQCB and local storm water management agency of any planned changes in the construction activity which may result in noncompliance with General Permit requirements.

12. Penalties for Falsification of Reports

Section 309(c)(4) of the CWA provides that any person who knowingly makes any false material statement, representation, or certification in any record or other document submitted or required to be maintained under this General Permit, including reports of compliance or noncompliance shall upon conviction, be punished by a fine of not more than \$10,000 or by imprisonment for not more than two years or by both.

13. Oil and Hazardous Substance Liability

Nothing in this General Permit shall be construed to preclude the institution of any legal action or relieve the discharger from any responsibilities, liabilities, or penalties to which the discharger is or may be subject to under Section 311 of the CWA.

14. Severability

The provisions of this General Permit are severable; and, if any provision of this General Permit or the application of any provision of this General Permit to any circumstance is held invalid, the application of such provision to other circumstances and the remainder of this General Permit shall not be affected thereby.

15. Reopener Clause

This General Permit may be modified, revoked and reissued, or terminated for cause due to promulgation of amended regulations, receipt of USEPA guidance concerning regulated activities, judicial decision, or in accordance with 40 Code of Federal Regulations (CFR) 122.62, 122.63, 122.64, and 124.5.

16. Penalties for Violations of Permit Conditions

- a. Section 309 of the CWA provides significant penalties for any person who violates a permit condition implementing Sections 301, 302, 306, 307, 308, 318, or 405 of the CWA or any permit condition or limitation implementing any such section in a permit issued under Section 402. Any person who violates any permit condition of this General Permit is subject to a civil penalty not to exceed \$27,500 per calendar day of such violation, as well as any other appropriate sanction provided by Section 309 of the CWA.
- b. The Porter-Cologne Water Quality Control Act also provides for civil and criminal penalties which in some cases are greater than those under the CWA.

17. Availability

A copy of this General Permit shall be maintained at the construction site during construction activity and be available to operating personnel.

18. Transfers

This General Permit is not transferable. A new owner of an ongoing construction activity must submit a NOI in accordance with the requirements of this General Permit to be authorized to discharge under this General Permit. An owner who sells property covered by this General Permit shall inform the new owner of the duty to file a NOI and shall provide the new owner with a copy of this General Permit.

19. Continuation of Expired Permit

This General Permit continues in force and effect until a new General Permit is issued or the SWRCB rescinds this General Permit. Only those dischargers authorized to discharge under the expiring General Permit are covered by the continued General Permit.

COUNTY OF SONOMA
PERMIT AND RESOURCE MANAGEMENT DEPARTMENT

2550 VENTURA AVENUE, SANTA ROSA, CA 95403-2829
 (707) 565-1900 FAX (707) 565-1103

Building Permit Invoice: BLD09-4150

Project Address: 404 AVIATION BLVD SRO	Printed: Thursday, November 05, 2009
Cross Street:	Initialized by: BDAVIS
APN: 059-350-105	Activity Type: B-BLD 901
Description: CONSTRUCT PUMP ROOM	Insp Area: 08
Res/Com: C	Site Review File #:
Std/Quick: Q	Site Review Fees Paid: \$0.00
Fire District: RINCON VAL FIRE GENERAL	

Owner: SONOMA COUNTY WATER AGENCY ATTN GENERAL MGR/CHIEF ENGINEER 2150 COLLEGE AVE SANTA ROSA CA 95401	Applicant: SONOMA COUNTY WATER AGENCY ATTN GENERAL MGR/CHIEF ENGINEER 2150 COLLEGE AVE SANTA ROSA CA 95401
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Valuation:

Occupancy	Type	Factor	Sq Feet	Valuation
S-1 Storage, Mod Haz	Type VB	31.90	220	\$7,018.00
	Totals...		220	\$7,018.00*

Fees:

Item#	Description	Account Code	Tot Fee	Prev. Pmts	Cur. Pmts
51	S.M.I.P. COMMERCIAL	327023-4040	1.47	1.47	.00
52	CA BLDG STANDARDS SB1473	327031-4040	1.00	1.00	.00
60	BLDG PERM PLAN CHECK FEE	025015-1341	169.25	169.25	.00
119	FIRE COMMERCIAL REVIEW	649103-3661	256.00	256.00	.00
122	ELECTRICAL FEE	025015-1341	69.00	69.00	.00
124	PLUMBING FEE	025015-1341	69.00	69.00	.00
132	BUILDING PERMIT FEE	025015-1341	268.68	268.68	.00
140	TECH ENHANCE FEE	025015-4040	20.68	20.68	.00
145	PLAN ADMIN FEE	025015-221-0	40.30	40.30	.00
706	DRN REV - MIN CLEARANCE	025015-3140	76.00	76.00	.00
735	NPDES - BUILDING	025015-1350	32.24	32.24	.00
1165	ZONING PERMITS W/O D.R.	025015-3829	94.00	94.00	.00

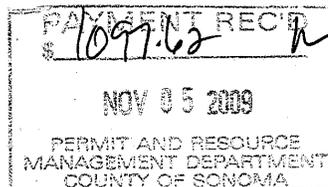
\$1,097.62 \$1,097.62

Total Fees: \$1,097.62
Total Paid: \$1,097.62

Balance Due: \$0.00

"Refunds of fees paid may be made pursuant to Section 108.6 of Appendix 1 of the California Building Code and adopted model codes, subject to the following: 1) 100% of a fee erroneously paid or collected. 2) 90% of the plan review fee when an application for a permit is withdrawn or canceled or expires or becomes void before any plan review effort has been expended. No portion of the plan review fee shall be refunded when any plan review effort has been expended. 3) 90% of the building, plumbing, electrical, and/or mechanical fee may be refunded when a permit is withdrawn, or cancelled or expires or becomes void before any work was done and before any inspections are performed. No portion of these fees shall be refunded when any work was done and/or any inspections have been performed. 4) Application for refund must be made within one year of the date the fee is paid."

When validated below, this is your receipt.
 This Building Permit shall EXPIRE 11/04/2012



INVBLDPRMA B-BLD 901 Rev. 08/25/03 ISSUED

COUNTY OF SONOMA
PERMIT AND RESOURCE MANAGEMENT DEPARTMENT
 2550 VENTURA AVENUE, SANTA ROSA, CA 95403-2829
 (707) 565-1900 FAX (707) 565-1103

Receipt for: BLD09-4150

Receipt Number: R090012131
Address: 404 AVIATION BLVD SRO
Parcel Number: 059350105
File Type: B-BLD 901
 Bldg Permit W/Plancheck

Payment Detail:

Payment Received By: MCROSAT MAC
Transaction Date: 11/05/2009 **09:34 AM**
Notation: JOURNAL VOUCHER

Type	Method	Description	Amount
Payment	Other		1,097.62
Total:			1,097.62

Description	Account Code	Current Pmts
BLDG PERM PLAN CHECK FEE	025015-1341	169.25
BUILDING PERMIT FEE	025015-1341	268.68
CA BLDG STANDARDS SB1473	327031-4040	1.00
DRN REV - MIN CLEARANCE	025015-3140	76.00
ELECTRICAL FEE	025015-1341	69.00
FIRE COMMERCIAL REVIEW	649103-3661	256.00
NPDES - BUILDING	025015-1350	32.24
PLAN ADMIN FEE	025015-221-02500	40.30
PLUMBING FEE	025015-1341	69.00
S.M.I.P. COMMERCIAL	327023-4040	1.47
TECH ENHANCE FEE	025015-4040-w	20.68
ZONING PERMITS W/O D.R.	025015-3829	94.00
Total:		1,097.62

COUNTY OF SONOMA - PERMIT AND RESOURCE MANAGEMENT DEPARTMENT

2550 Ventura Avenue, Santa Rosa, CA 95403 (707) 565-1900 FAX (707) 565-1103

Please Print Your Name: Date Applied:

INFORMATION WITHIN HEAVY LINE TO BE COMPLETED BY APPLICANT

SITE LOCATION INFORMATION - PRINT CLEARLY
Site Address: 404 AVIATION BLVD
City: SANTA ROSA
ZIP: 95403
Cross-Street: AIRPORT
APN: 057-350
Project: 05
Project Fax #:
Directions:
Describe Project: PUMP STATION FOR GEOTHERMAL HEAT PUMP PROJECT 270 W

OWNER NAME AND ADDRESS
Name: SONOMA COUNTY WATER AGENCY
Mailing Address: 404 AVIATION BLVD
City: SANTA ROSA
State: CA
ZIP: 95403
Day Ph: (707) 547-1979
Fax: (707) 524-3791
APPLICANT NAME AND ADDRESS
Name: FRED BERRY - SCWA
Mailing Address: 404 AVIATION BLVD
City: SANTA ROSA
State: CA
ZIP: 95403
Day Ph: (707) 925-5203
Fax: (707) 524-3791

CONTRACTOR INFORMATION
Company Name: TO BE DETERMINED
Address:
City:
State:
ZIP:
Day Ph:
Fax:
OTHER PERSONS (ARCHITECT, ENGINEER, ETC.)
Name:
Address:
City:
State:
ZIP:
Day Ph:
Fax:

WORKER'S COMPENSATION DECLARATION
I hereby affirm under penalty of perjury one of the following declarations:
I have and will maintain a certificate of consent to self-insure for worker's compensation, as provided for by Section 3700 of the Labor Code, for the performance of the work for which this permit is issued.
I have and will maintain worker's compensation insurance, as required by Section 3700 of the Labor Code, for the performance of the work for which this permit is issued. My worker's compensation insurance carrier and policy number are:

CONSTRUCTION LENDING DECLARATION
I hereby affirm under penalty of perjury that there is a construction lending agency for the performance of the work for which this permit is issued. (Sec. 3097, Civ. C.)
Lenders Name:
Lenders Address:

WARNING: FAILURE TO SECURE WORKER'S COMPENSATION COVERAGE IS UNLAWFUL, AND SHALL SUBJECT AN EMPLOYER TO CRIMINAL PENALTIES AND CIVIL FINES UP TO ONE HUNDRED THOUSAND DOLLARS (\$100,000), IN ADDITION TO THE COST OF COMPENSATION, DAMAGES AS PROVIDED FOR IN SECTION 3706 OF THE LABOR CODE, INTEREST, AND ATTORNEY'S FEES.

FOR DEPARTMENT USE
Zoning: MP 101H
File No:
Existing Use/Structures:
Zoning Min. Yard Requirements:
NOTE: Fire Safe Standards require all parcels greater than 1 Acre to have a min. 30' setback unless mitigated.
Approval for Permit Issuance:
Approval for Occupancy:
By:
Date: 11/2/09
Conditions: No design review required

OWNER-BUILDER DECLARATION
I hereby affirm under penalty of perjury that I am exempt from the Contractor's License Law for the following reason (Sec. 7031.5, Business and Professions Code): Any city or county which requires a permit to construct, alter, improve, demolish, or repair any structure, prior to its issuance, also requires the applicant for such permit to file a signed statement that he or she is licensed pursuant to the provisions of the Contractor's License Law (Chapter 9 (commencing with Section 7000) of Division 3 of the Business and Professions Code) or that he or she is exempt therefrom and the basis for the alleged exemption. Any violation of Section 7031.5 by any applicant for a permit subjects the applicant to a civil penalty of not more than five hundred dollars (\$500).

Sewer Connection: Available Fees Paid
Approved by: Date: 10-30-09

I, as owner of the property, or my employees with wages as their sole compensation, will do the work, and the structure is not intended or offered for sale (Sec. 7044 Business and Professions Code). The Contractor's License Law does not apply to an owner of property who builds or improves thereon, and who does such work himself or herself or through his or her own employees, provided that such improvements are not intended or offered for sale. If, however, the building or improvement is sold within one year of completion, the owner-builder will have the burden of proving that he or she did not build or improve for the purpose of sale.
I, as owner of the property, am exclusively contracting with licensed contractors to construct the project (Sec. 7044, Business and Professions Code). The Contractor's License Law does not apply to an owner who builds or improves thereon, and who contracts for such projects with a contractor(s) licensed pursuant to the Contractor's License Law.
I am exempt under Sec. B & P.C. for this reason:

Road Encroachment: Fees Paid
Approved by: Date: 10-30-09

By my signature below I acknowledge that, except for my personal residence in which I must have resided for at least one year prior to completion of the improvements covered by this permit, I cannot legally sell a structure that I have built as an owner-builder if it has not been constructed in its entirety by licensed contractors. I understand that a copy of the applicable law, Section 7044 of the Business and Professions Code, is available upon request when this application is submitted or at the following website: http://www.leginfo.ca.gov/calaw.html.
Date: 11/2/09
Signature of Property Owner or Authorized Agent:

Septic System Permit/Clearance #
Approved by: Date:

LICENSED CONTRACTOR'S DECLARATION
I hereby affirm under penalty of perjury that I am licensed under provisions of Chapter 9 (commencing with Section 7000) of Division 3 of the Business and Professions Code, and my license is in full force and effect.
Lic. Class:
Lic. No.:
Exp. Date:
Contractor:

Flood Zone: Yes No 100 Year Flood Elevation:
Site Review
Drainage Review:
Approved by: Date: 10-26-09

ASBESTOS DECLARATION
Written asbestos notification pursuant to Part 61 of Title 40 of the Code of Federal Regulations is required when asbestos exists in buildings, or portions thereof, undergoing demolition. I hereby declare that demolition authorized by this permit is from construction that () does () does not contain asbestos, or that () no demolition is authorized by this permit.
I certify that I have read this application and affirm under penalty of perjury that the above information is correct. I agree to comply with all local Ordinances and State laws relating to building construction. I hereby authorize representatives of the County of Sonoma to enter upon the above-mentioned property for inspection purposes. If, after making the Certificate of Exemption for the Worker's Compensation provision of the Labor Code I should become subject to such provisions, I will forthwith comply. In the event I do not comply with the Workman's Compensation law, this permit shall be deemed revoked.

Fire:
Approved by: Date: 10/30/09

PERMITTEE SIGNATURE
ADDRESS: 404 AVIATION BLVD
CITY: SANTA ROSA
ZIP:
Contractor Owner Other Licensed Professional

Code Enforcement Violation: Yes No Violation #
This permit is limited to days.

PERMIT AND RESOURCE MANAGEMENT DEPARTMENT
COUNTY OF SONOMA
NOV 05 2009

Work Authorized: pump house

Permit Approved
No Plans Subject to Field Inspection
Blungeck Cleared By: Date: 11/2/09
Type of Construction: Occupancy: No. of Stories: No. of Refinements:
Permit Cleared for Issuance By: Date:
Auto. Fire Sprinklers Report: No. of Units: Certificate of Occupancy:

PAYMENT REC'D
MACHINE SPACE FOR PERMIT FEE
NOV 05 2009
PERMIT AND RESOURCE MANAGEMENT DEPARTMENT
COUNTY OF SONOMA

JOB ADDRESS: 404 AVIATION BLVD
PERMIT NUMBER: B1009-4150
INSPECTION AREA: 4

THIS PERMIT SHALL EXPIRE IN THREE(3) YEARS FROM DATE FEES ARE PAID UNLESS OTHERWISE NOTED BY CODE ENFORCEMENT
Distribution: White - File Canary - Applicant Blue - Assessor Cardstock - Inspector

COUNTY OF SONOMA
PERMIT AND RESOURCE MANAGEMENT DEPARTMENT
 2550 VENTURA AVENUE, SANTA ROSA, CA 95403-2829
 (707) 565-1900 FAX (707) 565-1103

Building Permit Invoice: BLD09-3156

Project Address: 404 AVIATION BLVD SRO
Cross Street:

Printed: Thursday, November 05, 2009

APN: 059-350-105
Description: GEOTHERMAL HEAT PUMP RETRO FIT. COMMERCIAL
Res/Com: C
Std/Quick: S
Fire District: RINCON VAL FIRE GENERAL

Initialized by: CSTENLUN
Activity Type: B-BLD 901

Insp Area: 04

Site Review File #:
Site Review Fees Paid: \$141.00

Owner: SONOMA COUNTY WATER AGENCY
 ATTN GENERAL MGR/CHIEF ENGINEER
 2150 COLLEGE AVE
 SANTA ROSA CA 95401

Applicant: SONOMA COUNTY WATER AGENCY
 ATTN GENERAL MGR/CHIEF ENGINEER
 2150 COLLEGE AVE
 SANTA ROSA CA 95401
 707 547 1979

Valuation:

Occupancy	Type	Factor	Sq Feet	Valuation
	Totals...			\$0.00*

Fees:

Item#	Description	Account Code	Tot Fee	Prev. Pmts	Cur. Pmts
60	BLDG PERM PLAN CHECK FEE	025015-1341	5,520.00	5,520.00	.00
100	SITE REVIEW/ELEV. CERT.	025015-1341	141.00	141.00	.00
122	ELECTRICAL FEE	025015-1341	1,138.49	1,138.49	.00
123	MECHANICAL FEE	025015-1341	2,122.99	2,122.99	.00
124	PLUMBING FEE	025015-1341	688.45	688.45	.00
140	TECH ENHANCE FEE	025015-4040	193.74	193.74	.00
706	DRN REV - MIN CLEARANCE	025015-3140	76.00	76.00	.00

\$9,880.67 \$9,880.67

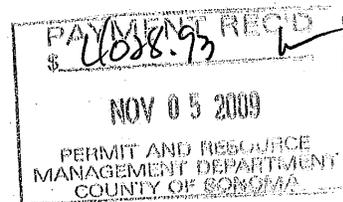
Total Fees: \$9,880.67

Total Paid: \$9,880.67

Balance Due: \$0.00

"Refunds of fees paid may be made pursuant to Section 108.6 of Appendix 1 of the California Building Code and adopted model codes, subject to the following: 1) 100% of a fee erroneously paid or collected. 2) 90% of the plan review fee when an application for a permit is withdrawn or canceled or expires or becomes void before any plan review effort has been expended. No portion of the plan review fee shall be refunded when any plan review effort has been expended. 3) 90% of the building, plumbing, electrical, and/or mechanical fee may be refunded when a permit is withdrawn, or cancelled or expires or becomes void before any work was done and before any inspections are performed. No portion of these fees shall be refunded when any work was done and/or any inspections have been performed. 4) Application for refund must be made within one year of the date the fee is paid."

When validated below, this is your receipt.
 This Building Permit shall EXPIRE 11/04/2012



COUNTY OF SONOMA
PERMIT AND RESOURCE MANAGEMENT DEPARTMENT
 2550 VENTURA AVENUE, SANTA ROSA, CA 95403-2829
 (707) 565-1900 FAX (707) 565-1103

Receipt for: BLD09-3156

Receipt Number: R090012132
Address: 404 AVIATION BLVD SRO
Parcel Number: 059350105
File Type: B-BLD 901
 Bldg Permit W/Plancheck

Payment Detail:

Payment Received By: MCROSAT MAC
Transaction Date: 11/05/2009 09:35 AM
Notation: JOURNAL VOUCHER

Type	Method	Description	Amount
Payment	Other		4,028.93
Total:			4,028.93

Description	Account Code	Current Pmts
ELECTRICAL FEE	025015-1341	1,138.49
MECHANICAL FEE	025015-1341	2,122.99
PLUMBING FEE	025015-1341	688.45
TECH ENHANCE FEE	025015-4040-w	79.00
Total:		4,028.93

COUNTY OF SONOMA - PERMIT AND RESOURCE MANAGEMENT DEPARTMENT
 2550 Ventura Avenue, Santa Rosa, CA 95403 (707) 565-1900 FAX (707) 565-1103

Please Print Your Name: DALE ROBERTS Date Applied: _____

INFORMATION WITHIN HEAVY LINE TO BE COMPLETED BY APPLICANT

SITE LOCATION INFORMATION - PRINT CLEARLY

Site Address: 404 AVIATION BLVD City: SANTA ROSA (UNINCORP AREA) ZIP: 95403
 Cross-Street: AIRPORT BLVD APN: 039 350 15 Project Phone #: (707) 547-1979 Project Fax #: (707) 547-3782
 Directions: _____ Email address: DALE.ROBERTS@SONOMA.CA.GOV Unit # _____ Lot # _____
 Describe Project: GEOHERMAL HEAT PUMP HVAC RETIREMENT Living Area: 60,000 S.F. Contract Price: \$2.7 MILLION
 Garage: _____ Decks: 3

OWNER NAME AND ADDRESS: SONOMA COUNTY WATER AGENCY APPLICANT NAME AND ADDRESS: SAME
 Name: _____ Mailing Address: PO Box 11628 Mailing Address: _____
 City: SANTA ROSA State: CA ZIP: 95406 City: _____ State: _____ ZIP: _____
 Day Ph: (707) 547-1900 Fax: (707) 521-3782 Day Ph: () Fax: ()

CONTRACTOR INFORMATION OTHER PERSONS (ARCHITECT, ENGINEER, ETC.)
 Company Name: TBD BY PUBLIC BID Name: _____
 Address: _____ Address: _____
 City: _____ State: _____ ZIP: _____ City: _____ State: _____ ZIP: _____
 Day Ph: () Fax: () Day Ph: () Fax: ()

WORKER'S COMPENSATION DECLARATION
 I hereby affirm under penalty of perjury that I am exempt from the Contractor's License Law for the following reason:
 I have and will maintain a certificate of consent to self-insure for worker's compensation, as provided for by Section 3700 of the Labor Code, for the performance of the work for which this permit is issued.
 I have and will maintain worker's compensation insurance, as required by Section 3700 of the Labor Code, for the performance of the work for which this permit is issued. My worker's compensation insurance carrier and policy number are: _____
 Carrier Policy No. _____
 (This section need not be completed if the permit is for one hundred dollars (\$100) or less.)
 I certify that in the performance of the work for which this permit is issued, I shall not employ any person in any manner so as to become subject to the worker's compensation laws of California, and agree that if I should become subject to the worker's compensation provisions of Section 3700 of the Labor Code, I shall forthwith comply with these provisions.
 Exp. Date: _____ Applicant: _____

CONSTRUCTION LENDING DECLARATION
 I hereby affirm under penalty of perjury that there is a construction lending agency for the performance of the work for which this permit is issued. (Sec. 3097, Civ. C.)
 Lenders Name: _____
 Lenders Address: _____

FOR DEPARTMENT USE

Zoning: MS-1 File No. _____ Acres _____
 Existing Use/Structures: _____
 Proposed Use/Structures: _____
 Zoning Min. Yard Requirements: Front _____ Left _____ Right _____ Back _____
 NOTE: Fire Safe Standards require all parcels greater than 1 Acre to have a min. 30' setback unless mitigated. Mitigation Required Address subject to change
 Approval for Permit Issuance: _____ Approval for Occupancy: _____
 By: _____ Date: _____
 Conditions: None
Mike Chase 8/12/09

Sewer Connection: Available Fees Paid
 Approved by: D. Caldwell Date: 8-12-09
 Road Encroachment: Fees Paid
 Approved by: D. Caldwell Date: 8-12-09
 Septic System Permit/Clearance # _____
 Approved by: _____ Date: _____
 Flood Zone: Yes No 100 Year Flood Elevation: _____
 Site Review
 Drainage Review: Fuller Date: 12 Aug 09
 Approved by: _____ Date: _____
 Files: NR Date: 8-12-09
 Code Enforcement Violation Yes No Violation # _____
 This permit is limited to _____ days.

Work Authorized: HVAC upgrade

LICENSED CONTRACTOR'S DECLARATION
 I hereby affirm under penalty of perjury that I am licensed under provisions of Chapter 9 (commencing with Section 7000) of Division 3 of the Business and Professions Code, and my license is in full force and effect.
 Lic. Class _____ Lic. No. _____
 Exp. Date _____ Contractor _____

ASBESTOS DECLARATION
 Written asbestos notification pursuant to Part 61 of Title 40 of the Code of Federal Regulations is required when asbestos exists in buildings, or portions thereof, undergoing demolition. I hereby declare that demolition authorized by this permit is from construction that () does () does not contain asbestos, or that () no demolition is authorized by this permit.
 I certify that I have read this application and affirm under penalty of perjury that the above information is correct. I agree to comply with all local Ordinances and State laws relating to building construction. I hereby authorize representatives of the County of Sonoma to enter upon the above-mentioned property for inspection purposes. If, after making the Certificate of Exemption for the Worker's Compensation provision of the labor Code I should become subject to such provisions, I will forthwith comply. In the event I do not comply with the Worker's Compensation law, this permit shall be deemed revoked.
 Signature: Dale Roberts
 PERMITTEE SIGNATURE: _____
 ADDRESS: _____ CITY: _____ ZIP: _____
 Contractor Owner Other Licensed Professional

PAYMENT RECEIVED
 \$ _____
 NOV 05 2009
 PERMIT AND RESOURCE MANAGEMENT DEPARTMENT
 COUNTY OF SONOMA
 Distribution: White - File Canary - Applicant Blue - Assessor Cardstock - Inspector

JOB ADDRESS: 404 AVIATION BLVD
 PERMIT NUMBER: B1009-3156
 INSPECTION AREA: 4

Special Inspection and Testing Requirements

CNI-012

S.C. Water Agency
Project Name

404 Aviation
Project Address

BLD09-3156
Permit No.

Reinforced Concrete, Gunite, Grout and Mortar: CBC 1701.5.1

- | | | | | |
|-------------------------------------|--------------------------|--------------------------|--------------------------|------------------------|
| Concrete | Gunite | Grout | Mortar | |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Aggregate Tests |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Reinforcing Tests |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Mix Designs |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Reinforcing Placement |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Batch Plant Inspection |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Inspect Placing |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Cast Samples |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Pick-up Samples |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Compression Tests |

CBC 1701.5.1 and .4

- | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|-------------------------|
| Piers | Grade Beams | Pretens | Precast | |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Aggregate Tests |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Reinforcing Tests |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Tendon Tests |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Mix Designs |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Reinforcing Placement |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Insert Placement |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Concrete Batching |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Installation Inspection |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Cast Samples |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Pick-up Samples |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Compression Tests |

Structural Observation by Architect or Engineer: CBC 1702

- Foundation Observation
- Framing Observation
- Final Observation
- General Conformance Letters

Masonry: CBC 1701.5.7

- Special Inspection Stresses Used
- Prelim. Acceptance Test (Masonry Units, Wall Prisms)
- Subsequent Tests (Mortar, Grout, Field Wall Prisms)
- Placement Inspection of Units

Plans Examiner _____ Date _____
MKA (sheet 50.1)
 Requirements specified by (Architect/Engineer of record) _____ Date _____

Embedded Bolts or Inserts: CBC 1701.5.2 and .15

- Bolt/Insert Placement Inspection _____ %
- Bolt/Insert Tension Test _____ %
- Bolt/Insert Shear Test _____ %
- Epoxy Mix and Placement Observation _____ %

Structural Steel / Welding: CBC 1701.5.5 and .6

- Sample and Test (list specific members below)
- Shop Material Identification
- Welding Inspection Shop Field
- Ultra Sonic Inspection Shop Field
- High-Stress Bolting Inspection
 - A325 Shop Field
 - A490 N X F

- Metal Deck Welding Inspection
- Reinforcing Steel Welding Inspection
- Metal Stud Welding Inspection
- Concrete Insert Welding Inspection

Structural Wood: CBC 1701.5.15

- Horizontal Diaphragms
- Shear Wall Nailing Inspection
- Inspection of Glulam Fabrication
- Inspection of Truss Joint Fabrication
- Sample and Test Components

Geotechnical/Foundation: CBC 1701.5.10

- Soils Engineer Plan Review/Acceptance Letter
- Foundation Excavation
- Pier Holes
- Site Drainage
- Fill Material

THESE ATTACHMENTS ARE PART OF THE APPROVED PLANS. * DO NOT REMOVE THEM *

OCT 26 2009

- Placement Inspection
- Field Density
- Acceptance Letter
- Acceptance Letter

PERMIT AND RESOURCE MANAGEMENT DEPARTMENT BUILDING PLAN CHECK

Fireproofing: PERMIT # CBC 1704.6.10

- Placement Inspection
- Density Tests
- Thickness Tests
- Inspect Batching

Insulating Concrete: CBC 1701.5.9

- Sample and Test
- Placement Inspection
- Unit Weights

Additional Instructions/Other Tests & Inspections:

Contractor _____ Date _____

Owner _____ Date _____

Sonoma County Permit and Resource Management Department
 2550 Ventura Avenue * Santa Rosa, CA * 95403-2829 * (707) 565-1900 * Fax (707) 565-2210

Sonoma County Water Agency
Santa Rosa, California

FILE:ROW\404 AVIATION GEOEXCHANGE
Permit to Enter 0-0-4

PERMIT TO ENTER

Airport Business Center, herein called "Grantor", permits the Sonoma County Water Agency, herein called "Agency", its agents, contractors or assigns, to enter upon that property located at 400 and 402 Aviation Boulevard, Santa Rosa, California and identified by the Sonoma County Assessor as parcel numbers 059-350-083 and 059-350-084.

Entry to the above-referenced parcel will be for the purpose of temporary parking related to the construction of the Airport Geoexchange Project located at 404 Aviation Boulevard.

During the term of this Permit to Enter, Grantor shall notify Agency of any pending transfer of this property within a reasonable time period prior to said transfer.

Agency shall indemnify and defend (with counsel reasonable acceptable to Grantor) and hold Grantor harmless from and against any and all claims, damages, costs, liabilities, losses, and expenses (including reasonable attorneys' fees) arising out of any entry by Agency or its agents or contractors; provided, however, that Agency shall have no obligation hereunder to the extent the claim, liability, or expense arises from the negligence or willful misconduct of Grantor.

This Permit to Enter shall terminate on July 31, 2010.

GRANTOR'S APPROVAL

By:  _____

Who by his/her signature herein above represents that he/she has been duly vested with authority to sign this instrument on behalf of all owners of record for the subject property.

Date: 3-31-09 _____

Larry L. Wasem

PRINT NAME

414 Aviation Blvd.

MAILING ADDRESS

Santa Rosa, CA 95403

CITY, STATE, ZIP CODE

707-578-5344

TELEPHONE NUMBER(S)

GENERAL MANAGER/CHIEF ENGINEER'S ACCEPTANCE:

 _____

Date: 4/3/09

Randy Poole
General Manager/Chief Engineer
Sonoma County Water Agency

SECTION 01200

PRICE AND PAYMENT PROCEDURES**PART 1 GENERAL****1.1 SUMMARY**

A. Section includes:

1. Description of requirements and procedures for determining amount of Work performed and for obtaining payment for Work performed.
2. Contingency Reserve

1.2 REFERENCES

- A. California Public Contract Code
- B. Code of Civil Procedure

1.3 SCOPE OF WORK

Work under Contract Documents, or under any Bid item, allowance, or Alternate, shall include all labor, materials, taxes, transport, handling, storage, supervision, administration, and all other items necessary for the satisfactory completion of Work, whether or not expressly specified or indicated.

1.4 DETERMINATION OF QUANTITIES

Quantity of Work to be paid for under any item for which a unit price is fixed in Contract Documents shall be number, as determined by Owner, of units of Work satisfactorily completed in accordance with Contract Documents or as directed by Owner. Unless otherwise provided, determination of number of units of Work so completed will be based, so far as practicable, on actual measurement or count within prescribed or ordered limits, and no payment will be made for Work done outside of limits. Measurements and computations will be made by methods set forth in Contract Documents, including without limitation this Section 01200. If methods are not so set forth, measurements shall be made in any manner which Owner considers appropriate for class of Work measured (e.g., pre-assigned values, percentage completion, units completed or incremental Milestones). Contractor must immediately inform Owner of any disputes regarding quantity measurements and shall immediately supply Owner with any documentation supporting the disputed measurements.

1.5 SCOPE OF PAYMENT

A. Except as otherwise expressly stated in Section 01100 (Summary), payment to Contractor at the unit price or other price fixed in Contract Documents for performing Work required under any item, or (if the Contract is on a single lump sum price basis) at the lump sum price fixed in the Contract Documents for performing all Work required under Contract Documents, and as either may be adjusted pursuant to any approved Change Order or Construction Change Directive, shall be full compensation for completing, in accordance with Contract Documents, all Work required under the item or under Contract Documents, and for all expense incurred by Contractor for any purpose in connection with the performance and completion of said Work, including all incidental Work necessary for completion of the Work.

- B. The Contract Sum, whether lump sum, unit price or otherwise, shall be deemed to include all costs necessary to complete required Work, all costs (if any) for loss or damage arising from nature of Work or prosecution of the Work, and from action of elements. Unless Contract Documents expressly provide otherwise, the Contract Sum shall be deemed to include:
1. Any and all costs arising from any unforeseen difficulties which may be encountered during, and all risks of any description connected with, prosecution of Work or prosecution of Bid item (whether lump sum or unit price) until acceptance by Owner;
 2. All expenses incurred due to suspension, or discontinuance of Work or discontinuance of Bid item (whether lump sum or unit price) as provided in Contract Documents;
 3. Escalation to allow for cost increases between time of Contract Award and completion of Work or completion of Bid item (whether lump sum or unit price).
- C. Whenever it is specified herein that Contractor is to do Work or furnish materials of any class for which no price is fixed in Contract Documents, it shall be understood that Contractor is to do such Work or furnish such materials without extra charge or allowance or direct payment of any sort, and that cost of doing Work or furnishing materials is to be included in price Bid, unless it is expressly specified herein, in particular cases, that Work or material is to be paid for as extra Work.
- D. Unit Prices shall apply to Work covered by unit prices so long as actual quantities performed on the Project are not less than 75 percent or greater than 125 percent of the estimated quantities contained in Document 00400 (Bid Form) or otherwise referenced in Section 01100 (Summary). If actual quantities exceed these parameters, then the unit price shall be adjusted by an amount to reflect the Contractor's incremental cost differential resulting from increased or decreased economies of scale.
- E. No payment shall be made for materials or equipment not yet incorporated into the Work, except as specified in Section 01100 (Summary).
- F. For any materials and equipment referenced in Section 01100 (Summary) as subject to payment prior to incorporation into the Work, where Contractor requests payment on the basis of such materials and equipment not incorporated in the Work, Contractor must satisfy the following conditions:
1. The materials and/or equipment shall be delivered and suitably stored at the Site or at another local location agreed to in writing, for example, a mutually acceptable warehouse;
 2. Full title to the materials and/or equipment shall vest in Owner at the time of delivery to the Site, warehouse or other storage location;
 3. Obtain a negotiable warehouse receipt, endorsed over to Owner for materials and/or equipment stored in an Off Site warehouse. No payment will be made until such endorsed receipts are delivered to Owner;
 4. Stockpiled materials and/or equipment shall be available for Owner inspection, but Owner shall have no obligation to inspect them and its inspection or failure to inspect shall not relieve Contractor of any obligations under the Contract Documents. Materials and/or equipment shall be segregated and labeled or tagged to identify these specific Contract Documents;
 5. After delivery of materials and/or equipment, if any inherent or acquired defects are discovered, Defective materials and/or equipment shall be removed and replaced with suitable materials and/or equipment at Contractor's expense;

6. At Contractor's expense, insure the materials and/or equipment against theft, fire, flood, vandalism, and malicious mischief, as well as any other coverages required under the Contract Documents;
 7. Contractor's Application for Payment shall be accompanied by a bill of sale, invoice or other documentation warranting that Owner has received the materials and equipment free and clear of all liens and evidence that the materials and equipment are covered by appropriate property insurance and other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner. This documentation shall include, but not be limited to, conditional releases of mechanics' liens and stop notices from all those providing materials and equipment as to which the Application for Payment relates, as well as unconditional releases of the same from the same as to the previous Application for Payment for which they have not already been provided.
- G. Amounts previously paid for materials and equipment prior to incorporation into the Work shall be deducted from amounts otherwise due Contractor as they are incorporated.

1.6 BASIS OF PAYMENT

- A. Unit Price Quantities: When estimated quantity for specific portions of Work is listed in Document 00400 (Bid Form), quantity of Work to be paid for shall be actual number of units satisfactorily completed, as determined by Owner and certified by Contractor, in accordance with Contract Documents.
- B. Lump Sum: When estimated quantity for specific portion of Work is not indicated and unit is designated as lump sum, payment will be on a lump sum basis for Work satisfactorily completed in accordance with Contract Documents.
- C. Allowances: Allowance items (if any) will be paid for as provided in Section 01100 (Summary). Funds authorized for Allowance Work will not be released for Contract payments unless Owner has authorized Allowance Work in writing.
- D. Owner does not expressly, or by implication, agree, warrant, or represent in any manner, that actual amount of Work will correspond with amount shown or estimated and reserves right to increase or decrease amount of any class or portion of Work, to leave out entire Bid item or items, or to add work not originally included in Bid or Contract Documents, when in its judgment such change is in best interest of Owner. No change in Work shall be considered a waiver of any other condition of Contract Documents. No claim shall be made for anticipated profit, for loss of profit, for damages, or for extra payment whatever, except as otherwise expressly provided for in Contract Documents, because of any differences between amount of Work actually done and estimated amount as set forth herein, or for elimination of Bid items.

1.7 PROGRESS PAYMENTS

- A. Owner's General Manager/Chief Engineer is authorized to approve progress payments in conformance with Contract Documents and the Auditor/Controller of the County of Sonoma is authorized to process such payments upon their submission by the General Manager/Chief Engineer.
- B. If requested by Contractor, progress payments will be made monthly.
- C. Schedule of Values:
 1. Within the time set forth in Document 00700 (General Conditions), submit a detailed breakdown of Contractor's Bid by scheduled Work items and/or activities, including coordination responsibilities and Project Record Documents responsibilities. Where more than one Subcontractor comprises the work of a Work item or activity, the Schedule of Values shall show a separate line item for each subcontract. Furnish such

- breakdown of the total Contract Sum by assigning dollar values (cost estimates) to each applicable Progress Schedule network activity, which cumulative sum equals the total Contract Sum. The format and detail of the breakdown shall be as directed by Owner to facilitate and clarify future progress payments to Contractor for direct Work under Contract Documents. This breakdown shall be referred to as the Schedule of Values.
2. Contractor's overhead, profit, insurance, cost of bonds (except to the extent expressly identified in a Bid item) and/or other financing, as well as "general conditions costs," (e.g., Site cleanup and maintenance, temporary roads and access, off-Site access roads, temporary power and lighting, security, and the like), shall be prorated through all activities so that the sum of all the Schedule of Values line items equals Contractor's total Contract Sum, less any allowances designated by Owner. Scheduling, record documents and quality assurance control shall be separate line items.
 3. Owner will review the breakdown in conjunction with the Progress Schedule to ensure that the dollar amounts of this Schedule of Values are, in fact, fair market cost allocations for the Work items listed. Upon favorable review by Owner, Owner will accept this Schedule of Values for use. Owner shall be the sole judge of fair market cost allocations.
 4. Owner will reject any attempt to increase the cost of early activities, i.e., "front loading," resulting in a complete reallocation of moneys until such "front loading" is corrected. Repeated attempts at "front loading" may result in suspension or termination of the Work for default, or refusal to process progress payments until such time as the Schedule of Values is acceptable to Owner.
- D. Monthly Report Sheets and Applications for Payment: Contractor shall establish and maintain records of cost of the Work in accordance with generally accepted accounting practices; reconcile the amount of Work completed monthly with Owner, and sign Owner's monthly report sheet certifying to the Work done. Monthly report sheets shall be considered the true record of the Cost of the Work and Contractor shall submit in a form acceptable to Owner an itemized cost breakdown of Contractor's record of Cost of the Work together with supporting data and any certification required by Owner. In addition:
1. On or before the sooner of (a) the 20th Day of each month and (b) receipt of Owner's approval of the updated Schedule as required by Section 01320 (Progress Schedules and Reports), Owner and Contractor will reconcile any differences in the field, based on the reconciled monthly report sheets, and Contractor shall submit to Owner an Application for Payment for the cost of the Work put in place during the period from the 15th Day of the previous month to the 15th Day of the current month, along with the Owner-approved updated Schedule. Such Applications for Payment shall be for the total value of activities completed or partially completed, including approved activity costs, based upon Schedule of Values prices (or Bid item prices if unit price) of all labor and materials incorporated in the Work up until midnight of the last Day of that one month period, less the aggregate of previous payments. Accumulated retainage shall be shown as separate item in payment summary. If Contractor is late submitting its Application for Payment, that Application may be processed at any time during the succeeding one-month period, resulting in processing of Contractor's Application for Payment being delayed for more than a Day for Day basis.
 2. Applications for Payment may include, but are not necessarily limited to the following:
 - a. Material, equipment, and labor incorporated into the Work, less any previous payments for the same.

- b. Up to 75 percent of the cost of equipment identified in paragraph 1.5F of this Section 01200 (if any), if purchased and delivered to the Site or stored off Site, as may be approved by Owner.
 - c. Up to 50 percent of the cost of materials identified in paragraph 1.5F of this Section 01200 (if any), specifically fabricated for the Project that are not yet incorporated into the Work.
3. At the time any Application for Payment is submitted, certify in writing the accuracy of the Application and that Contractor has fulfilled all scheduling requirements of Document 00700 (General Conditions) and Section 01320 (Progress Schedules and Reports), including updates and revisions. A responsible officer of Contractor shall execute the certification.
 4. No progress payment will be processed prior to Owner receiving all requested, acceptable schedule update information. Failure to submit a schedule update complying with Section 01320 justifies denying the entire Application for Payment, or in Owner's discretion withholding amounts as described in paragraph 1.7E.10 of this Section 01200.
 5. Each Application for Payment shall list each Change Order and Construction Change Directive ("CCD") executed prior to date of submission, including the Change Order/CCD Number, and a description of the Work activities, consistent with the descriptions of original Work activities. Submit a monthly Change Order/CCD status log to Owner.
 6. If Owner requires substantiating data, submit information requested by Owner, with cover letter identifying Project, Application for Payment number and date, and detailed list of enclosures.
 7. If Contractor fails or refuses to participate in monthly Work reconciliations or other construction progress evaluation with Owner, Contractor shall not receive current payment until Contractor has participated fully in providing construction progress information and schedule update information to Owner.
- E. Progress Payments
1. Owner will review Contractor's Application for Payment following receipt. If adjustments need to be made to percent of completion of each activity, Owner will make appropriate notations and return to Contractor. Contractor shall revise and resubmit. All parties shall update percentage of completion values in the same manner, i.e., express value of an accumulated percentage of completion to date.
 2. Each Application for Payment may be reviewed by Owner and/or inspectors to determine whether the Application for Payment is proper, and shall be rejected, revised, or approved by Owner pursuant to the Schedule of Values prepared in accordance with paragraph 1.7C of this Section 01200.
 3. If it is determined that the Application for Payment is not proper and suitable for payment, Owner will return it to the Contractor as soon as practicable, but no later than seven Days after receipt, together with a document setting forth in writing the reasons why the Application for Payment is not proper. If Owner determines that portions of the Application for Payment are not proper or not due under the Contract Documents, then Owner may approve the other portions of the Application for Payment, and in the case of disputed items or Defective Work not remedied, may withhold up to 150 percent of the disputed amount from the progress payment.
 4. Pursuant to California Public Contract Code Section 20104.50, if Owner fails to make any progress payment within 30 Days after receipt of an undisputed and properly submitted

Application for Payment from Contractor, Owner shall pay interest to the Contractor equivalent to the legal rates set forth in subdivision (a) of Section 685.010 of the Code of Civil Procedure. The 30-Day period shall be reduced by the number of Days by which Owner exceeds the seven-Day return requirement set forth herein.

5. As soon as practicable after approval of each Application for Payment for progress payments, Owner will pay to Contractor in manner provided by law, an amount equal to 90 percent of the amounts otherwise due as provided in the Contract Documents, or a lesser amount if so provided in Contract Documents, provided that payments may at any time be withheld if, in judgment of Owner, Work is not proceeding in accordance with Contract, or Contractor is not complying with requirements of Contract, or to comply with stop notices or to offset liquidated damages accruing or expected.
6. Before any progress payment or final payment is due or made, Contractor shall submit satisfactory evidence that Contractor is not delinquent in payments to employees, Subcontractors, suppliers, or creditors for labor and materials incorporated into Work. This specifically includes, without limitation, conditional lien release forms for the current progress payment and unconditional release forms for past progress payments.
7. Owner reserves and shall have the right to withhold payment for any equipment and/or specifically fabricated materials that, in the sole judgment of Owner, are not adequately and properly protected against weather and/or damage prior to or following incorporation into the Work.
8. Granting of progress payment or payments by Owner, or receipt thereof by Contractor, shall not be understood as constituting in any sense acceptance of Work or of any portion thereof, and shall in no way lessen liability of Contractor to replace unsatisfactory Work or material, though unsatisfactory character of Work or material may have been apparent or detected at time payment was made.
9. When Owner shall charge sum of money against Contractor under any provision of Contract Documents, amount of charge shall be deducted and retained by Owner from amount of next succeeding progress payment or from any other moneys due or that may become due Contractor under Contract. If, on completion or termination of Contract, such moneys due Contractor are found insufficient to cover Owner's charges against it, Owner shall have right to recover balance from Contractor or Sureties.
10. If Contractor fails to submit an acceptable Progress Schedule update, or fails to bring an acceptable Project Record Drawings update to Progress Payment Meeting, Owner will retain 5% of each Progress Payment amount thereafter (in addition to any other retention) until Owner's acceptance of a Progress Schedule update. This retention shall apply cumulatively.

1.8 FINAL PAYMENT

- A. As soon as practicable after all required Work is completed in accordance with Contract Documents, including punchlist, testing, record documents and Contractor maintenance after Final Acceptance, Owner will pay to Contractor, in manner provided by law, unpaid balance of Contract Sum of Work (including without limitation retentions), or whole Contract Sum of Work if no progress payment has been made, determined in accordance with terms of Contract Documents, less sums as may be lawfully retained under any provisions of Contract Documents or by law.
- B. Prior progress payments shall be subject to correction in the final payment. Owner's determination of amount due as final payment shall be final and conclusive evidence of

amount of Work performed by Contractor under Contract Documents and shall be full measure of compensation to be received by Contractor.

- C. Contractor and each assignee under an assignment in effect at time of final payment shall execute and deliver at time of final payment, and as a condition precedent to final payment, Document 00650 (Agreement and Release of Any and All Claims).

1.9 EFFECT OF PAYMENT

- A. Payment will be made by Owner, based on Owner's observations at the Site and the data comprising the Application for Payment. Payment will not be a representation that Owner has:
 - 1. Made exhaustive or continuous on-Site inspections to check the quality or quantity of Work;
 - 2. Reviewed construction means, methods, techniques, sequences, or procedures;
 - 3. Reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by Owner to substantiate Contractor's right to payment; or
 - 4. Made examination to ascertain how or for what purpose Contractor has used money previously paid on account of the Contract Sum.

1.10 CONTINGENCY RESERVE

- A. Owner will authorize and direct Contractor regarding provisions in this paragraph 1.10.
- B. Contingency Reserve Amount: as listed in Document 00520 (Agreement).
- C. Cost shall be determined for CCD Work as provided in Section 01250 (Modification Procedures) or on a time-and-materials basis if agreed by Contractor and Owner.
- D. Prior to final payment, an appropriate Change Order will be issued to reflect actual amounts due Contractor on account of Work covered by this Contingency Reserve, and the Contract Sum will be correspondingly adjusted.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01250

MODIFICATION PROCEDURES**PART 1 GENERAL****1.1 SUMMARY**

A. Section includes:

1. Description of general procedural requirements for alterations, Modifications, and extras.

1.2 GENERAL

- A. Any change in scope of Work or deviation from Contract Documents including, without limitation, extra Work, or alterations or additions to or deductions from the original Work, shall not invalidate the original Contract, and shall be performed under the terms of the Contract Documents.
- B. Only Contractor or Owner may initiate changes in scope of Work or deviation from Contract Documents.
 1. Contractor may initiate changes by submitting RFIs, Notice of Differing Site Conditions, or Notice of Hazardous Waste or Materials Conditions.
 - a. RFIs shall be submitted to seek clarification of or request changes in the Contract Documents.
 - b. Notices of Differing Site Conditions shall be submitted in accordance with Document 00700 (General Conditions).
 - c. Notices of Hazardous Waste or Materials Conditions shall be submitted in accordance with Document 00700 (General Conditions).
 2. Contractor shall be responsible for its costs to implement and administer RFIs throughout the Contract duration. Regardless of the number of RFIs submitted, Contractor shall not be entitled to additional compensation for administrative costs. Contractor shall be responsible for both Owner and its Engineer's administrative costs for answering RFIs where the answer could reasonably be found by reviewing the Contract Documents, as determined by Owner; at Owner's discretion, such costs may be deducted from progress payments or final payment.
 3. Owner may initiate changes by issuing a Supplemental Instruction, which may revise, add to or subtract from the Work.
 4. Owner may initiate changes in the Work or Contract Time by issuing RFPs to Contractor. Such RFPs will detail all proposed changes in the Work and request a quotation of changes in Contract Sum and Contract Time from Contractor.
 5. Owner may also, by Construction Change Directive ("CCD"), order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly. A CCD shall be used in the absence of total agreement on the terms of a Change Order and may, upon notice, consist of a Change Order executed by Owner only.

1.3 PROCEDURES

- A. Cost Proposal and Procedures: Whenever Contractor is required in this Section 01250 to prepare a Cost Proposal, and whenever Contractor is entitled to submit a Cost Proposal and elects to do so, Contractor shall prepare and submit to Owner for consideration a Cost

Proposal using the form attached to this Section 01250. All Cost Proposals must contain a complete breakdown of costs of credits, deducts, and extras; and itemizing materials, labor, taxes, overhead and profit. All Subcontractor Work shall be so indicated. Individual entries on the Cost Proposal form shall be determined as provided in paragraphs 1.4 and 1.5 of this Section 01250. After receipt of a Cost Proposal with a detailed breakdown, Owner will act promptly thereon.

1. If Owner accepts a Cost Proposal, Owner will prepare Change Order for Owner and Contractor signatures.
 2. If Cost Proposal is not acceptable to Owner because it does not agree with cost and/or time included in Cost Proposal, Owner will submit in a response what it believes to be a reasonable cost and/or adjustment, if any. Except as otherwise provided in this Section 01250, Contractor shall have seven Days in which to respond to Owner with a revised Cost Proposal.
 3. When necessity to proceed with a change does not allow the Owner sufficient time to conduct a proper check of a Cost Proposal (or revised Cost Proposal), Owner may order Contractor to proceed on basis to be determined at earliest practical date. In this event, value of change, with corresponding equitable adjustment to Contract, shall not be more than increase or less than decrease proposed.
- B. Request for Information (RFI): Whenever Contractor requires information regarding the Project or Contract Documents, or receives a request for information from a Subcontractor, Contractor may prepare and deliver an RFI to Owner, using the form attached to this Section 01250 or using the Contractor interface for Owner's project management software. Contractor must submit time critical RFIs at least 30 Days before scheduled start date of the affected Work activity. Contractor shall reference each RFI to an activity of Progress Schedule and shall note time criticality of the RFI, indicating time within which a response is required. Contractor's failure to reference RFI to an activity on the Progress Schedule and note time criticality on the RFI shall constitute Contractor's waiver of any claim for time delay or interruption to the Work resulting from any delay in responding to the RFI.
1. Owner will respond within 15 Days from receipt of RFI with a written response to Contractor. Contractor shall distribute response to all appropriate Subcontractors.
 2. If Contractor is satisfied with the response and does not request change in Contract Sum or Contract Time, then the response shall be executed without a change.
 3. If Contractor believes the response is incomplete, Contractor shall issue another RFI to Owner clarifying original RFI. Additionally, Owner may return RFI requesting additional information should original RFI be inadequate in describing condition.
 4. If Contractor believes that the response results in change in Contract Sum or Contract Time, Contractor shall notify Owner in writing within 15 Days after receiving the response. If Owner disagrees with Contractor, then Contractor may give notice of intent to submit a Claim as described in Article 12 of Document 00700 (General Conditions), and submit its Claim within 30 Days. If Owner agrees with Contractor, then Contractor must submit a Cost Proposal within 21 Days of receiving the response to the RFI. Contractor's failure to deliver either the foregoing notice and Claim or Cost Proposal by the respective deadlines stated in the foregoing sentences shall result in waiver of the right to file a Cost Proposal or Claim.
- C. Supplemental Instruction: Owner may issue Supplemental Instruction to Contractor.
1. If Contractor is satisfied with Supplemental Instruction and does not request change in Contract Sum or Contract Time, then Supplemental Instruction shall be executed without a Change Order.

2. If Contractor believes that Supplemental Instruction results in change in Contract Sum or Contract Time, then Contractor must submit a Cost Proposal to Owner within 21 Days of receiving the Supplemental Instruction.
- D. Construction Change Directives: If at any time Owner believes in good faith that a timely Change Order will not be agreed upon using the foregoing procedures, Owner may issue a CCD with its estimated cost and/or time adjustment. Upon receipt of CCD, Contractor shall promptly proceed with the change of Work involved and concurrently respond to Owner's CCD within 10 Days.
1. Contractor's response must be any one of following:
 - a. Return CCD signed, thereby accepting Owner's response, time, and cost.
 - b. Submit a (revised if applicable) Cost Proposal with supporting documentation (if applicable, reference original Cost Proposal number followed by letter A, B, etc. for each revision), if Owner so requests.
 - c. Give notice of intent to submit a Claim as described in Article 12 of Document 00700 (General Conditions), and submit its Claim within 30 Days.
 2. If the CCD provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:
 - a. Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation.
 - b. Unit prices stated in the Contract Documents or subsequently agreed upon.
 - c. Cost to be determined in a manner agreed.
 3. CCD signed by Contractor indicates the agreement of Contractor therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.
 4. If Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the method and the adjustment shall be determined by Owner on the basis of reasonable expenditures and savings of those performing the Work attributable to the change including, in case of an increase in the Contract Sum, a reasonable allowance for overhead and profit. If the parties still do not agree on the price for a CCD, Contractor may file a Claim per Article 12 of Document 00700 (General Conditions). Contractor shall keep and present, in such form as Owner may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this paragraph shall be limited to those provided in paragraphs 1.4 and 1.5 of this Section 01250.
 5. Pending final determination of cost to Owner, amounts not in dispute may be included in Applications for Payment. The amount of credit to be allowed by Contractor to Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by Owner. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.
- E. Owner Requested RFP: Contractor shall furnish a Cost Proposal within 21 Business Days of Owner's RFP. Upon approval of Cost Proposal, Owner will issue a Change Order directing Contractor to proceed with extra Work. If the parties do not agree on the price, Owner may either issue a CCD or decide the issue per Article 12 of Document 00700 (General Conditions). Contractor shall perform the changed Work notwithstanding any claims or disagreements of any nature.
- F. Differing Site Conditions: Contractor shall submit Notices of Differing Site Conditions to resolve problems regarding differing underground Site conditions encountered in the

execution of the Work pursuant to paragraph 13.4 of Document 00700 (General Conditions), which shall govern. If Owner determines that a change in Contract Sum or Contract Time is justified, Owner will issue RFP or CCD.

- G. Hazardous Waste Conditions: Contractor shall submit Notices of Hazardous Waste or Materials Conditions to resolve problems regarding hazardous materials encountered in the execution of the Work pursuant to paragraph 13.5 of Document 00700 (General Conditions), which shall govern. If Owner determines that a change in Contract Sum or Contract Time is justified, Owner will issue RFP or CCD.
- H. All Changes:
1. Documentation of Change in Contract Sum and Contract Time:
 - a. Contractor shall maintain detailed records of Work performed on a time-and-material basis.
 - b. Contractor shall document each proposal for a change in cost or time with sufficient data to allow evaluation of the proposal.
 - c. Contractor shall, on request, provide additional data to support computations for:
 - 1) Quantities of products, materials, labor, and equipment.
 - 2) Taxes.
 - 3) Justification for any change in Contract Time and new Progress Schedule showing revision due, if any.
 - 4) Credit for deletions from Contract, similarly documented.
 - d. Contractor shall support each claim for additional costs, and for Work performed on a cost-and-percentage basis, with additional information including:
 - 1) Credit for deletions from Contract, similarly documented.
 - 2) Origin and date of claim.
 - 3) Dates and times Work was performed and by whom.
 - 4) Time records and wage rates paid.
 - 5) Invoices and receipts for products, materials, equipment, and subcontracts, similarly documented.
 - I. Correlation of Other Items:
 1. Contractor shall revise Schedule of Values and Application for Payment forms to record each authorized Change Order or CCD as a separate line item and adjust the Contract Sum as shown thereon prior to the next monthly pay period.
 2. Contractor shall revise the Progress Schedules prior to the next monthly pay period.
 3. Contractor shall enter changes in Project Record Documents prior to the next monthly pay period.
 - J. Responses: For all responses for which the Contract Documents, including without limitation this Section 01250, do not provide a specific time period, recipients shall respond within a reasonable time.

1.4 COST DETERMINATION

- A. Total cost of extra Work or of Work omitted shall be the sum of labor costs, material costs, equipment rental costs, and specialist costs as defined herein plus overhead and profit as allowed herein. This limit applies in all cases of claims for extra Work, whether calculating Cost Proposals, Change Orders or CCDs, or calculating claims of all types, and applies even in the event of fault, negligence, strict liability, or tort claims of all kinds, including strict liability or negligence. Contractor may recover no other costs arising out of or connected with the performance of extra Work, of any nature. No special, incidental or consequential damages may be claimed or recovered against Owner, its representatives or agents, whether

arising from breach of Contract, negligence, or strict liability, unless specifically authorized in the Contract Documents.

- B. Markup for Overhead and Profit: (Overhead shall be as defined in paragraph 1.8 of this Section 01250)
1. Markup for overhead and profit on labor for extra Work shall not exceed 15 percent.
 2. Markup for overhead and profit on materials for extra Work shall not exceed 15 percent.
 3. Markup for overhead and profit on owner-operated equipment for extra Work shall not exceed 15 percent.
 4. Markup for overhead and profit on equipment for extra Work shall not exceed 10 percent.
 5. When extra Work is performed by a first tier Subcontractor, Contractor shall receive a 5 percent markup on Subcontractors' total costs of extra Work. First tier Subcontractor's markup on its Work shall not exceed percentages listed in paragraphs 1.4B.1, 1.4B.2, 1.4B.3, and 1.4B.4 immediately above.
 6. When extra Work is performed by a lower tier Subcontractor, Contractor, first tier Subcontractors, and lower tier Subcontractors shall divide (as mutually agreed) a total of 5 percent markup on the lower tier Subcontractors' total costs of extra Work.
 7. Notwithstanding the foregoing, in no case shall the total markup on any extra Work exceed 20 percent of the direct cost, notwithstanding the actual number of Contract tiers.
 8. On proposals covering both increases and decreases in Contract Sum, overhead, profit, and commission shall be allowed on the net increase only as determined in this paragraph 1.4. When the net difference is a deletion, no percentage for overhead profit and commission shall be allowed, but rather a deduction shall apply.
 9. The markup shall include profit, small tools, cleanup, engineering, supervision, warranties, cost of preparing the cost proposal, jobsite overhead, and home office overhead. No markup will be allowed on taxes, insurance, and bonds.
- C. Taxes:
1. All State sales tax, use tax, and Sonoma County and applicable City sales taxes shall be included.
 2. Federal and Excise tax shall not be included.
- D. Owner-Operated Equipment: When owner-operated equipment is used to perform extra Work, Contractor will be paid as follows:
1. Payment for cost of equipment will be made at no more than rates of such equipment established in paragraph 1.5C of this Section 01250.
 2. Payment for cost of labor will be made at no more than rates of such labor established by collective bargaining agreements for type of worker and location of Work, whether or not owner-operator is actually covered by such an agreement.
 3. Invoices for owner-operated equipment need not itemize labor and equipment costs, unless specifically requested by Owner. In any event, the total rate for owner-operated equipment shall not exceed the combined rates for labor and equipment listed in paragraphs 1.4D.1 and 1.4D.2 above.
- E. Accord and Satisfaction: Every Change Order and accepted CCD shall constitute a full accord and satisfaction, and release, of all Contractor (and if applicable, Subcontractor) claims for additional time, money or other relief arising from or relating to the subject matter of the change including, without limitation, impacts of all types, cumulative impacts, inefficiency, overtime, delay, and any other type of claim. Contractor may elect to reserve its rights to disputed claims arising from or relating to the changed Work at the time it signs a Change Order or accepts a CCD, but must do so expressly in a writing delivered

concurrently with the executed Change Order or approved CCD, and must also submit a Claim for the reserved disputed items pursuant to Article 12 of Document 00700 (General Conditions) no later than 30 Days of Contractor's first written notice of its intent to reserve rights.

1.5 COST BREAKDOWN

- A. Labor: Contractor will be paid cost of labor for workers (including forepersons when authorized by Owner) used in actual and direct performance of extra Work. Labor rate, whether employer is Contractor, Subcontractor or other forces, will be sum of following:
1. Actual Wages: Actual wages paid shall include any employer payments to or on behalf of workers for health and welfare, pension, vacation, and similar purposes.
 2. Labor surcharge: Payments imposed by local, county, state, and federal laws and ordinances, and other payments made to, or on behalf of, workers, other than actual wages as defined in paragraph 1.5A.1 of this Section 01250, such as taxes and insurance. Labor surcharge shall be and shall not exceed that set forth in Caltrans official labor surcharges schedule which is in effect on date upon which extra Work is accomplished and which schedule is incorporated herein by reference as though fully set forth herein.
- B. Material: Only materials furnished by Contractor and necessarily used in performance of extra Work will be paid for. Cost of such materials will be cost, including sales tax, to purchaser (Contractor, Subcontractor or other forces) from supplier thereof, except as the following are applicable:
1. If cash or trade discount by actual supplier is offered or available to purchaser, it shall be credited to Owner notwithstanding fact that such discount may not have been taken.
 2. For materials salvaged upon completion of extra Work, salvage value of materials shall be deducted from cost, less discounts, of materials.
 3. If cost of a material is, in opinion of Owner, excessive, then cost of material shall be deemed to be lowest current wholesale price at which material is available in quantities concerned delivered to Site, less any discounts as provided in paragraph 1.5B.1 of this Section 01250.
- C. Equipment: For Contractor- or Subcontractor-owned equipment, payment will be made at rental rates listed for equipment in Caltrans official equipment rental rate schedule which is in effect on date upon which extra Work is accomplished and which schedule is incorporated herein by reference as though fully set forth herein. If there is no applicable rate for an item of equipment, then payment shall be made for Contractor- or Subcontractor-owned equipment at rental rate listed in the most recent edition of the Association of Equipment Distributors (AED) book. For rented equipment, payment will be made based on actual rental invoices. Equipment used on extra Work shall be of proper size and type. If, however, equipment of unwarranted size or type and cost is used, cost of use of equipment shall be calculated at rental rate for equipment of proper size and type, as determined by Owner. Rates paid shall be deemed to cover cost of fuel, oil, lubrication, supplies, small tools, necessary attachments, repairs and maintenance of any kind, depreciation, storage, insurance, and all incidentals. Unless otherwise specified, manufacturer's ratings, and manufacturer-approved modifications, shall be used to classify equipment for determination of applicable rates. Individual pieces of equipment or tools not listed in said publication and having a replacement value of \$100 or less, whether or not consumed by use, shall be considered to be small tools and no payment will be made therefor as payment is included in payment for labor. Payment will not be made for time in which equipment is inoperative due to breakdowns.

1. For Contractor or Subcontractor -owned equipment on Site, payment for equipment use will be for time equipment is in operation on extra Work being performed or on standby as approved by Owner.
 2. For rented equipment on Site, the following shall be used in computing rental time of equipment:
 - a. When hourly rates are listed, less than 30 minutes of operation shall be considered to be ½ hour of operation.
 - b. When daily rates are listed, less than four hours of operation shall be considered to be ½ Day of operation.
 3. For equipment that must be brought to Site to be used exclusively on extra Work, cost of transporting equipment to Site and its return to its original location shall be determined as follows:
 - a. Owner will pay for costs of loading and unloading equipment.
 - b. Cost of transporting equipment in low bed trailers shall not exceed hourly rates charged by established haulers.
 - c. Cost of transporting equipment shall not exceed applicable minimum established rates of California Public Utilities Commission.
 - d. Owner will not make any payment for transporting and loading and unloading equipment if equipment is used on Work in any other way than upon extra Work.
 4. For rented equipment, rental period may begin at time equipment is unloaded at Site of extra Work and terminate at end of the performance of the extra Work or Day on which Owner directs Contractor to discontinue use of equipment, whichever first occurs. Excluding Saturdays, Sundays, and Owner's legal holidays, unless equipment is used to perform extra Work on such Days, rental time to be paid per Day shall be four hours for zero hours of operation, six hours for four hours of operation and eight hours for eight hours of operation, time being prorated between these parameters. Hours to be paid for equipment that is operated less than eight hours due to breakdowns, shall not exceed eight less number of hours equipment is inoperative due to breakdowns.
- D. Work Performed by Special Forces or Other Special Services: When Owner and Contractor, by agreement, determine that special service or item of extra Work cannot be performed by forces of Contractor or those of any Subcontractors, service or extra Work item may be performed by specialist. Invoices for service or item of extra Work on basis of current market price thereof may be accepted without complete itemization of labor, material, and equipment rental costs when it is impracticable and not in accordance with established practice of special service industry to provide complete itemization. In those instances wherein Contractor is required to perform extra Work necessitating a fabrication or machining process in a fabrication or machine shop facility away from Site, charges for that portion of extra Work performed in such facility may, by agreement, be accepted as a specialist billing. Owner must be notified in advance of all off-Site Work. In lieu of overhead and profit provided in paragraph 1.4B of this Section 01250, 15 percent will be added to specialist invoice price, after deduction of any cash or trade discount offered or available, whether or not such discount may have been taken.

1.6 FORCE-ACCOUNT WORK

- A. If it is impracticable because of nature of Work, or for any other reason, to fix an increase or decrease in price definitely in advance, the Contractor may be directed to proceed at a not-to-exceed (NTE) maximum price which shall not under any circumstances be exceeded. Subject to such limitation, such extra Work shall be paid for at actual necessary cost for

- Force-Account Work or at the negotiated cost, as determined by Owner. The cost for Force-Account Work shall be determined pursuant to paragraphs 1.4 and 1.5 of this Section 01250.
- B. Force-Account Work shall be used when it is not possible or practical to price out the changed Work prior to the start of that Work. In these cases, Force-Account Work will be utilized during the pricing and negotiation phase of the change. Once negotiations have been concluded and a bilateral agreement has been reached, the tracking of the Work under Force-Account is no longer necessary. Force-Account Work shall also be used when negotiations between Owner and Contractor have broken apart and a bilateral agreement on the value of the changed Work cannot be reached. Owner may approve other uses of Force-Account Work.
 - C. Whenever any Force-Account Work is in progress, definite price for which has not been agreed on in advance, Contractor shall report to Owner each Business Day in writing in detail amount and cost of labor and material used, and any other expense incurred in Force-Account Work on preceding Day, by using the Cost Proposal form attached hereto. No claim for compensation for Force-Account Work will be allowed unless report shall have been made.
 - D. Whenever Force-Account Work is in progress, definite price for which has not been agreed on in advance, Contractor shall report to Owner when 75 percent of the NTE amount has been expended.
 - E. Force-Account Work shall be paid as extra Work under this Section 01250. Methods of determining payment for Work and materials provided in this paragraph 1.6 shall not apply to performance of Work or furnishings of material that, in judgment of Owner, may properly be classified under items for which prices are otherwise established in Contract Documents.

1.7 OWNER-FURNISHED MATERIALS

- A. Owner reserves right to furnish materials as it deems advisable, and Contractor shall have no claims for costs and overhead and profit on such materials.

1.8 OVERHEAD DEFINED FOR MODIFICATIONS

- A. The following constitutes charges that are deemed included in overhead for all Contract Modifications, including Force-Account Work or CCD Work, whether incurred by Contractor, Subcontractors, or suppliers, and Contractor shall not invoice or receive payment for these costs separately:
 1. Drawings: field drawings, Shop Drawings, as-builts, etc., including submissions of drawings
 2. Routine field inspection of Work proposed
 3. General superintendence
 4. General administration and preparation of cost proposals, schedule analysis, Change Orders, and other supporting documentation as necessary
 5. Computer services
 6. Reproduction services
 7. Salaries of project engineer, superintendent, timekeeper, storekeeper, and secretaries
 8. Janitorial services
 9. Temporary on-Site facilities:
 - a. Offices
 - b. Telephones
 - c. Plumbing
 - d. Electrical: Power, lighting

- e. Platforms
- f. Fencing, etc.
- g. Water
- h. Sanitation
- 10. Home office expenses
- 11. Insurance and Bond premiums
- 12. Procurement and use of vehicles and fuel used coincidentally in Work otherwise included in the Contract Documents
- 13. Surveying
- 14. Estimating
- 15. Protection of Work
- 16. Handling and disposal fees
- 17. Final cleanup
- 18. Other incidental Work

1.9 RECORDS AND CERTIFICATION

- A. Force-Account (cost reimbursement) charges shall be recorded daily and summarized in Cost Proposal form attached hereto. Contractor or authorized representative shall complete and sign form each Day. Contractor shall also provide with the form: the names and classifications of workers and hours worked by each; an itemization of all materials used; a list by size, type, and identification number of equipment and hours operated; and an indication of all Work performed by specialists.
- B. No payment for Force-Account Work shall be made until Contractor submits original invoices substantiating materials and specialists charges.
- C. Owner shall have the right to audit all records in possession of Contractor relating to activities covered by Contractor's claims for Modification of Contract, including Force-Account Work and CCD Work.
- D. Further, Owner will have right to audit, inspect, or copy all records maintained in connection with this Contract, including financial records and Escrow Bid Documents, in possession of Contractor relating to any transaction or activity occurring or arising out of, or by virtue of, the Contract. If Contractor is a joint venture, right of Owner shall apply collaterally to same extent to records of joint venture sponsor, and of each individual joint venture member. This right shall be specifically enforceable, and any failure of Contractor to voluntarily comply shall be deemed an irrevocable waiver and release of all claims then pending that were or could have been subject to the Article 12 of Document 00700 (General Conditions).

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

COST PROPOSAL AND REQUEST FOR INFORMATION (RFI) FORMS FOLLOW ON NEXT PAGE

COST PROPOSAL (CP)

Geothermal Heat Pump Retrofit at 404 Aviation Boulevard, Santa Rosa, CA

Contract Number 71-80-7 #1

CP Number: _____

To: Sonoma County Water Agency
 Attention: Contract Administration/Inspection
 404 Aviation Boulevard, Santa Rosa, CA 95403
 PO Box 11628
 Santa Rosa, CA 95406-1628 Phone: (707) 524-3786

Date: _____

In Response To _____

RFP #, etc.

Subject Ref. No: _____

(for Project Manager use only)

Fax: (707) 524-3791

From: [Insert Contractor's Name/Address]

This Cost Proposal is in response to the above-referenced _____ [insert RFP, etc. as applicable].

Brief description of change(s): _____

ITEM DESCRIPTION	PRI ME CO NT R.	SU B 1	SU B 2	SUB 3	SUB 4	TOTAL
MATERIAL						
DIRECT LABOR COST						
EQUIPMENT						
Other (Specify)						
Total Cost						
Subcontractor's Markup for Overhead and Profit 15 percent						
Contractor's Markup for Overhead and Profit 15 percent (Labor and Materials)						
Contractor's Markup for Overhead and Profit 10 percent (Equipment Rental)						
Markup for Overhead and Profit to Contractor for Subcontractor's Work 5 percent						
GRAND TOTAL						
(percent of Total Cost above not including any Markup for Overhead and Profit) [Grand Total divided by Total Cost]						
REQUESTED CHANGE IN CONTRACT TIME (DAYS)						

By Contractor: _____

Signature: _____

Date: _____

REQUEST FOR INFORMATION (RFI)

Geothermal Heat Pump Retrofit at 404 Aviation Boulevard, Santa Rosa, CA

Contract Number 71-80-7 #1

RFI Number: _____

Date Submitted: _____

To: Sonoma County Water Agency
Attention: Contract Administration/Inspection
404 Aviation Boulevard, Santa Rosa, CA 95403
PO Box 11628
Santa Rosa, CA 95406-1628
Phone: (707) 524-3786 Fax: (707) 524-3791

From: [Insert Contractor's Name/Address]

Subcontractor: [Insert Sub's Name]

Spec Section or Drawing Reference No.: _____

CONTRACTOR'S QUESTION

Empty box for Contractor's Question

Contractor's Signature: _____

Date: _____

Date Response Required: _____

Reference to Activity on Progress Schedule: _____

OWNER'S RESPONSE

Empty box for Owner's Response

Owner's Signature: _____

Date: _____

SECTION 01315

PROJECT MEETINGS**PART 1 GENERAL****1.1 SUMMARY**

A. Section Includes:

1. Descriptions of the required Project meetings for the Work. These meetings include:
 - a. Post-Notice of Award Meeting
 - b. Schedule Review Meetings
 - c. Preconstruction Conference
 - d. Monthly Progress Meetings
 - e. Progress Payment Meetings
 - f. Optional Submittal Review Meeting
 - g. Special Meetings
 - h. Safety Meetings

1.2 POST-NOTICE OF AWARD MEETING

- A. Owner will call for and administer a Post-Notice of Award Meeting at time and place to be announced.
- B. Contractor's general superintendent, Contractor's foreman, preparer of Safety Program, preparer of SWPPP, if applicable, and all major Subcontractors shall attend this meeting.
- C. Agenda will include, but not be limited to, discussion of requirements for the following items:
 1. Insurance
 2. Bonds
 3. Notice to Proceed
 4. Commencement of Contract Time
 5. Start of Work at Site
 6. Contractor's Initial and Original Schedule
 7. Contractor's Schedule of Values
 8. Contractor's Schedule of Submittals
 9. Submittal and RFI procedures
 10. Safety Program
 11. SWPPP, if applicable
 12. Permits
 13. Name of Owner's Representative
 14. Other items as appropriate
- D. Owner will distribute minutes of Post-Notice of Award Meeting to attendees. Attendees shall have 5 Days to submit comments or additions to minutes. Minutes will constitute final memorialization of results of Post-Notice of Award Meeting.

1.3 SCHEDULE REVIEW MEETINGS

- A. Within 30 Days of issuance of Notice to Proceed, meet with Owner and conduct initial review of Contractor's draft Schedule of Submittals, draft Schedule of Values, and Initial Schedule.

- B. Authorized representative in Contractor's organization, designated in writing, who will be responsible for working and coordinating with Owner relative to preparation and maintenance of Progress Schedule shall attend the initial schedule review meeting.
- C. Contractor shall, within 30 Days from the commencement of Contract Time and prior to commencement of Work at the Site, meet with Owner to review the Original Progress Schedule and construction schedule submittals.
 - 1. Contractor shall have its manager, superintendent, scheduler, and key Subcontractor representatives, as required by Owner, in attendance. The meeting will take place over a continuous one-Day period.
 - 2. Owner's review will be limited to submittals' conformance to Contract Documents requirements including, but not limited to, coordination requirements. Owner's review may also include:
 - a. Clarifications of Contract Requirements
 - b. Directions to include activities and information missing from submittals
 - c. Requests to Contractor to clarify its schedule
 - 3. Within 5 Days of the Schedule Review Meeting, Contractor shall respond in writing to all questions and comments expressed by Owner at the meeting.
- D. Owner will administer Schedule Review Meetings and shall distribute minutes of Schedule Review Meetings to attendees. Attendees shall have 5 Days to submit comments or additions to minutes. Minutes will constitute final memorialization of results of Schedule Review Meetings.

1.4 PRECONSTRUCTION CONFERENCE

- A. Owner will call for and administer Preconstruction Conference at time and place to be announced.
- B. Contractor, all major Subcontractors, and major suppliers shall attend Preconstruction Conference.
- C. Agenda will include, but not be limited to, the following items.
 - 1. Revised/updated schedules
 - 2. Personnel and vehicle permit procedures
 - 3. Use of premises
 - 4. Location of the Contractor's on-Site facilities
 - 5. Security
 - 6. Housekeeping
 - 7. Inspection and testing procedures, on-Site and off-Site
 - 8. Utility shutdown procedures
 - 9. Control and reference point survey procedures
 - 10. Safety Program
 - 11. Jurisdictional agency requirements
 - 12. Other items as appropriate
- D. Owner will distribute copies of minutes to attendees. Attendees shall have 7 Days to submit comments or additions to minutes. Minutes will constitute final memorialization of results of Preconstruction Conference.

1.5 MONTHLY PROGRESS MEETINGS

- A. Owner will schedule and administer monthly progress meetings throughout duration of Work. Progress meetings will be held monthly on approximately the 20th of each month.
 - 1. Meetings shall be held at Contractor's on-Site office unless otherwise directed by Owner.

2. An Owner Representative will prepare agenda and distribute it at the meeting to Contractor.
 3. Contractor's general superintendent shall attend these meetings.
 4. Owner will record. Approximately 7 Days after meeting, Owner will distribute minutes to Contractor, who will distribute to those affected by decisions made at meeting. Attendees can either submit comments or additions to minutes prior to the next progress meeting, or may attend the next progress meeting and submit comments or additions there. Minutes will constitute final memorialization of results of meeting.
- B. These meetings are considered a critical component of overall monthly schedule update submittal and Contractor shall have appropriate personnel attend. Contractor's job superintendent, major Subcontractors and suppliers, Owner, and others as appropriate shall attend progress meetings.
- C. Agenda will contain the following items, as appropriate:
1. Review, revise as necessary, and approve previous meeting minutes
 2. Review of Work progress since last meeting, including percent complete of each activity
 3. Review of the schedule update submittal
 - a. Time impact evaluations for Change Orders and Time Extension Request
 - b. Actual and anticipated activity sequence changes
 - c. Actual and anticipated duration changes
 - d. Actual and anticipated Contractor delays
 4. Review the Application for Payment
 5. Status of Construction Work Schedule, delivery schedules, adjustments
 6. Submittal, RFI, and Change Order status
 7. Review of the Contractor's safety program activities and results, including report on all serious injury and/or damage accidents
 8. Other items affecting progress of Work

1.6 PROGRESS PAYMENT MEETINGS

- A. Prior to official application for Payment submission, a meeting will be held on approximately the 20th of each month to review the Application for Payment.
1. At this meeting, the following items will be reviewed:
 - a. Percent complete of each activity
 - b. Project Schedule
 - c. hard-copy updates of the Project Record Drawings (Field Set)
 2. Contractor's general superintendent shall attend these meetings.

1.7 OPTIONAL SUBMITTAL REVIEW MEETING

- A. At Owner or Contractor's request, in order to facilitate the timeliness of the review process, Owner may schedule a meeting to review the materials submitted.
1. Request a meeting date with Owner at least 10 Business Days in advance.
 2. Provide complete package of Submittals at least 10 Business Days in advance of the meeting.
 3. The meeting shall take place at Owner's office. Owner will provide the authorized staff to review Submittals during the meeting.
 4. Make available for this meeting the job superintendent and/or foreman, Contractor's safety officer, protective coating manufacturer's representative (if applicable), and someone knowledgeable of all Submittals and authorized to make substitutions or changes.

1.8 SPECIAL MEETINGS

- A. Owner or Contractor may call special meetings by notifying all desired participants and Owner 5 Days in advance, giving reason for meeting. Special meetings may be held without advance notice in emergency situations.
- B. At any time during the progress of Work, Owner shall have authority to require Contractor to attend meeting of any or all of the Subcontractors engaged in Work or in other work, and notice of such meeting shall be duly observed and complied with by Contractor.
- C. Contractor shall schedule and conduct coordination meetings as necessary to discharge coordination responsibilities in Document 00700 (General Conditions). Contractor shall give Owner 5 Days written notice of coordination meetings. Contractor shall maintain minutes of coordination meetings. Attendees shall have 7 Days to submit comments or additions to minutes. Minutes will constitute final memorialization of results of coordination meetings.

1.9 SAFETY MEETINGS

- A. Conduct monthly Contractor Safety Committee meetings.
- B. Conduct weekly toolbox safety talks.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01320

PROGRESS SCHEDULES AND REPORTS**PART 1 GENERAL****1.1 SUMMARY**

- A. Perform scheduling of Work under this Contract in accordance with requirements of this Section 01320.
 - 1. Development of schedule, cost, and resource loading of the Progress Schedule, monthly payment requests, and Project status reporting requirements of the Contract Documents shall employ scheduling as required in this Section 01320.
 - 2. The Schedule shall be cost-loaded based on Schedule of Values as approved by Owner.
 - 3. Submit schedules and reports as specified in Document 00700 (General Conditions).
- B. Upon Award of Contract, immediately commence development of Initial Schedule to ensure compliance with schedule submittal requirements.
- C. Contractor's obligations under this Section 01320 are hereby deemed material obligations justifying Owner's remedies for default if Contractor fails to perform. Nothing in this paragraph 1.1.C of this Document 01320 or the lack of an express statement that any other Contract Documents provision is or is not material shall be considered in determining whether any such other provision is material.
- D. Employ competent scheduling personnel or a schedule consultant with experience performing scheduling required herein on two prior, similar projects.

1.2 GENERAL

- A. Progress Schedule shall be based on and incorporate Milestone and completion dates specified in Contract Documents.
- B. Overall time of completion and time of completion for each Milestone shown on Progress Schedule shall adhere to times in Document 00520 (Agreement), unless an earlier (advanced) time of completion is requested by Contractor and agreed to by Owner. A Change Order shall formalize any such agreement.
 - 1. Owner is not required to accept an earlier (advanced) schedule, i.e., one that shows early completion date(s) for the Contract Time.
 - 2. Contractor is not entitled to extra compensation in event agreement is reached on an earlier (advanced) schedule and Contractor completes its Work, for whatever reason, beyond completion date shown in earlier (advanced) schedule but within the Contract Time.
 - 3. A schedule showing the Work completed in less than the Contract Time, which has been accepted by Owner, shall be considered to have Project Float. The Project Float is the time between the scheduled completion of the Work and Contract Substantial Completion. Project Float is a resource available to both Owner and Contractor.
 - 4. Project Float Ownership: Neither Owner nor Contractor owns Project Float. The Project owns the Project Float. As such, liability for delay of any Substantial Completion date rests with the party whose actions, last in time, actually cause delay to a Substantial Completion date.
 - a. For example, in the event of unexcused delay by Party A and Party B, and if Party A uses some, but not all of the Project Float and Party B later uses remainder of the

Project Float as well as additional time beyond the Project Float, Party B shall be liable for the time that represents a delay to the Substantial Completion date.

- b. Under this scenario, Party A would not be responsible for the time since it did not consume all of the Project Float and additional Project Float remained; therefore, the Substantial Completion Date was unaffected.
- C. Progress Schedule shall be the basis for evaluating job progress, payment requests, and time extension requests. Responsibility for developing Contract schedule and monitoring actual progress as compared to Progress Schedule rests with Contractor.
- D. Failure of Progress Schedule to include any element of the Work or any inaccuracy in Progress Schedule will not relieve Contractor from responsibility for accomplishing the Work in accordance with the Contract. Owner's acceptance of Schedule shall be for its use in monitoring and evaluating job progress, payment requests, and time extension requests, and shall not, in any manner, impose a duty of care upon Owner, or act to relieve Contractor of its responsibility for means and methods of construction.
- E. Transmit each item using form approved by Owner or following Section 01330 (Submittal Procedures).
 1. Identify Project with the Owner Contract number, and name of Contractor.
 2. Provide space for Contractor's approval stamp and Owner's review stamps.
 3. Submittals received from sources other than Contractor will be returned to Contractor without Owner's review.

1.3 INITIAL AND ORIGINAL PROGRESS SCHEDULE

- A. Initial Schedule submitted within 21 Days after issuance of Notice to Proceed for review at the initial Schedule Review Meeting shall serve as Contractor's schedule for up to 30 Days after the commencement of Contract Time.
 1. Initial Schedule must indicate detailed plan for the Work to be completed in first 30 Days after commencement of Contract Time of the Contract; details of planned mobilization of plant and equipment; sequence of early operations; and procurement of materials and equipment. Show Work beyond 30 Days in summary form.
- B. Contractor shall submit its Original Schedule for review no later than first Application for Payment and prior to commencement of Work at the Site. Original Schedule and all updates shall comply with all standards herein.
- C. All Schedules shall be time-scaled.
- D. All Schedules shall be cost- and resource-loaded. Accepted cost- and resource-loaded Schedule will be used as basis for monthly progress payments. Use of Initial Schedule for progress payments shall not exceed 30 Days.
- E. Except as otherwise expressly provided in this Section 01320, meet with Owner to review and discuss each Schedule (i.e., Initial, Original and updates) within seven Days after each Schedule has been submitted to Owner.
 1. Owner's review and comment on any Schedule shall be limited to Contract conformance (with sequencing, coordination, and Milestone requirements).
 2. Contractor shall make corrections to Schedule necessary to comply with Contract requirements and shall adjust Schedule to incorporate any missing information requested by Owner. Resubmit Initial Schedule if requested by Owner.
- F. If Contractor is of the opinion that any of the Work included on its Schedule has been impacted, submit to Owner a written TIE in accordance with paragraph 1.8 of this Section 01320. The TIE shall be based on the most current update of the Schedule.

1.4 SCHEDULE FORMAT AND LEVEL OF DETAIL

- A. Each Schedule (Initial, Original, and updates) shall indicate all separate submittals, fabrication, procurement and field construction activities required for completion of the Work, including but not limited to the following:
1. All Contractor, Subcontractor, and assigned Contractor Work shall be shown in a logical Work sequence that demonstrates a coordinated plan of Work for all contractors. The intent is to provide a common basis of acceptance, understanding, and communication, as well as interface with other contractors.
 2. Incorporate Schedule of Submittals into each Schedule.
 3. Activities related to the delivery of Contractor- and Owner-furnished equipment to be Contractor-installed per Contract shall be shown.
 4. All activities shall be identified through codes or other identification to indicate the building (i.e. buildings, Site Work) and Contractor/Subcontractor responsibility to which they pertain.
 5. Break up the Work schedule into activities of durations of approximately 21 Days or less each, except for non-field construction activities or as otherwise deemed acceptable by Owner.
 6. Show the critical path in red. For each activity, show early start, late start, early finish, late finish, durations measured in Days, Project Float, resources, predecessor and successor activities, planned workday/week for the activity, manpower loading, and scheduled/actual progress payments.
- B. Seasonal weather conditions (which do not constitute a delay as defined herein) shall be considered in the planning and scheduling of all Work influenced by high or low ambient temperatures or presence of high moisture for the completion of the Work within the allotted Contract Time.
- C. Failure by Contractor to include any element of Work required for performance of the Work on the detailed construction schedule shall not excuse Contractor from completing all Work required within the Contract Time.
- D. A two-week "look ahead," detailed daily bar chart schedule shall be updated and issued weekly.
- E. Prepare schedule using Microsoft® Office Project, Primavera Contractor®, or Primavera Project Planner® (P3®) software for all scheduling, including schedule updates.

1.5 MONTHLY SCHEDULE UPDATE SUBMITTALS

- A. Following acceptance of Contractor's Initial Schedule, monitor progress of Work and adjust Schedule each month to reflect actual progress and any anticipated changes to planned activities.
1. Each Schedule update submitted shall be complete, including all information requested for the Initial Schedule and Original Schedule submittal.
 2. Each update shall continue to show all Work activities including those already completed. Completed activities (shown in blue) shall accurately reflect "as built" information by indicating when activities were actually started and completed, and Contractor warrants the accuracy of as-built information as shown.
- B. A meeting will be held in accordance with Section 01315 (Project Meetings) to review the Schedule update submittal. Submit Schedule updates monthly, 7 Days prior to the Monthly Progress Meeting.
- C. Within five Days after monthly Schedule update meeting, submit the updated Schedule.

- D. Within five Days of receipt of above-noted revised submittals, Owner will either accept or reject monthly schedule update submittal.
 - 1. If accepted, percent complete shown in monthly update will be basis for Application for Payment by Contractor. The schedule update shall be submitted as part of Contractor's Application for Payment.
 - 2. If rejected, update shall be corrected and resubmitted by Contractor before the Application for Payment is submitted.
- E. Updating, changing or revising of any report, curve, schedule or narrative submitted to Owner by Contractor under this Contract, nor Owner's review or acceptance of any such report, curve, schedule or narrative shall not have the effect of amending or modifying, in any way, the Contract Substantial Completion date or Milestone dates or of modifying or limiting, in any way, Contractor's obligations under this Contract.

1.6 SCHEDULE REVISIONS

- A. Updating the Schedule (Initial and Original) to reflect actual progress shall not be considered revisions to the Schedule. Since scheduling is a dynamic process, however, revisions to activity durations and sequences are expected on a monthly basis.
- B. To reflect revisions to the Schedule, provide Owner with a written narrative with a full description and reasons for each Work activity revised. For revisions affecting the sequence of Work, provide a schedule diagram that compares the original sequence to the revised sequence of Work. Provide the written narrative and schedule diagram for revisions three Days in advance of the monthly schedule update meeting. Clearly show and discuss any changes in the critical path.
- C. Schedule revisions shall not be incorporated into any schedule update until Owner has reviewed the revisions. Owner may request further information and justification for schedule revisions and, within three Days, provide Owner with a complete written narrative response to Owner's request.
- D. If Owner does not accept Contractor's revision, and Contractor disagrees with Owner's position, Contractor has seven Days from receipt of Owner's letter rejecting the revision, to provide a written narrative providing full justification and explanation for the revision. Contractor's failure to respond in writing within seven Days of Owner's written rejection of a schedule revision shall be contractually interpreted as acceptance of Owner's position, and Contractor waives its rights to subsequently dispute or file a claim regarding Owner's position. If Contractor files a timely response as provided in this paragraph, and the parties are still unable to agree, Contractor's sole right shall be to file a claim as provided in Document 00700 (General Conditions), Article 12.
- E. At Owner's discretion, Contractor can be required to provide Subcontractor certifications of performance regarding proposed schedule revisions affecting said Subcontractors.

1.7 RECOVERY SCHEDULE

- A. If a Schedule update shows a Substantial Completion date 21 Days beyond any Contract Substantial Completion date, or individual Milestone completion dates, submit to Owner within seven Days the proposed revisions to recover the lost time. As part of this submittal, provide a written narrative for each revision made to recapture the lost time. If the revisions include sequence changes, provide a schedule diagram comparing the original sequence to the revised sequence of Work. If Owner reasonably requests, show the intended critical path; secure appropriate Subcontractor and supplier consent to the recovery Schedule; submit a narrative explaining trade flow and construction flow changes,

duration changes, added/ deleted activities, critical path changes and identify all near critical paths and man-hour loading assumptions for major Subcontractors.

- B. The revisions shall not be incorporated into any Schedule update until Owner has reviewed the revisions.
- C. If Owner does not accept Contractor's revisions, Owner and Contractor shall follow the procedures in paragraphs 1.6C, 1.6D, and 1.6E of this Section 01320.
- D. At Owner's discretion, Contractor can be required to provide Subcontractor certifications for revisions affecting said Subcontractors.

1.8 TIME IMPACT EVALUATION (TIE) FOR CHANGE ORDERS AND OTHER DELAYS

- A. When Contractor is directed to proceed with changed Work, prepare and submit, within 14 Days from the direction to proceed, a TIE that includes both a written narrative and a schedule diagram depicting how the changed Work affects other schedule activities. The schedule diagram shall show how Contractor proposes to incorporate the changed Work in the schedule, and how it impacts the current Schedule update critical path or otherwise. Contractor is also responsible for requesting time extensions based on the TIE's impact on the critical path. The diagram shall be tied to the main sequence of scheduled activities to enable Owner to evaluate the impact of changed Work to the scheduled critical path.
- B. Comply with the requirements of paragraph 1.8A of this Section 01320 for all types of delays such as, but not limited to, Contractor/Subcontractor delays, adverse weather delays, strikes, procurement delays, fabrication delays, etc.
- C. Contractor is responsible for all costs associated with the preparation of TIEs, and the process of incorporating TIEs into the current schedule update.
- D. Once agreement has been reached on a TIE, the Contract Time will be adjusted accordingly. If agreement is not reached on a TIE, the Contract Time may be extended in an amount Owner allows, and Contractor may submit a claim for additional time claimed by Contractor as provided in Document 00700 (General Conditions).

1.9 TIME EXTENSIONS

- A. Contractor is responsible for requesting time extensions for time impacts that, in the opinion of Contractor, impact the critical path of the current schedule update. Notice of time impacts shall be given in accordance with Document 00700 (General Conditions).
- B. Where an event for which Owner is responsible impacts the projected Substantial Completion date, provide a written mitigation plan, including a schedule diagram, which explains how (e.g., increase crew size, overtime, etc.) the impact can be mitigated. Also include a detailed cost breakdown of the labor, equipment, and material Contractor would expend to mitigate Owner-caused time impact. Submit mitigation plan to Owner within 14 Days from the date of discovery of said impact. Contractor is responsible for the cost to prepare the mitigation plan.
- C. Failure to request time, provide TIE, or provide the required mitigation plan will result in Contractor waiving its right to a time extension and cost to mitigate the delay.
- D. No time will be granted under the Contract Documents for cumulative effect of changes.
- E. Owner will not be obligated to consider any time extension request unless requirements of Contract Documents are complied with.
- F. Failure of Contractor to perform in accordance with the current schedule update shall not be excused by submittal of time extension requests.
- G. Notwithstanding any other provision of this Section 01320, if Contractor does not submit a TIE within the required 14 Days for any issue, Contractor hereby agrees that Contractor does not require a time extension for that issue.

1.10 PROJECT STATUS REPORTING

- A. In addition to submittal requirements for scheduling identified in this Section 01320, provide a monthly Project status report (i.e., written narrative report) to be submitted in conjunction with each Schedule as specified herein. Status reporting shall be in form specified in this paragraph 1.10 below.
- B. Prepare monthly written narrative reports of status of Project for submission to Owner. Written status reports shall include:
1. Status of major Project components (percent complete, amount of time ahead or behind schedule) and an explanation of how Project will be brought back on schedule if delays have occurred.
 2. Progress made on critical activities indicated on each Schedule, including inspections.
 3. Explanations for any lack of Work on critical path activities planned to be performed during last month.
 4. Explanations for any schedule changes, including changes to logic or to activity durations.
 5. List of critical activities scheduled to be performed during the next month.
 6. Status of major material and equipment procurement.
 7. Any delays encountered during reporting period.
 8. Provide printed report indicating actual versus planned resource loading for each trade and each activity. This report shall be provided on weekly and monthly basis.
 - a. Actual resource shall be accumulated in field by Contractor, and shall be as noted on Contractor's daily reports. These reports will be basis for information provided in monthly and weekly printed reports.
 - b. Explain all variances and mitigation measures.
 9. Contractor may include any other information pertinent to status of Project. Include additional status information requested by Owner at no additional cost.
 10. Status reports, and the information contained therein, shall not be construed as claims, notice of claims, notice of delay, or requests for changes or compensation.

PART 2 PRODUCTS - NOT USED**PART 3 EXECUTION - NOT USED**

END OF SECTION

SECTION 01330

SUBMITTAL PROCEDURES**PART 1 GENERAL****1.1 SUMMARY**

A. Section Includes:

1. Description of general requirements for Submittals for the Work, as applicable:
 - a. Procedures
 - b. Schedule of Submittals
 - c. Safety Program
 - d. Progress Schedule
 - e. Product Data
 - f. Shop Drawings
 - g. Samples
 - h. Coordination Drawings
 - i. Quality Assurance/Control Submittals
 - 1) Design Data
 - 2) Test Reports
 - 3) Certificates
 - 4) Manufacturers' Instructions
 - 5) Work Plans
 - j. Installation, Operation, and Maintenance Manual
 - k. Project Record Documents
 - l. Storm Water Pollution Prevention Program
 - m. Delay of Submittals

1.2 PROCEDURES

- A. Submit at Contractor's expense the Submittals required by the Contract Documents.
- B. Submit Submittals to Owner in accordance with accepted Schedule of Submittals. If no such schedule is agreed upon, then all Submittals shall be submitted within 35 Days after receipt of Notice of Award from Owner.
- C. Transmit each item with the appropriate Submittal transmittal form (included at the end of this Section 01330). Where manufacturer's standard drawings or data sheets are used, they shall be marked clearly to show those portions of the data that are applicable to this Project. Inapplicable portions shall be marked out. Organize Submittals by Specification Section. Submittals containing information about more than one Specification Section will be returned for resubmittal. Submittals shall include all information requested by each Specification Section. Incomplete Submittals will be returned not reviewed by Owner.
- D. The data shown on the Submittals shall be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Owner the materials and equipment Contractor proposes to provide and to enable Owner to review the information for the limited purposes specified in this Section 01330. Submittals shall be identified clearly as to material, supplier, pertinent data such as catalog numbers and the use for which it is intended and otherwise as Owner may require to enable Owner to review the Submittal.

- E. At the time of each submission, give Owner specific written notice of all variations, if any, that the Submittal may have from the requirements of the Contract Documents, and the reasons therefore. This written notice shall be in a written communication attached to the Submittal transmittal form. In addition, cause a specific notation to be made on each Submittal submitted to Owner for review and approval of each such variation. If Owner accepts deviation, Owner will note its acceptance on the returned Submittal transmittal form and, if necessary, issue appropriate Contract Modification.
- F. Submittal coordination and verification is the responsibility of Contractor; this responsibility shall not be delegated in whole or in part to Subcontractors or suppliers. Before submitting each Submittal, review and coordinate each Submittal with other Submittals and with the requirements of the Work and the Contract Documents, and determine and verify:
 - 1. All field measurements, quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;
 - 2. All materials with respect to intended use, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
 - 3. All information relative to Contractor's sole responsibility for means, methods, techniques, sequences, and procedures of construction and safety precautions and programs incident thereto.
- G. Contractor's submission to Owner of a Submittal shall constitute Contractor's representation that it has satisfied its obligations under the Contract Documents, and as set forth immediately above in this paragraph 1.2 of this Section 01330, with respect to Contractor's review and approval of that Submittal.
- H. Designation of Work "by others," if shown in Submittals, shall mean that Work will be responsibility of Contractor rather than Subcontractor or supplier who has prepared Submittals.
- I. After review by Owner of each Submittal, an electronic copy of each Submittal will be returned to Contractor with actions defined as follows:
 - 1. NO EXCEPTIONS TAKEN - Accepted subject to its compatibility with future Submittals and additional partial Submittals for portions of the Work not covered in this Submittal. Does not constitute approval or deletion of specified or required items not shown on the Submittal.
 - 2. MAKE CORRECTIONS NOTED (NO RESUBMISSIONS REQUIRED) - Same as item 1 above, except that minor corrections as noted shall be made by Contractor.
 - 3. REVISE AS NOTED AND RESUBMIT - Rejected because of major inconsistencies or errors that shall be resolved or corrected by Contractor prior to subsequent review by Owner.
 - 4. REJECTED - RESUBMIT - Submitted material does not conform to Drawings and/or Specifications in major respect, i.e.: wrong size, model, capacity, or material.
- J. Make a complete and acceptable Submittal at least by second submission. Owner reserves the right to deduct monies from payments due Contractor to cover additional costs of review beyond the second submission per paragraph 1.2T. Illegible Submittals will be rejected and returned to Contractor for resubmission. Contractor shall be in breach of the Contract if Contractor's first resubmittal, following a Submittal which Owner determines falls within categories 3 or 4 above, does not fall within categories 1 or 2 above.
- K. Favorable review will not constitute acceptance by Owner of any responsibility for the accuracy, coordination, or completeness of the Submittals. Accuracy, coordination, and

completeness of Submittals shall be sole responsibility of Contractor, including responsibility to back-check comments, corrections, and modifications from Owner's review before fabrication. Contractor, Subcontractors, or suppliers may prepare Submittals, but Contractor shall ascertain that Submittals meet requirements of Contract Documents, while conforming to structural space and access conditions at point of installation. Owner's review will be only to assess if the items covered by the Submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as indicated by the Contract Documents. Favorable review of Submittal, method of Work, or information regarding materials and equipment Contractor proposes to furnish shall not relieve Contractor of responsibility for errors therein and shall not be regarded as assumption of risks or liability by Owner, or any officer or employee thereof, and Contractor shall have no claim under Contract Documents on account of failure or partial failure or inefficiency or insufficiency of any plan or method of Work or material and equipment so accepted. Favorable review shall be considered to mean merely that Owner has no objection to Contractor using, upon Contractor's own full responsibility, plan or method of Work proposed, or furnishing materials and equipment proposed.

- L. Unless otherwise specified, Owner's review will not extend to the means, methods, techniques, sequences, or procedures of construction or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
- M. Submit complete initial Submittal for those items where required by individual Specification Sections. Complete Submittal shall contain sufficient data to demonstrate that items comply with Specifications, shall meet minimum requirements for submissions cited in Specification Sections, shall include motor data and seismic anchorage certifications, where required, and shall include necessary revisions required for equipment other than first named. If Contractor submits incomplete initial Submittal when complete Submittal is required, Submittal may be returned to Contractor without review.
- N. Copy, conform, and distribute reviewed Submittals in sufficient numbers for Contractor's files, Subcontractors, and vendors.
- O. After Owner's review of Submittal, revise as noted and resubmit as required. Identify changes made since previous Submittal.
 - 1. Begin no fabrication or Work that requires Submittals until return of Submittals not requiring resubmittal. Do not extrapolate from Submittals covering similar Work.
 - 2. Normally, Submittals will be processed and returned to Contractor within 30 Days of receipt.
- P. Distribute reviewed Submittals to concerned persons. Instruct recipients to promptly report any inability to comply with provisions.
- Q. All Submittals shall be number-identified by Contractor, prior to submission to Owner, in accordance with Owner's numbering format. Owner will provide Contractor with sample numbering format.
- R. Submission Requirements:
 - 1. Deliver Submittals to Owner at least 30 Days before dates reviewed Submittals will be needed.
 - 2. Initial Submittal of Installation, Operation, and Maintenance Manual shall be:
 - a. 45 Days after the date Submittal(s) that pertain to the item are favorably reviewed; and
 - b. Prior to start-up and testing of the applicable product or equipment.

3. The following table lists the number of initial Submittals required from Contractor for each type of submission and to whom Contractor shall distribute the information. Submittals requiring resubmission will require the same quantity and distribution as an initial Submittal.

Submittal	Contractor Submittal	
	# of Hard copies/ Prints/ Samples	Electronic copy
Items Go To →	Owner	Owner
Schedule of Submittals	1	✓
Safety Program	1	✓
Fire Protection Plan	1	✓
Progress Schedule	1	✓
Product Data	1	✓
MSDSs	1	✓
Shop Drawings	1	✓
Drawings or any documents larger than 11" x 17"	2	✓
Samples	4	-
Coordination Drawings	1	✓
Quality Assurance/Control Submittals:		
Design Data	1	✓
Test Reports	1	✓
Certificates	1	✓
Manufacturers' Instructions	1	✓
Work Plans	1	✓
Installation, Operation, and Maintenance Manuals (initial submittal)	1	✓
Installation, Operation, and Maintenance Manuals (final submittal)	4	✓
Major Products List	1	✓
Storm Water Pollution Prevention Program	1	✓
Other Documents	1	✓

4. Accompany each copy of the Submittal(s) with a Submittal transmittal form, containing:
 - a. Date, revision date, and Submittal identification number.
 - b. Project name and Owner's Contract number.
 - c. Contractor's name, address, and job number.
 - d. Specification Section number clearly identified.
 - e. The quantity of Shop Drawings, Product Data, or Samples submitted.
 - f. Notification of deviations from Contract Documents.
 - g. MSDS for each item complying with OSHA's Hazard Communication Standard 29 CFR 1910.1200.
 - h. Other pertinent data.
5. Submittal shall include:
 - a. Date and revision dates.
 - b. Revisions, if any, identified.

- c. Project Name and Contract number.
 - d. The names of:
 - 1) Contractor, Subcontractor, Supplier, Manufacturer, and separate detailer, when pertinent.
 - e. Identification of product material by location within the Project.
 - f. Relation to adjacent structure or materials.
 - g. Field dimensions, clearly identified as such.
 - h. Specification Section number and applicable detail reference number and Drawing number.
 - i. Applicable reference standards, such as ASTM, ANSI, FS, NEMA, SMACNA or ACI.
 - j. A blank space, on the first sheet of each Submittal set, 5" x 4" for the Owner's stamp.
 - k. Identification of deviations from Contract Documents.
- S. Resubmission requirements:
- 1. Shop Drawings:
 - a. Revise initial Shop Drawings as required and resubmit as specified for initial Submittals.
 - b. Indicate on Shop Drawings any changes that have been made other than those requested by Owner.
 - 2. Product Data and Samples:
 - a. Submit new Product Data and Samples as required for initial Submittals.
 - 3. Installation, Operation, and Maintenance Manual:
 - a. Revise initial Installation, Operation, and Maintenance Manual(s) as required and resubmit as specified for initial Submittals.
- T. Charge for resubmissions:
- 1. One re-examination of Contractor's Submittals that have been returned for correction or replacement will be included in Owner's budget. Any additional re-examination of Contractor's Submittals will be considered additional scope services to be paid by Contractor through Owner. Contractor shall pay Owner (or Owner may deduct from any progress or final payment), for engineering personnel, on an hourly basis at 2.5 times direct payroll expenses, and for consultant personnel time at 1.25 times the amount billed Owner.

1.3 SCHEDULE OF SUBMITTALS

- A. Submit a preliminary Schedule of Submittals as required herein and by Document 00700 (General Conditions). Utilize Owner's Submittal Log form to prepare Schedule of Submittals. Owner's Submittal Log form will be provided to Contractor in electronic media format compatible with Microsoft® Excel 2000.
- B. Schedule of Submittals will be used by Owner to schedule its activities relating to review of Submittals. Schedule of Submittals shall indicate a spreading out of Submittals and early Submittals of long-lead-time items and of items that require extensive review.
- C. Schedule of Submittals will be reviewed by Owner and shall be revised and resubmitted until accepted by Owner.
- D. Unless otherwise specified, transmit Submittals for associated items simultaneously to ensure that information is available for checking each item when it is received. Identify on the Submittal transmittal form that such Submittals should be reviewed together.

1.4 SAFETY PROGRAM

- A. Submit Safety Program specific to these Contract Documents as required by Section 01540 (Site Security and Safety).

1.5 PROGRESS SCHEDULE

- A. See Section 01320 (Progress Schedules and Reports) for schedule and report requirements. Section 01320 (Progress Schedules and Reports) shall control in any conflict with this Section 01330.
- B. Progress schedules, schedule updates, and reports shall be submitted using software described in paragraph 1.4E of Section 01320 (Progress Schedules and Reports). Electronic files shall be complete copies, including all programs and electronic coding.

1.6 PRODUCT DATA

- A. Within ten Days after Contract Time commences to run, submit complete list of major products proposed for use (included at the end of this Section 01330), with name of manufacturer, telephone number, trade name, and model number of each product. Tabulate data by Specification Section.
- B. Product or Catalog Data:
 - 1. Manufacturers' standard drawings shall be modified to delete non-applicable data or include applicable data.
 - 2. Manufacturers' catalog sheets, brochures, diagrams, schedules, charts, illustrations, and other standard descriptive data:
 - a. Mark each copy to identify pertinent materials, products, or models.
 - b. Show dimensions and clearances required, performance characteristics and capacities, wiring diagrams and controls.
 - 3. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.
 - 4. Material Safety Data Sheets:
 - a. In addition to MSDSs otherwise required by the Contract Documents, submit MSDSs for any products containing a hazardous substance such as paints, solvents, thinners, varnish, lacquer, glues and adhesives, mastics, sealants, equipment fuel, equipment lubricant, or other materials needed for the Project as required by the individual Specification Sections or as otherwise specified in the Contract Documents.
 - b. MSDSs must be submitted with Product Data Submittal in order for the Submittal to be reviewed.
- C. Supplemental Data:
 - 1. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturer's standard data to provide information unique to Project.

1.7 SHOP DRAWINGS

- A. Minimum Sheet Size: 8½ inches by 11 inches. All others: Multiples of 8½ inches by 11 inches, 34 inches by 44 inches maximum.
- B. The electronic copy will be marked with Owner's review comments and returned to Contractor.
- C. Mark each copy to identify applicable products, models, options, and other data; supplement manufacturers' standard data to provide information unique to Work.
- D. Include manufacturers' installation instructions when required by Specification Section.
- E. If Contractor submits Shop Drawings for items that Shop Drawings are not specified, Owner will not be obliged to review them.
- F. Contractor is responsible for procuring copies of Shop Drawings for its own use as it may require for the progress of the Work.

- G. Shop Drawings shall be drawn to scale and completely dimensioned, showing plan view together with such sectional views as are necessary to clearly show construction detail, materials, and methods.

1.8 SAMPLES

- A. Submit full range of manufacturers' standard colors, textures, and patterns for Owner's selection.
- B. Submit Samples to illustrate functional and aesthetic characteristics of product, with integral parts and attachment devices. Coordinate Submittal of different categories for interfacing Work.
- C. Include identification on each Sample, giving full information.
- D. Sizes: Unless otherwise specified, provide the following:
 - 1. Paint Chips: Manufacturers' standard
 - 2. Flat or Sheet Products: Minimum 6 inches square, maximum 12 inches square
 - 3. Linear Products: Minimum 6 inches, maximum 12 inches long
 - 4. Bulk Products: Minimum 1 pint, maximum 1 gallon
- E. Full size Samples may be used in Work upon approval by Owner.
- F. Field Samples and Mock-ups (if applicable):
 - 1. Erect field Samples and mock-ups at Site in accordance with requirements of Specification Sections. If testing is conducted, record and certify results and full Contract compliance.
 - 2. Modify or make additional field Samples and mock-ups as required to provide appearance and finishes approved by Owner.
 - 3. Approved field Samples and mock-ups may be used in Work upon approval by Owner.
 - 4. Construct or prepare as many additional Samples as may be required, as directed by the Owner, until desired textures, finishes, and/or colors are obtained.
 - 5. Accepted Samples and mock-up shall serve as the standard of quality for the various units of Work.
- G. No review of a Sample shall be taken in itself to change or modify the requirements in the Contract Documents.
- H. Finishes, materials, and workmanship in the completed Work shall match accepted Samples.
- I. Samples will not be returned to Contractor.

1.9 COORDINATION DRAWINGS

- A. Layout Drawings: As soon as practical and in no case starting later than 30 Days after issuance of Notice to Proceed, Contractor shall prepare layout drawings of all equipment, ductwork, conduit and piping at not less than 1/4" scale. The layout drawings shall show the location of all equipment as well as locations of all valves, piping, fittings, ductwork, dampers, and other items requiring access for service and maintenance. The layout drawings shall also show beams, ceiling heights, walls, floor-to-floor dimensions, columns, doors and other major architectural and structural drawings.
 - 1. At Contractor's option, the layout drawings may be produced using computer-aided drafting.
- B. Coordination with Subcontractors: Within 30 Days after the date of the Notice to Proceed, send one reproducible and two prints of the layout drawings to Subcontractors who shall then make on the reproducible their own routings, etc., as required to determine interrelationship and possible interferences with mechanical equipment, piping, ductwork,

- electrical equipment, and architectural or structural features. The marked-up reproducibles shall then be returned to Contractor no less than 30 Days after receipt by the Subcontractors.
- C. Composite Drawings: Contractor shall prepare preliminary composite drawings of such layout drawings, incorporating all the information and routings provided by the Subcontractors. (At Contractor's option, a group of transparent overlays may be substituted, provided that they clearly show the relationship of all proposed installations and they are pin-registered/aligned.)
1. The preliminary composite drawings or the overlays shall be reviewed during a series of meetings called by Contractor and attended by Owner, at which all Subcontractors and trades shall be represented in order to review and resolve any real or apparent interferences or conflicts.
- D. Agreement by Subcontractors: After all conflicts or interferences are resolved, Contractor shall develop a final set of composite drawings showing the agreed-upon routing, layout and juxtaposition of all , piping, ductwork, major conduit, valves, panels, controls, lighting fixtures and all major mechanical and electrical installations. In areas where no mechanical and electrical installations are installed, each Subcontractor shall be responsible for its own Work and pay its own costs in connection therewith. In preparation of all the final composite drawings, large scale details as well as cross and longitudinal sections shall be prepared as required to fully delineate all conditions. Particular attention shall be given to the locations, size, and clearance dimensions of equipment items, shafts, and similar features. These final composite drawings shall then be signed off by Subcontractors and Contractor, indicating their awareness of and agreement with the indicated routings and layouts and their interrelationship with the adjoining or contiguous Work. Thereafter, no unauthorized deviations will be permitted and, if made without knowledge or agreement of Owner, such unauthorized Work will be subject to removal and correction at no additional cost to Owner.
- E. Minor Changes: In preparing the composite drawings, minor changes in duct, pipe or conduit routings that do not affect the intended function may be made as required to avoid space conflicts, when mutually agreed, but items may not be resized or exposed items relocated without Owner's written approval. No changes shall be made in any wall or chase locations, ceiling heights, door swings or locations, window or other openings or other features affecting the function or aesthetic effect of the building. If conflicts or interferences cannot be satisfactorily resolved, Owner shall be notified and Owner's decision obtained.
- F. Distribution of Composite Drawings: After the final composite drawings have been agreed upon and signed by all Subcontractors, provide and distribute four prints to each of the Subcontractors for reference and record purposes. Make similar distribution of all supplementary composite drawings, initiated by other Subcontractors. Also provide final composite drawings to Owner. All Subcontractors desiring additional prints of such drawings, beyond the basic distribution indicated above in this paragraph 1.9F, shall arrange for and pay the cost of same.
- G. Record Composite Drawings: The record copies of the final composite drawings shall be retained by Owner, Contractor, and each Subcontractor as a working reference. All Shop Drawings, prior to their Submittal to Owner, shall be compared with the composite drawings and developed accordingly by Contractor and the responsible Subcontractor. Any revisions to the composite drawings that may become necessary during the progress of the Work shall be noted by Contractor and all Subcontractors and shall be neatly and accurately recorded on the record copies. Contractor and each Subcontractor shall be responsible for

the up-to-date maintenance of Subcontractor record copies of the composite drawings and for keeping two copies available at the Site. Contractor and each Subcontractor shall utilize the composite drawings, and any subsequent changes thereto, in the development of Subcontractor "Project Record Documents" drawings.

- H. Timely Submission: The composite drawings need not be submitted as a whole, but shall be submitted in all cases in ample time to avoid construction delay. The coordination drawings may lack complete data in certain instances pending receipt of Shop Drawings, but sufficient space shall be allotted for the items affected. When final information is received, such data shall be promptly inserted on the composite drawings.
- I. Improperly Coordinated Work: No extra compensation will be paid for relocating any duct, pipe, conduit, or other material that has been installed without proper coordination between Contractor and all Subcontractors involved. If any improperly coordinated Work or Work installed that is not in accordance with the approved composite drawings, necessitates additional Work by Contractor or other Subcontractors, the costs of all such Work shall be borne solely by Contractor or the Subcontractor responsible for the Work.
- J. Incorporation of Changes: All changes in the scope of Work due to revisions formally issued and approved shall be shown on the composite drawings.
- K. Quality Draftsmanship: All Work on Shop Drawings, ductwork layout drawings, coordination drawings, and composite drawings shall be performed by competent drafters and shall be clear and fully legible. Owner shall be the sole judge of the acceptability of the drawings.
- L. Structural Cutting: Obtain specific positive written instructions from Owner before cutting beams or other structural members, walls, arches, or lintel, and comply with such instructions.

1.10 QUALITY ASSURANCE/CONTROL SUBMITTALS

- A. Design Data:
 - 1. Indicate that material or product conforms to or exceeds specified requirements.
- B. Test Reports:
 - 1. Indicate that material or product conforms to or exceeds specified requirements.
 - 2. Reports may be from recent or previous tests on material or product, but shall be acceptable to Owner. Comply with requirements of each individual Specification Section.
- C. Certificates:
 - 1. Indicate that material or product conforms to or exceeds specified requirements.
 - 2. Submit supporting reference data, affidavits, and certifications as appropriate.
 - 3. Certificates may be recent or from previous test results on material or product, but shall be acceptable to Owner.
- D. Manufacturers' Instructions:
 - 1. Include manufacturers' printed instructions for delivery, storage, assembly, installation, startup, adjusting, and finishing.
 - 2. Identify conflicts between manufacturers' instructions and Contract Documents.
- E. Work Plans:
 - 1. Submit work plans with sufficient detail to clearly indicate compliance with Specification requirements and to clearly describe by what means and methods Contractor intends to execute the subject Work.

1.11 INSTALLATION, OPERATION, AND MAINTENANCE MANUAL (IF APPLICABLE)

- A. Sheet Size: 8½ x 11 inch

- B. Drawing Size: Reduce drawings or diagrams to an 8½ x 11 inch or 11 x 17 inch size. However, where reduction is not practical to ensure readability, fold larger drawings separately and place in vinyl envelopes bound into the binder. Identify vinyl envelopes with drawing numbers.
- C. Binding: Bind in heavy-duty white vinyl D-ring binders (locking rings), not more than 3" thick, with standard three-hole punch, two inside pockets, and a clear overlay (front pocket). Binder shall be no more than 80% full.
- D. Multiple Items: Multiple items may be combined into one binder; tab each section with plastic-coated dividers.
- E. Volumes: create volumes, numbered sequentially, as appropriate.
- F. Page Protectors: Provide plastic sheet lifters prior to first page and following last page.
- G. Binder title: Include the following title on front and spine of binder(s):
 - GEOHERMAL HEAT PUMP RETROFIT AT 404 AVIATION BOULEVARD, SANTA ROSA, CA
 - INSTALLATION, OPERATION, AND MAINTENANCE MANUAL, [YEAR]
 - VOLUME [__(number) of __(total number of volumes)]
- H. Contents:
 - 1. Introductory Information:
 - a. Title page providing the same information as paragraph 1.11G above
 - b. Contractor's name, address, and telephone number
 - c. Table of Contents: include a complete table of contents in each volume, if applicable
 - 2. Include, at a minimum, the following detailed information for each item as applicable and as required by individual Specification Sections:
 - a. Bill of materials: include manufacturer, complete model number, quantity, and equipment location.
 - b. Operational information:
 - 1) Equipment function, normal operating characteristics, limiting operations.
 - 2) Operating instructions for startup, routine and normal operation, regulation and control, shutdown, and emergency conditions.
 - 3) A list of recommended spare parts with a price list, predicted life of parts subject to wear, and a list of spare parts provided under this Contract.
 - 4) Instrumentation or tag numbers relating the equipment back to the Contract Documents.
 - c. Maintenance information:
 - 1) Assembly, disassembly, installation, alignment, adjustment, and checking instructions.
 - 2) Lubrication and maintenance instructions including specific type and amount of lubricant and recommended lubrication interval.
 - 3) Outline, cross-section, and assembly drawings; engineering data; and electrical diagrams, including elementary diagrams, labeled wiring diagrams, connection diagrams, word description of wiring diagrams and interconnection diagrams.
 - 4) Test data and performance curves.
 - 5) Parts lists or other documents packed with equipment when delivered.
 - 6) Instrumentation or tag numbers relating the equipment back to the Contract Documents.
 - 7) Include a filled-out Maintenance Summary form (included at the end of this Section 01330) as the first page(s) of each manual. Complete maintenance requirements in detail. Reference to the manual will not be accepted. For

equipment items involving components or sub-units, a Maintenance Summary for each operating component or sub-unit is required.

- d. Troubleshooting guide.
- e. Delete information that is not pertinent to the Project.
- 3. Index: alphabetical by keyword
- I. Final Submittal: Upon favorable review of Installation, Operation, and Maintenance Manual(s) by Owner, deliver the final approved Installation, Operation, and Maintenance Manual(s). Electronic media format copy shall include all tables, charts, drawings, codes and all other matters reflected in hard copies.

1.12 PROJECT RECORD DOCUMENTS

- A. Submit Project Record Documents as required by Section 01780 (Project Record Documents).

1.13 STORM WATER POLLUTION PREVENTION PROGRAM (IF APPLICABLE)

- A. Submit Storm Water Pollution Prevention Program if required by Section 01500 (Temporary Facilities and Controls).

1.14 DELAY OF SUBMITTALS

- A. Delay of Submittals by Contractor is considered avoidable delay. Liquidated damages incurred because of late Submittals will be assessed to Contractor.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

MAJOR PRODUCTS LIST, TRANSMITTAL FORMS, AND MAINTENANCE SUMMARY FORM
FOLLOW THIS PAGE

MAJOR PRODUCTS LIST

	Specification Section Number	Product	Name of Manufacturer, Trade Name, Model Number	Telephone number
1.	15745	Water Source Heat Pumps		
2.	15185	Hydronic Pumps		
3.	15900	Building Management System		

SUBMITTAL, TRANSMITTAL NO. _____

Project Name: Geothermal Heat Pump Retrofit at 404 Aviation Boulevard, Santa Rosa, CA		Date Received:		
Owner: Sonoma County Water Agency Attention: Mathew Vail		Checked By:		
Mail: PO Box 11628 Santa Rosa, CA 95406		Hand delivery: 404 Aviation Boulevard Santa Rosa, CA 95403		
Contractor: Address:		Log Page:		
Attention:		Specification Section Number:		
		1st Submittal <input type="checkbox"/>	Resubmittal <input type="checkbox"/>	
<p align="center">By _____ Date _____</p> <p>Contractor's signature above shall constitute Contractor's representation that it has satisfied its obligations under the Contract Documents with respect to Contractor's review and approval of Submittals.</p>				
Date Transmitted:		Previous Transmittal Date:		
No. Copies	Description	Manufacturer	Dwg. or Data No.	Action Taken*

Remarks:

* The action designated above is in accordance with the following legend:

- | | |
|---|---|
| <p>A - No Exceptions Taken</p> <p>B - Make Corrections Noted (No Resubmission Required)</p> <p>C - Revise as Noted and Resubmit</p> | <p>D - Rejected - Resubmit</p> <ol style="list-style-type: none"> 1. Not enough information for review 2. No reproduces submitted 3. Copies illegible 4. Not enough copies submitted 5. Wrong sequence number 6. Wrong resubmittal number 7. Wrong Specification section number 8. Wrong form used 9. See comments |
|---|---|

Comments:

By _____

Date _____

INSTALLATION, OPERATION, AND MAINTENANCE MANUAL, TRANSMITTAL NO. _____

Project Name: Geothermal Heat Pump Retrofit at 404 Aviation Boulevard, Santa Rosa, CA		Date Received:		
Owner: Sonoma County Water Agency Attention: Mathew Vail		Checked By:		
Mail: PO Box 11628 Santa Rosa, CA 95406		Hand delivery: 404 Aviation Boulevard Santa Rosa, CA 95403		
Contractor: Address:		Log Page:		
Attention:		Specification Section Number:		
		1st Submittal <input type="checkbox"/>	Resubmittal <input type="checkbox"/>	
<p>By _____ Date _____</p> <p>Contractor's signature above shall constitute Contractor's representation that it has satisfied its obligations under the Contract Documents with respect to Contractor's review and approval of Submittals.</p>				
Date Transmitted:		Previous Transmittal Date:		
No. Copies	Description	Manufacturer	Dwg. or Data No.	Action Taken*

Remarks:

* The action designated above is in accordance with the following legend:

- | | |
|--|---|
| <p>A - No Exceptions Taken</p> <p>B - Make Corrections Noted (No Resubmission Required)</p> <p>C - Revise as Noted and Resubmit</p> <p>D - Rejected - Resubmit- this manual Submittal is deficient in the following area:</p> <ol style="list-style-type: none"> 1. Equipment record sheets 2. Functional description 3. Assembly, disassembly, installation, alignment, adjustment, and checkout instructions 4. Operating instructions | <p>D - (continued)</p> <ol style="list-style-type: none"> 5. Lubrication and maintenance instructions 6. Troubleshooting guide 7. Parts list and ordering instructions 8. Organization (indexing and tabbing) 9. Wiring diagrams and schematics specific to installation 10. Outline, cross section, and assembly diagrams 11. Test data and performance curves 12. Tag or equipment identification numbers 13. See comments |
|--|---|

Comments:

By _____

Date _____

MAINTENANCE SUMMARY

- 1. EQUIPMENT ITEM: _____
- 2. MANUFACTURER: _____
- 3. MODEL NUMBER: _____
- 4. SERIAL NO. (IF APPLICABLE): _____
- 5. NAMEPLATE DATE (HP VOLTAGE, SPEED, ETC.): _____
- 6. MANUFACTURER'S LOCAL REPRESENTATIVE
NAME: _____
ADDRESS: _____
TELEPHONE NUMBER: _____ FAX NUMBER: _____
- 7. MAINTENANCE REQUIREMENTS:

MAINTENANCE OPERATION

List briefly each maintenance operation required and refer to specific information in manufacturer's standard maintenance manual, if applicable. _____

FREQUENCY

List required frequency of each maintenance operation. _____

LUBRICANT (IF APPLICABLE)

Refer by symbol to lubricant list as required. _____

COMMENTS

8. LUBRICANT LIST: REFERENCE SYMBOL

(A-) (B-) (C-) (D-)

List symbols used. List equivalent lubricants as distributed and recommended by manufacturer's representative listed in item 6 above.

9. SPARE PARTS:

Include your recommendations regarding what spare parts, if any, should be kept on the job.

SECTION 01410

REGULATORY REQUIREMENTS**PART 1 GENERAL****1.1 SUMMARY**

- A. Section includes: regulatory requirements that may be applicable to Contract Documents.
- B. Specific reference in the Specifications to codes and regulations or requirements of regulatory agencies shall mean the latest printed edition of each adopted by the regulatory agency in effect at the time of the opening of Bids, except as may be otherwise specifically stated in the Contract Documents.
- C. Should any conditions develop not covered by the Contract Documents wherein the finished Work will not comply with current codes, a Change Order detailing and specifying the required Work shall be submitted to and approved by Owner before proceeding with the Work.

1.2 REFERENCES TO REGULATORY REQUIREMENTS

- A. Codes, laws, ordinances, rules and regulations referred to shall have full force and effect as though printed in full in these Specifications. Code, laws, ordinances, rules and regulations are not furnished to Contractor, because Contractor is assumed to be familiar with these requirements. The listing of applicable codes, laws, and regulations for hazardous waste abatement Work in the Contract Documents is supplied to Contractor as a courtesy and shall not limit Contractor's responsibility for complying with all applicable laws, regulations, or ordinances having application to the Work. Where conflict among the requirements or with these Specifications occurs, the most stringent requirements shall be used.
- B. Conform to referenced codes, laws, ordinances, rules and regulations.

1.3 CODES

- A. Codes that apply to Contract Documents include, but are not limited to, the following:
 - 1. CBC (Part 2, Title 24, CCR, including, without means of limitation, Sections 16A, 102A.23, 308, 420A, 504-506, 904.2.6, 1019 and 1604)
 - 2. CEC (Part 3, Title 24, CCR)
 - 3. CMC (Part 4, Title 24, CCR)
 - 4. CPC (Part 5, Title 24, CCR),
 - 5. State Elevator Safety Regulations (Part 7, Title 24, CCR)
 - 6. UBC
 - 7. UPC
 - 8. UMC
 - 9. NEC
 - 10. Sonoma County Code

1.4 LAWS, ORDINANCES, RULES, AND REGULATIONS

- A. During prosecution of Work to be done under Contract Documents, comply with applicable laws, ordinances, rules and regulations, including, but not limited to, the following:
 - 1. Federal:
 - a. Americans With Disabilities Act of 1990

- b. 29 CFR, Section 1910.1001, Asbestos
 - c. 40 CFR, Subpart M, National Emission Standards for Asbestos
 - d. Executive Order 11246
 - e. Federal Endangered Species Act
 - f. Clean Water Act
2. State of California:
- a. California Code of Regulations, Titles 5, 8, 19, 21, 22, 24 and 25
 - b. California Public Contract Code
 - c. California Health and Safety Code
 - d. California Government Code
 - e. California Labor Code
 - f. California Civil Code
 - g. California Code of Civil Procedure
 - h. CPUC General Order 95, Rules for Overhead Electric Line Construction
 - i. CPUC General Order 128, Rules for Construction of Underground Electric Supply and Communications Systems
 - j. Cal/OSHA
 - k. OSHA: Hazard Communications Standards
 - l. California Endangered Species Act
 - m. Water Code
 - n. Fish and Game Code
3. State of California Agencies:
- a. State and Consumer Services Agency
 - b. Office of the State Fire Marshall
 - c. Office of Statewide Health Planning and Development
 - d. Department of Fish and Game
 - e. Bay Area Air Quality Management District
 - f. San Francisco Bay Regional Water Quality Control Board
 - g. North Coast Regional Water Quality Control Board
 - 1) Order No. 93-61
 - 2) Order No. 81-73
 - 3) Clean Water Act Section 401
4. County of Sonoma:
- a. Ordinance 3836R
 - b. Building permit
 - c. Electrical permit
 - d. Grading permit
 - e. Encroachment permit
 - f. Valley Oak Protection Ordinance
5. Local Agencies:
- a. Applicable City Ordinances
 - b. Northern Sonoma County Air Pollution Control District
6. Other Requirements:
- a. National Fire Protection Association (NFPA): Pamphlet 101, Life Safety.
 - b. References on Drawings or in Specifications to "code" or "building code" not otherwise identified shall mean the codes specified in this Section 01410, together with all additions, amendments, changes, and interpretations adopted by code authorities of the jurisdiction.

- B. Have access to all of the foregoing within 24 hours.
- C. Other Applicable Laws, Ordinances and Regulations:
 1. Work shall be accomplished in conformance with all applicable laws, ordinances, rules and regulations of federal, state, and local governmental agencies and jurisdictions having authority over the Project.
 2. Work shall be accomplished in conformance with all rules and regulations of public utilities and utility districts.
 3. Where such laws, ordinances rules, and regulations require more care or greater time to accomplish Work, or require better quality, higher standards or greater size of products, Work shall be accomplished in conformance to such requirements with no change to the Contract Time and Contract Sum, except where changes in laws, ordinances, rules, and regulations occur subsequent to the time of opening of the Bids.
- D. Change Orders and Claims. The California Public Contract Code (including but not limited to Section 7105 (d)(2)) applies to all contract procedures for changes, time extensions, change orders (time and money), and claims, and per California Government Code Section 930.2, et seq., Contractor's timely compliance with these procedures is a mandatory prerequisite to filing a Government Code Claim. Any change, alteration, modifications, waiver, or omission to implement these procedures, shall have no legal effect unless approved in advance in a fully executed Change Order approved by the Board. Federal construction law (U.S. v. Holspruch 326 U.S. 234) and the jurisprudence of the Federal District of Columbia Circuit shall supplement (but not supercede) California law on construction claims topics including but not limited to, termination claims, home office overhead claims, and delay/disruption claims.

1.5 PRECEDENCE

- A. Where Drawings or Specifications require or describe products or execution of better quality, higher standard or greater size than required by applicable codes, ordinances and standards, Drawings and Specifications shall take precedence so long as such increase is legal.
- B. Where no requirements are identified on Drawings or in Specifications, comply with all requirements of applicable codes, ordinances and standards of governing authorities having jurisdiction.
- C. Conflicts between referenced regulatory requirements: Comply with the one establishing the more stringent requirement.
- D. Conflicts between referenced regulatory requirements and Contract Documents: Comply with the one establishing the more stringent requirement.

1.6 REQUIRED PROVISIONS ON CONTRACT CLAIM RESOLUTION

- A. The California Public Contract Code specifies required provisions on resolving contract claims less than \$375,000, which are set forth below, and constitute a part of this Contract.
 1. For the purposes of this section, "Claim" means a separate demand by Contractor of \$375,000 or less for (1) a time extension, (2) payment or money or damages arising from Work done by or on behalf of Contractor arising under the Contract Documents and payment of which is not otherwise expressly provided for or the Claimant is not otherwise entitled to, or (3) an amount the payment of which is disputed by Owner. In order to qualify as a Claim, the written demand must state that it is a Claim submitted under Article 12 of Document 00700 (General Conditions) and be submitted in compliance with all requirements of Document 00700 (General Conditions), Article 12.

- Separate Claims which total more than \$375,000 do not qualify as a “separate demand of \$375,000 or less,” as referenced above, and are not subject to this section.
2. A voucher, invoice, payment application, or other routine or authorized form of request for payment is not a Claim for purposes of this section. If such request is disputed as to liability or amount, then the disputed portion of the submission may be converted to a Claim under this section by submitting a separate claim in compliance with Contract Documents claim submission requirements.
 3. Caution: This section does not apply to tort claims and nothing in this section is intended nor shall be construed to change the time periods for filing tort claims or actions specified by Chapter 1 and Chapter 2 of Part 3 of Division 3.6 of Title 1 of the California Government Code.
- B. Procedure:
1. The Claim must be in writing, submitted in compliance with all requirements of Document 00700 (General Conditions), Article 12, including, but not limited to, the time prescribed by and including the documents necessary to substantiate the Claim, pursuant to Document 00700 (General Conditions), paragraph 12.3. Claims must be filed on or before the day of final payment. Nothing in this section is intended to extend the time limit or supersede notice requirements for the filing of claims as set forth in Document 00700 (General Conditions), Article 12 or elsewhere in the Contract Documents.
 2. For Claims of fifty thousand dollars (\$50,000) or less
 - a. Owner shall respond in writing within 45 days of receipt of the Claim, or
 - b. Owner may request in writing within 30 days of receipt of the Claim, any additional documentation supporting the Claim or relating to any defenses or claims Owner may have against Claimant.
 - 1) If additional information is thereafter required, it shall be requested and provided in accordance with this section, upon mutual agreement of Owner and Claimant.
 - 2) Owner’s written response to the Claim, as further documented, shall be submitted to Claimant within 15 days after receipt of further documentation or within a period of time no greater than taken by Claimant in producing the additional information, whichever is greater.
 3. For Claims over Fifty Thousand Dollars (\$50,000) and less than or equal to \$375,000:
 - a. Owner shall respond in writing within 60 days of receipt of the Claim, or
 - b. Owner may request in writing within 30 days of receipt of the Claim, any additional documentation supporting the Claim or relating to any defenses or claims Owner may have against Claimant.
 - 1) If additional information is thereafter required, it shall be requested and provided in accordance with this section, upon mutual agreement of Owner and Claimant;
 - 2) Owner’s written response to the Claim, as further documented, shall be submitted to Claimant within 30 days after receipt of further documentation or within a period of time no greater than taken by Claimant in producing the additional information, whichever is greater.
 4. Meet and Confer:
 - a. If Claimant disputes Owner’s written response, or Owner fails to respond within the time prescribed above, Claimant shall notify Owner, in writing, either within 15 days of receipt of Owner’s response or within 15 days of Owner’s failure to timely

respond, and demand an informal conference to meet and confer for settlement of the issues in dispute. Upon demand Owner will schedule a meet and confer conference within 30 days for settlement of the dispute.

- b. Following the meet and confer conference, if the Claim or any portion remains in dispute, Claimant may file a claim as provided in Chapter 1 (commencing with Section 900) and Chapter 2 (commencing with Section 910) of Part 3 of Division 3.6 of Title 1 of the California Government Code. For purposes of those provisions, the running of the period of time within which a claim must be filed shall be tolled from the time Claimant submits its written claim as set forth in paragraph 12.2.B of Document 00700 (General Conditions), until the time that Claim is denied as a result of the meet and confer process, including any period of time utilized by the meet and confer process.

1.7 COMPLIANCE WITH AMERICANS WITH DISABILITIES ACT

- A. Contractor acknowledges that, pursuant to the Americans with Disabilities Act (ADA), programs, services, and other activities provided by a public entity to the public, whether directly or through a contractor, must be accessible to the disabled public. Contractor shall provide the services specified in the Contract Documents in a manner that complies with the ADA and any and all other applicable federal, state, and local disability rights legislation. Contractor agrees not to discriminate against disabled persons in the provision of services, benefits, or activities provided under this Agreement and further agrees that any violation of this prohibition on the part of Contractor, its employees, agents, or assigns shall constitute a material breach of the Contract Documents.

1.8 SUBSTITUTION OF SECURITIES IN LIEU OF RETENTION

- A. In accordance with the provisions of Public Contract Code Section 22300, substitution of securities for any moneys withheld under Contract Documents to ensure performance is permitted under following conditions:
 1. At request and expense of Contractor, securities listed in Section 16430 of the Government Code, bank or savings and loan certificates of deposit, interest bearing demand deposit accounts, standby letters of credit, or any other security mutually agreed to by Contractor and Owner which are equivalent to the amount withheld under retention provisions of Contract shall be deposited with Controller or with a state or federally chartered bank in California, as the escrow agent, who shall then pay such moneys to Contractor. Upon satisfactory completion of Contract, securities shall be returned to Contractor.
 2. Alternatively, Contractor may request and Owner shall make payment of retentions earned directly to the escrow agent at the expense of Contractor. At the expense of Contractor, Contractor may direct the investment of the payments into securities and receive the interest earned on the investments upon the same terms provided for in this Section 01410 for securities deposited by Contractor. Upon satisfactory completion of Contract Documents, Contractor shall receive from escrow agent all securities, interest, and payments received by the escrow agent from Owner, pursuant to the terms of this Section 01410. Pay to each Subcontractor, not later than 20 Days after receipt of the payment, the respective amount of interest earned, net of costs attributed to retention withheld from each Subcontractor, on the amount of retention withheld to insure the performance of Contractor.
 3. Contractor shall be beneficial owner of securities substituted for moneys withheld and shall receive any interest thereon.

4. Enter into escrow agreement with Controller according to Document 00680 (Escrow Agreement for Security Deposits in Lieu of Retention), as authorized under Public Contract Code Section 22300, specifying amount of securities to be deposited, terms and conditions of conversion to cash in case of default of Contractor, and termination of escrow upon completion of Contract Documents.
5. Public Contract Code Section 22300 is hereby incorporated in full by this reference.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01420

REFERENCES AND DEFINITIONS**PART 1 GENERAL****1.1 SUMMARY**

- A. Section Includes: Reference standards, abbreviations, symbols, definitions, and terminology used in Contract Documents.
- B. Full titles are given in this Section for standards cited in other Sections of Specifications.
- C. Material and workmanship specified by reference to number, symbol, or title of specific standard such as state standard, commercial standard, federal specifications, technical society, or trade association standard, or other similar standard, shall comply with requirements of standards except when more rigid requirements are specified or required by applicable codes.
- D. Standards referred to, except as modified herein, shall have full force and effect as though printed in the Contract Documents. Standards are not furnished to Contractor because manufacturers and trades involved are assumed to be familiar with their requirements.

1.2 REFERENCE TO STANDARDS AND SPECIFICATIONS OF TECHNICAL SOCIETIES; REPORTING AND RESOLVING DISCREPANCIES

- A. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to the laws or regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard, specification, manual, code, or laws or regulations (including all amendments, changes, errata, addenda, and supplements) in effect at the time of opening of Bids, except as may be otherwise specifically stated in the Contract Documents.
 - 1. When an edition or effective date of a reference is not given, it shall be understood to be the current edition or latest revision published as of the date of opening Bids.
 - a. Exception: Comply with issues in effect as listed in governing legal requirements.
- B. If during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents or between the Contract Documents and any provision of any such law or regulation applicable to the performance of the Work or of any such standard, specification, manual, or code, or of any instruction of any supplier, report it in writing at once by submitting a RFI to Owner, and do not proceed with the Work affected thereby until consent to do so is given by Owner.
- C. Except as otherwise specifically stated in the Contract Documents or as may be provided by Change Order, CCD, or Supplemental Instruction, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:
 - 1. The provisions of any such standard, specification, manual, code, or instruction (whether or not specifically incorporated by reference in the Contract Documents); or
 - 2. The provisions of any such laws or regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such law or regulation).
- D. No provision of any such standard, specification, manual, code, or instruction shall be effective to change the duties and responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the

Contract Documents, nor shall it be effective to assign to Owner, Engineer, or any of their consultants, agents, representatives or employees any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

- E. Comply with the applicable portions of standards and specifications published by the technical societies, institutions, associations, and governmental agencies referred to in Specifications.
- F. Referenced Grades, Classes, and Types: Where an alternative or optional grade, class, or type of product or execution is included in a reference but is not identified in Drawings or in Specifications, provide the highest, best, and greatest of the alternatives or options for the intended use and prevailing conditions.
- G. Jobsite Copies:
 - 1. Obtain and maintain at the Site copies of reference standards identified on Drawings and in Specifications in order to properly execute the Work.
 - 2. At a minimum, the following shall be readily available at the Site:
 - a. Safety Codes: State of California, Division of Industrial Safety regulations.
- H. ASTM and ANSI References: Specifications and Standards of the American Society for Testing and Materials (ASTM) and the American National Standards Institute (ANSI) are identified in the Drawings and Specifications by abbreviation and number only and may not be further identified by title, date, revision, or amendment. It is presumed that Contractor is familiar with and has access to these nationally- and industry-recognized specifications and standards.

1.3 ABBREVIATIONS

- A. Listed hereinafter are the various organizations or references which may appear in the Contract Documents, along with their respective acronyms and/or abbreviations:

AA	Aluminum Association
AABC	Associated Air Balance Council
AAMA	Architectural Aluminum Manufacturers Association
AAP	Affirmative Action Program
AASHTO	American Association of State Highway and Transportation Officials
AB	Aggregate Base
ABMA	American Bearing Manufacturers Association
ABPA	American Board Products Association
ACI	American Concrete Institute
ADA	Americans with Disabilities Act
AED	Association of Equipment Distributors
AFBMA	Anti-friction Bearing Manufacturers Association
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Conditioning Association, Inc.
ANSI	American National Standards Institute (formerly American Standards Association)
APA	American Plywood Association

API	American Petroleum Institute
ARI	Air-Conditioning and Refrigeration Institute
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigeration, and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWCI	Association of the Wall and Ceiling Industries
AWG	American Wire Gauge
AWPA	American Wood-Preservers' Association
AWPB	American Wood Preservers Bureau
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturers Association
BIL	Basic Insulation Level
BOD	Biological Oxygen Demand
Cal/OSHA	California Occupational Safety and Health Administration
Caltrans	State of California, Department of Transportation
CBC	California Building Code
CCD	Construction Change Directive
CCR	California Code of Regulations
CEC	California Electric Code or California Energy Commission
CF	Cubic Foot or Cubic Feet
CFM	Cubic Feet per Minute
CFR	Code of Federal Regulations
CGA	Common Ground Alliance
CI	Chlorine Institute, Inc.
CISPI	Cast Iron Soil Pipe Institute
CL	Center Line
CLMFI	Chain Link Fence Manufacturers Institute
CMAA	Crane Manufacturers Association of America, Inc.
CMC	California Mechanical Code
CO	Change Order
COE	United States Army Corps of Engineers
CPC	California Plumbing Code
CPM	Critical Path Method
CPUC	California Public Utilities Commission
CRA	California Redwood Association
CRSI	Concrete Reinforcing Steel Institute
CS	Commercial Standards, U.S. Department of Commerce
CSA	Canadian Standards Association
CY	Cubic Yard or Cubic Yards
DFPA	Douglas Fir Plywood Institute
DFT	Dry Film Thickness
DHI	Door and Hardware Institute
EIA	Electronic Industries Association
EPA	Environmental Protection Agency
ETL	Electrical Testing Laboratories

FGMA	Flat Glass Marketing Association
FPS	Feet per Second or Fluid Power Society
FS	Federal Specifications
GA	Gypsum Association
GPM	Gallons Per Minute
Greenbook	Standard Specifications for Public Works Construction
HI	Hydraulic Institute
HMI	Hoist Manufacturer's Institute
HMMA	Hollow Metal Manufacturer's Association
HP	Horse Power
HPMA	Hardwood Plywood Manufacturers Association
HVAC	Heating, Ventilating and Air Conditioning
IACS	International Annealed Copper Standards
IAPMO	International Association of Plumbing and Mechanical Officials
ICBO	International Conference of Building Officials
ICEA	Insulated Cable Engineers Association
ID	Identification or Inside Diameter
IEEE	Institute of Electrical and Electronic Engineers
IES	Illuminating Engineering Society
ISA	International Society of Arboriculture
ISAS	Instrumentation, Systems, and Automation Society
ISO	International Organization for Standardization
JATC	Joint Apprenticeship Training Committee
JV	Joint Venture
LBE	Local Business Enterprise
LLC	Limited Liability Corporation or Company
LS	Lump Sum
M.I.	Middle Initial
M/WBE	Minority and/or Woman-Owned Business Enterprise
MBE	Minority Business Enterprise
MGD	Million Gallons per Day
MIA	Masonry Institute of America
MIA	Marble Institute of America
MLSFA	Metal Lath/Steel Framing Association
MS	Military Specifications
MSDS	Material Safety Data Sheet
MSS	Manufacturers Standardization Society of the Valve & Fitting Industry
NAAMM	National Association of Architectural Metal Manufacturers
NACE	National Association of Corrosion Engineers
NBS	National Bureau of Standards
NEC	National Electric Code
NEMA	National Electric Manufacturers Association
NESC	National Electrical Safety Code
NFoPA	National Forest Products Association
NFPA	National Fire Protection Association
NIC	Not In Contract
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology

NPT	National Pipe Thread
NRMCA	National Ready Mixed Concrete Association
NSF	National Sanitation Foundation
NTS	Not to Scale
NWWDA	National Wood Windows and Doors Association
OC	On Center
OD	Outside Diameter
OSHA	Occupational Safety and Health Administration
OSHPD	Office of Statewide Health Planning and Department
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute
PDI	Plumbing and Drainage Institute
PG&E	Pacific Gas and Electric Company
PL	Property Line
PLC	Programmable Logic Controller
PM	Preventive Maintenance
PPM	Parts per Million
PR	Proposal Request
PRMD	Permits and Resource Management Department, County of Sonoma
PS	Product Standard, U. S. Department of Commerce
PSF or psf	Pounds per Square Foot
PSI or psi	Pounds per Square Inch
PSIG	Pounds per Square Inch Gauge
PVC	Polyvinyl chloride
RC	Relative Compaction
RFI	Request for Information
RFP	Request for Proposals
RFS	Request for Substitution
RIS	Redwood Inspection Service
RPM	Revolutions per Minute
SAE	Society of Automotive Engineers
SDeI	Steel Deck Institute
SDoI	Steel Door Institute
SDR	Standard Dimension Ratio
SF	Square Foot or Square Feet
SFM	State of California, Office of State Fire Marshal
SIDR	Standard Inside Dimension Ratio
SIGMA	Sealed Insulating Glass Manufacturers Association
SJI	Steel Joint Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SPIB	Southern Pine Inspection Bureau
SSPC	Society for Protective Coating (formerly Steel Structures Painting Council)
SWI	Steel Window Institute
TCA	Tile Council of America
TIE	Time Impact Evaluation
TMS	The Masonry Society
TPI	Truss Plate Institute Inc.
UBC	Uniform Building Code

UFC	Uniform Fire Code
UL	Underwriters' Laboratories, Inc.
UMC	Uniform Mechanical Code
UPC	Uniform Plumbing Code
USA	Underground Service Alert
USACE	United States Army Corps of Engineers
USC	United States Code
VOC	Volatile Organic Compounds
WBE	Women's Business Enterprise
WCLIB	West Coast Lumber Inspection Bureau
WHI	Warnock Hersey International
WIC	Woodwork Institute of California
WWPA	Western Wood Products Association
WWPI	Western Wood Preservers Institute

B. Abbreviations in Specifications:

cm	centimeter (centimeters)
Co.	Company
Corp.	Corporation
cu	Cubic
dia	diameter
Div	Division
ft	foot (feet)
g	gram (grams) or Standard Acceleration of Gravity
gal	gallon (gallons)
gpd	gallons per Day
hr	hour
in	inch (inches)
Inc.	Incorporated
kg	kilogram (kilograms)
km	kilometer (kilometers)
kVAR	kilovolts amperes reactive
kW	kilowatt
l	liter (liters)
lb(s)	Pound(s)
m	meter (meters)
mfr	manufacturer
mg	milligram (milligrams)
ml/mls	milliliter (milliliters)
mm	millimeter (millimeters)
No	number
sq	square
Sta	Station
T & G	tongue and groove
Typ	typical
US	United States
yd	yard (yards)

C. Abbreviations on Drawings:

1. As listed for Specifications above.
2. Additional abbreviations, used only on Drawings, are indicated thereon.

1.4 SYMBOLS

A. Symbols in Specifications:

:	“shall be” or “shall” - where used within sentences or paragraphs
#1	number
1#	pound
&	and
%	percent
C	Centigrade
F	Fahrenheit
°	degree
/	“per,” except where used to combine words; example: power/fuel, and in that case it means “and”
“	inch (inches)
’	foot (feet)
@	at

B. Symbols on Drawings:

1. As listed for Specifications above.
2. Symbols, used only on Drawings, are indicated thereon.

1.5 DEFINITIONS

- A. Wherever any of the words or phrases defined below, or a pronoun used in place thereof, is used in any part of the Contract Documents, it shall have the meaning here set forth. In the Contract Documents, the neuter gender includes the feminine and masculine, and the singular number includes the plural.
- B. The following definitions shall apply regardless of capitalization unless the context otherwise requires:
 1. Wherever words “as directed,” “as required,” “as permitted,” or words of like effect are used, it shall be understood that direction, requirements, or permission of Owner is intended. Words “sufficient,” “necessary,” “proper,” and the like shall mean sufficient, necessary, or proper in judgment of Owner. Words “approved,” “acceptable,” “satisfactory,” “favorably reviewed,” or words of like import, shall mean approved by, or acceptable to, or satisfactory to, or favorably reviewed by Owner.
 2. Wherever the word “may” or “ought” is used, the action to which it refers is discretionary. Wherever the word “shall” or “will” is used, the action to which it refers is mandatory.
 3. Addenda: Written or graphic instruments issued prior to the opening of Bids, which clarify, correct, or change the bidding requirements or the Contract Documents. Addenda shall not include the minutes of the Pre-Bid Conference and/or Site Visit.

4. Agency: The Sonoma County Water Agency (SCWA), a public agency of the State of California, acting under and by virtue of the authority vested in the Owner by the laws of the State of California.
5. Agreement (Document 00520): Agreement is the basic Contract Document that binds the parties to construction Work. Agreement defines relationships and obligations between Owner and Contractor and by reference incorporates Conditions of Contract, Drawings, and Specifications and contains Addenda and all Modifications subsequent to execution of Contract Documents.
6. Alternate: Work added to or deducted from the base Bid, if accepted by Owner.
7. Application for Payment: Written application for monthly or periodic progress or final payment made by Contractor complying with the Contract Documents.
8. Approved Equal: Approved in writing by Owner as being of equivalent quality, utility and appearance.
9. Asbestos: Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by OSHA or Cal/OSHA.
10. Bid: The offer or proposal of the Bidder submitted on the prescribed form(s) setting forth the prices for the Work to be performed.
11. Bidder: One who submits a Bid.
12. Bidding Documents: All documents comprising the Project Manual (including all documents and Specification Sections listed in Document 00010 [Table of Contents]), including documents supplied for bidding purposes only and Contract Documents.
13. Board: The Board of Directors of the Owner.
14. Business Day: Any Day other than Saturday, Sunday, and the following days that have been designated as holidays by Owner. If a holiday falls on a Saturday, the preceding Friday will be the holiday. If a holiday falls on a Sunday, the following Monday will be the holiday.
 - a. New Year's Day, January 1;
 - b. Martin Luther King Jr.'s Birthday, third Monday in January;
 - c. Lincoln's Birthday, February 12;
 - d. Presidents' Day, third Monday in February;
 - e. Memorial Day, last Monday in May;
 - f. Independence Day, July 4;
 - g. Labor Day, first Monday in September;
 - h. Veterans' Day, November 11;
 - i. Thanksgiving Day, as designated by the President;
 - j. The Day following Thanksgiving Day;
 - k. Christmas Day, December 25; and
 - l. Each day appointed by the Governor of California and formally recognized by the Sonoma County Board of Supervisors as a day of mourning, thanksgiving, or special observance.
15. By Owner: Work that will be performed by Owner or its agents at the Owner's expense.

16. By Others: Work that is outside scope of Work to be performed by Contractor under this Contract, which will be performed by Owner, other contractors, or other means.
17. Change Order: A written instrument prepared by Owner and signed by Owner and Contractor, stating their agreement upon all of the following:
 - a. a change in the Work;
 - b. the amount of the adjustment in the Contract Sum, if any; and
 - c. the amount of the adjustment in the Contract Time, if any.
18. Code Inspector: A local or state agency responsible for the enforcement of applicable codes and regulations.
19. Concealed: Work not exposed to view in the finished Work, including within or behind various construction elements.
20. Construction Change Directive ("CCD"): A written order prepared and signed by Owner, directing a change in the Work and stating a proposed basis for adjustment, if any, in the Contract Sum or Contract Time, or both.
21. Contract Conditions or Conditions of the Contract: Consists of two parts: General Conditions and Supplementary Conditions.
 - a. General Conditions are general clauses that are common to the Owner Contracts, including Document 00700 (General Conditions).
 - b. Supplementary Conditions modify or supplement General Conditions to meet specific requirements for these Contract Documents, including Document 00800 (Supplementary Conditions).
22. Contract Documents and Contract: Contract Documents and Contract shall consist of the documents identified as the Contract Documents in Document 00520 (Agreement), plus all changes, Addenda, and Modifications thereto.
23. Contract Modification: Either:
 - a. a written amendment to Contract signed by Contractor and Owner; or
 - b. a Change Order; or
 - c. a Construction Change Directive; or
 - d. a written directive for a minor change in the Work issued by Owner.
24. Contract Sum: The sum stated in the Agreement and, including authorized adjustments, the total amount payable by Owner to Contractor for performance of the Work and the Contract Documents. The Contract Sum is also sometimes referred to as the Contract Price or the Contract Amount.
25. Contract Time: The number or numbers of Days or the dates stated in the Agreement:
 - a. to achieve Substantial Completion of the Work or designated Milestones; and/or
 - b. to complete the Work so that it is ready for final payment and is accepted.
26. Contractor: The person or entity identified as such in the Agreement and referred to throughout the Contract Documents as if singular in number and neutral in gender. The term "Contractor" means the Contractor or its authorized representative.
27. Contractor's Employees: Persons engaged in execution of Work under Contract as direct employees of Contractor, as Subcontractors, or as employees of Subcontractors.
28. Day: One calendar day of 24 hours measured from midnight to the next midnight, unless the word "day" is specifically modified to the contrary.

29. Defective: An adjective which, when modifying the word "Work," refers to Work that is unsatisfactory or unsuited for the use intended, faulty, or deficient, that does not conform to the Contract Documents, or does not meet the requirements of any inspection, reference standard, test or approval referred to in the Contract Documents (including but not limited to approval of Samples and "or equal" items), or has been damaged prior to final payment (unless responsibility for the protection thereof has been assumed by Owner). Owner is the judge of whether Work is Defective.
30. Drawings: The graphic and pictorial portions of Contract Documents, wherever located and whenever issued, showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.
31. Engineer: If used elsewhere in the Contract Documents, "Engineer" shall mean a person holding a valid California State Architect's or Engineer's license representing the Owner in the administration of the Contract Documents. Engineer may be an employee of or an independent consultant to Owner. When Engineer is referred to within the Contract Documents and no Engineer has in fact been designated, then the matter shall be referred to Owner. The term Engineer shall be construed to include employees of Engineer and/or employees that Engineer supervises. When the designated Engineer is an employee of Owner, his or her authorized representatives on the Project will be included under the term Engineer. If Engineer is an employee of Owner, Engineer is the beneficiary of all Contractor obligations to Owner, including without limitation, all releases and indemnities.
32. Equal: Equal in opinion of Owner. Burden of proof of equality is responsibility of Contractor.
33. Exposed: Work exposed to view in the finished Work, including behind louvers, grilles, registers and various other construction elements.
34. Final Acceptance or Final Completion: Owner's acceptance of the Work as satisfactorily completed in accordance with Contract Documents. Requirements for Final Acceptance/Final Completion include, but are not limited to:
 - a. All systems having been tested and accepted as having met requirements of Contract Documents.
 - b. All required instructions and training sessions having been given by Contractor.
 - c. All Project Record Documents having been submitted by Contractor, reviewed by Owner, and accepted by Owner.
 - d. All punch list Work, as directed by Owner, having been completed by Contractor.
 - e. Generally all Work, except Contractor maintenance after Final Acceptance/Final Completion, having been completed to satisfaction of Owner.
35. Force Account: Work directed to be performed without prior agreement as to lump sum or unit price cost thereof, and which is to be billed at cost for labor, materials, equipment, taxes, and other costs, plus a specified percentage for overhead and profit.
36. Furnish: Supply only, do not install.
37. Indicated: Shown or noted on the Drawings.
38. Install: Install or apply only, do not furnish.
39. Latent: Not apparent by reasonable inspection, including but not limited to, the inspections and research required as a condition to bidding under Document 00700 (General Conditions).

40. Law: Unless otherwise limited, all applicable laws including without limitation all federal, state, and local laws, statutes, standards, rules, regulations, ordinances, and judicial and administrative decisions.
41. Material: This word shall be construed to embrace machinery, manufactured articles, materials of construction (fabricated or otherwise), and any other classes of material to be furnished in connection with Contract, except where a more limited meaning is indicated by context.
42. Milestone: A principal event specified in Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all Work.
43. Modification: Same as Contract Modification.
44. Not in Contract: Work that is outside the scope of Work to be performed by Contractor under Contract Documents.
45. Notice of Completion: Shall have the meaning provided in California Civil Code Section 3093, and any successor statute.
46. Off Site: Outside geographical location of the Project.
47. Owner: The Agency.
48. Owner-Furnished, Contractor-Installed: Items furnished by Owner at its cost for installation by Contractor at its cost under Contract Documents.
49. Owner's Representative(s): See Document 00520 (Agreement).
50. Partial Utilization: Use by Owner of a substantially completed part of the Work for the purpose for which it is intended (or a related purpose) prior to Substantial Completion of all of the Work.
51. PCBs: Polychlorinated biphenyls.
52. Phase: A specified portion of the Work (if any) specifically identified as a Phase in Document 00520 (Agreement) or Document 01100 (Summary).
53. Product Data: That information (brochures, catalog sheets, manufacturer's cut sheets, etc.) supplied by vendors having technical and commercial characteristics of the supplied equipment or materials and accompanying commercial terms such as warranties, instructions, and manuals.
54. Progress Report: A periodic report submitted by Contractor to Owner with progress payment invoices accompanying progress schedule. See Section 01320 (Progress Schedules and Reports) and Document 00700 (General Conditions).
55. Project: Total construction of which Work performed under Contract Documents may be whole or part.
56. Project Float: As defined in paragraph 1.2.B.3, Section 01320 (Progress Schedules and Reports).
57. Project Manual: Project Manual consists of Bidding Requirements, Agreement, Bonds, Certificates, Contract Conditions, Drawings, and Specifications.
58. Project Record Documents: All Project deliverables required under Sections 01700 et seq., including without limitation, as-built drawings; Project Record Specifications; Installation, Operation, and Maintenance Manuals; and Machine Inventory Sheets.
59. Provide: Furnish and install.
60. Request for Information ("RFI"): A document prepared by Contractor requesting information regarding the Project or Contract Documents as provided in Section 01250

- (Modification Procedures). The RFI system is also a means for Owner to submit Contract Document clarifications or supplements to Contractor.
61. Request for Proposals (“RFP”): A document issued by Owner to Contractor whereby Owner may initiate changes in the Work or Contract Time as provided in Contract Documents. See Section 01250 (Modification Procedures).
 62. Request for Substitution (“RFS”): A document prepared by Contractor requesting substitution of materials as permitted and to the extent permitted in Contract Documents. See Section 01600 (Product Requirements).
 63. RFI-Reply: A document consisting of supplementary details, instructions, or information issued by Owner that clarifies or supplements Contract Documents, and with which Contractor shall comply. RFI-Replies do not constitute changes in Contract Sum or Contract Time except as otherwise agreed in writing by Owner. RFI-Replies will be issued through the RFI administrative system.
 64. Samples: Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.
 65. Shop Drawings: All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.
 66. Shown: As indicated on Drawings.
 67. Site: The particular geographical location of Work performed pursuant to Contract Documents.
 68. Specifications: The written portion of the Contract Documents consisting of requirements for materials, equipment, construction systems, standards, and workmanship for the Work; performance of related services; and are contained in Divisions 1 through 16.
 69. Specified: As written in Specifications.
 70. Subcontractor: A person or entity that has a direct contract with Contractor to perform a portion of the Work at the Site. The term “Subcontractor” is referred to throughout the Contract Documents as if singular in number and neutral in gender and means a Subcontractor or an authorized representative of the Subcontractor. The term “Subcontractor” does not include a separate contractor or subcontractors of a separate contractor.
 71. Substantial Completion: The Work (or a specified part thereof) has progressed to the point where, in the opinion of Owner as evidenced by a Certificate of Substantial Completion, the Work is sufficiently complete, in accordance with Contract Documents, so that the Work (or specified part) can be utilized for the purposes for which it is intended; or if no such certificate is issued, when the Work (or specified part) is complete and ready for final payment as evidenced by written recommendation of Owner for final payment. The terms “Substantially Complete” and “Substantially Completed” as applied to all or part of the Work refer to Substantial Completion thereof.
 72. Superintendence: Executive oversight and charge of the main aspects of construction, including scheduling, sequence of subcontractor Work, and quality control.
 73. Supplemental Instruction: A written directive from Owner to Contractor ordering alterations or Modifications that do not result in change in Contract Sum or Contract

Time, and do not substantially change Drawings or Specifications. See Section 01250 (Modification Procedures).

74. Testing and special inspection agency: An independent entity engaged by Owner to inspect and/or test the workmanship, materials, or manner of construction of buildings or portions of buildings, to determine if such construction complies with the Contract Documents and applicable codes.
75. Underground Facilities: All pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels or other such facilities or attachments, and any encasements containing such facilities that have been installed underground to furnish any of the following services or materials: Electricity, gases, chemicals, steam, liquid petroleum products, telephone or other communications, cable television, sewage and drainage removal, traffic or other control systems, or water.
76. Unit Price Work: Shall be the portions of the Work for which a unit price is provided in Document 00520 (Agreement) or Section 01100 (Summary).
77. Work: The entire completed construction, or the various separately identifiable parts thereof, required to be furnished under the Contract Documents within the Contract Time. Work includes and is the result of performing or furnishing labor and furnishing and incorporating materials and equipment into the construction, and performing or furnishing services and furnishing documents, all as required by the Contract Documents including everything shown in the Drawings and set forth in the Specifications. Wherever the word "work" is used, rather than the word "Work," it shall be understood to have its ordinary and customary meaning.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01450

QUALITY CONTROL**PART 1 GENERAL****1.1 SECTION INCLUDES**

- A. Contractor's Quality Control
- B. Quality of the Work
- C. Inspections and Tests by Governing Authorities
- D. Inspections and Tests by Serving Utilities
- E. Inspections and Tests by Manufacturer's Representatives
- F. Tests and Inspections by Owner or Owner's Independent Testing and Inspection Agency
- G. Additional Testing and Inspection

1.2 CONTRACTOR'S QUALITY CONTROL

- A. Contractor's Quality Control: Ensure that products, services, workmanship, and Site conditions comply with requirements of Drawings and Specifications by coordinating, supervising, testing, and inspecting the Work and by utilizing only suitably qualified and appropriately audited, licensed, or trained personnel.
- B. Quality Requirements: Work shall be accomplished in accordance with quality requirements of Drawings and Specifications, including, by reference, all codes, laws, rules, regulations, and standards. When no quality basis is prescribed, the quality and testing procedures shall be in accordance with the best-accepted practices of the construction industry for the locale of the Project, for projects of this type, or standards set by engineering or technical societies (e.g., ASTM or ASHRAE), whichever is more stringent.
- C. Quality Control Personnel: Employ and assign knowledgeable and skilled personnel as necessary to perform quality control functions to ensure that the Work is provided as required.
- D. At Contractor's expense, Contractor may employ a certified independent testing agency to perform compaction tests where there is disagreement. Owner may consider such tests, but will have the authority to make the final determination of relative compaction.
- E. At Contractor's expense, Contractor may employ a certified independent welding inspection agency to perform welding inspections. Owner may consider such tests, but will have the authority to make the final determination of welding quality.

1.3 QUALITY OF THE WORK

- A. Quality of Products: Unless otherwise indicated or specified, all products shall be new, free of defects, and fit for the intended use.
- B. Quality of Installation: All Work shall be produced plumb, level, square and true, or true to indicated angle, and with proper alignment and relationship between the various elements, as indicated or required by Contract Documents.
- C. Protection of Completed Work: Take all measures necessary to preserve completed Work free from damage, deterioration, soiling, and staining, until acceptance by Owner.
- D. Standards and Code Compliance and Manufacturer's Instructions and Recommendations: Unless more stringent requirements are indicated or specified, comply with manufacturer's instructions and recommendations, reference standards and building code research report

- requirements in preparing, fabricating, erecting, installing, applying, connecting, and finishing Work.
- E. Deviations from Standards and Code Compliance and Manufacturer's Instructions and Recommendations: Secure Owner's advance written consent. Document and explain all deviations from reference standards and building code research report requirements and manufacturer's product installation instructions and recommendations, including acknowledgement by the manufacturer that such deviations are acceptable and appropriate for the Project.
 - F. Verification of Quality: Work shall be subject to verification of quality by Owner in accordance with provisions of the Contract Documents.
 - 1. Cooperate by making Work available for inspection.
 - 2. Such verification may include mill, plant, shop, or field inspection as required.
 - 3. Provide access to all parts of the Work, including plants where materials or equipment are manufactured or fabricated.
 - 4. Provide all information and assistance as required, including that by and from subcontractors, fabricators, materials suppliers and manufacturers, for verification of quality by Owner.
 - 5. Applicable provisions of the Contract Documents shall govern Contract Modifications, if any, resulting from such verification activities.
 - G. Observations by Owner's Consultants: Periodic and occasional observations of Work in progress will be made by Owner and Owner's consultants as deemed necessary to review progress of Work and general conformance with design intent.
 - H. Limitations on Inspection, Test, and Observation: Neither employment of independent testing and inspection agency nor observations or tests by Owner and Owner's consultants shall in any manner relieve Contractor of obligation to perform Work in full conformance to all requirements of Contract Documents.
 - I. Owner's Acceptance and Rejection of Work: Owner reserves the right to reject all Work not in conformance with the requirements of the Drawings and Specifications, or otherwise Defective.
 - J. Correction of Defective Work: Defective Work shall be modified, replaced, repaired or redone by the Contractor at no change in Contract Sum or Contract Time.
 - K. Acceptance of Defective Work: Acceptance of Defective Work, without specific written acknowledgement and approval of Owner, shall not relieve the Contractor of the obligation to correct such Work.
 - L. Contract Adjustment for Defective Work: Should Owner determine that it is not feasible or in Owner's interest to require Defective Work to be repaired or replaced, an equitable reduction in Contract Sum shall be made by agreement between Owner and Contractor. If equitable amount cannot be agreed upon, a Construction Change Directive will be issued and the amount in dispute resolved in accordance with applicable provisions of Document 00700 (General Conditions).
 - M. Non-Responsibility for Defective Work: Owner and Owner's consultants disclaim any and all responsibility for Work produced not in conformance with the Drawings and Specifications.
 - N. Responsibility for Defective Work: Contractor shall have full responsibility for all consequences resulting from Defective Work, including without limitation all delays, disruptions, extra inspection and correction costs by Contractor and Owner and re-Work, and extra time and costs of all types. Contractor waives excuses for Defective Work relating

to Owner's prior review of Submittals and/or prior failure to notice Defective Work in place on inspection.

1.4 INSPECTIONS AND TESTS BY GOVERNING AUTHORITIES

- A. Regulatory Requirements for Testing and Inspection: Comply with UBC requirements and all other requirements of governing authorities having jurisdiction.
- B. Inspections and Tests by Governing Authorities: Cause all tests and inspections required by governing authorities having jurisdiction to be made for Work under this Contract.
 - 1. Such authorities may include, but are not limited to, Office of Statewide Health Planning Department (OSHDP), Public Works Department, Fire Department, and similar agencies.
 - 2. Except as specifically noted, scheduling, conducting and paying for such inspections shall be solely the Contractor's responsibility.

1.5 INSPECTIONS AND TESTS BY SERVING UTILITIES

- A. Inspections and Tests by Serving Utilities: Cause all tests and inspections required by serving utilities to be made for Work under this Contract. Scheduling, conducting, and paying for such inspections shall be solely the Contractor's responsibility.

1.6 INSPECTIONS AND TESTS BY MANUFACTURER'S REPRESENTATIVES

- A. Inspections and Tests by Manufacturer's Representatives: Cause all tests and inspections specified to be conducted by materials or systems manufacturers to be made. Additionally, all tests and inspections required by materials or systems manufacturers as conditions of warranty or certification of Work shall be made, the cost of which shall be included in the Contract Sum.

1.7 TESTS AND INSPECTIONS BY OWNER OR OWNER'S INDEPENDENT TESTING AND INSPECTION AGENCY

- A. Owner may conduct or Owner may select an independent testing and inspection agency or agencies to conduct tests and inspections as indicated on Drawings, in Specifications, and as required by governing authorities having jurisdiction.
- B. Responsibility for payment for such tests and inspections shall be as indicated in paragraph 1.7D below. All time and costs for Contractor's service related to such tests and inspections shall be included in Contract Time and Contract Sum.
- C. Contractor shall pay for all additional charges by testing and inspection agencies and governing authorities having jurisdiction due to the following:
 - 1. Contractor's failure to properly schedule or notify testing and inspection agency or authorities having jurisdiction.
 - 2. Changes in sources, lots, or suppliers of products after original tests or inspections.
 - 3. Changes in means, methods, techniques, sequences, and procedures of construction that necessitate additional testing, inspection, and related services.
 - 4. Changes in mix designs for concrete and mortar after review and acceptance of submitted mix design.
 - 5. Contractor-submitted requests to change materials or products, which are accepted, but require testing and/or reinspection beyond original design.
- D. In addition to tests to be performed by Contractor (and to be paid by Contractor) as required elsewhere in Contract Documents, tests and special inspections that may be performed by Owner or Owner's independent testing and inspection agency or agencies and paid by Owner include, but are not limited to, the following:

SECTION TESTS

None

- E. Owner may perform tests at any time at its discretion.
- F. California Test Method No. 216 (Relative Compaction of Untreated and Treated Soils and Aggregates) and 231 (Relative Compaction of Untreated/Treated Soils and Aggregates [Area Concept Utilizing Nuclear Gauges]) may be modified as follows:
1. In lieu of the specified 10-pound hammer, a Test Lab Model No. F-590 Mechanical Compactor (or equal) with a 10-pound hammer will be used.
 2. In lieu of the specified split cylindrical mold, a non-split cylindrical mold of the same diameter and wall thickness will be used.
 3. Any of the provisions of Test Method No. 216 which conflict with the use of such equipment described in (1) and (2) are considered void to the extent they preclude the use of such equipment.
 4. In lieu of the specified test form, an Owner standard form will be used.
 5. Correction for oversize material may be obtained from a table based upon the given equations and the coefficient for +3/4-inch aggregate will be computed from the following formulae:

$$Y = 1.0 \text{ for } P = 10 \text{ to } 20$$

$$Y = 1.0 - .002 (P - 20) \text{ for } P = 20 \text{ to } 50$$
 where:
 - Y = coefficient for 3/4" aggregate
 - P = percent retained on 3/4" screen
 6. In lieu of the sand cone method of determination of in-place density, the method described in Part 1 of California Test Method 231 will be used except that the mode of operation and the probe depth will be determined by Owner.
 7. In-place density and relative compaction will be determined on the basis of individual test sites in lieu of the area concept.
- G. Test and Inspection Reports: After each inspection and test by an independent testing and inspection agency or agencies, one copy of report shall be promptly submitted to Owner, who will distribute copies to Contractor and any agency having jurisdiction (if required by Code).
1. Reports shall clearly identify the following:
 - a. Date issued.
 - b. Project name and number.
 - c. Identification of product and Specifications Section in which Work is specified.
 - d. Name of inspector.
 - e. Date and time of sampling or inspection.
 - f. Location in Project where sampling or inspection was conducted.
 - g. Type of inspection or test.
 - h. Date of test.
 - i. Results of tests.
 - j. Comments concerning conformance with Contract Documents and other requirements.

2. Test reports shall indicate specified or required values and shall include statement whether test results indicate satisfactory performance of products.
3. Samples taken but not tested shall be reported.
4. Test reports shall confirm that methods used for sampling and testing conform to specified test procedures.
5. When requested, testing and inspection agency shall provide interpretations of test results.

H. Contractor Responsibilities for Inspections and Tests:

1. Unless specified otherwise, notify Owner and testing agency 72 hours in advance of expected time of each test and inspection, and for all other operations requiring inspection and testing services, by submitting Contractor's inspection request in writing (or, if Owner provides a specific form, on that form).
 - a. When tests or inspections cannot be performed after such notice, due to Contractor's negligence, reimburse Owner for testing and inspection agency personnel and travel expenses incurred.
2. Deliver to laboratory or designated location, adequate samples of materials proposed to be used that require advance testing, together with proposed mix designs.
3. Cooperate with testing and inspection agency personnel, Owner, and Owner's consultants. Provide access to Work areas and off-Site fabrication and assembly locations, including during weekends and after normal Work hours.
4. Provide incidental labor and facilities to provide safe access to Work to be tested and inspected, to obtain and handle Samples at the Site or at source of products to be tested, and to store and cure test Samples.
5. Provide, at least 15 Days in advance of first test or inspection of each type, a schedule of tests or inspections indicating types of tests or inspections and their scheduled dates.

1.8 ADDITIONAL TESTING AND INSPECTION

- A. If initial tests or inspections made by Owner or the testing and inspection agency reveal that materials do not comply with Contract Documents, or if Owner has reasonable doubt that materials do not comply with Contract Documents, additional tests and inspections shall be made as directed.
1. If additional tests and inspections establish that materials comply with Contract Documents, Owner shall pay all costs for such tests and inspections.
 2. If additional tests and inspections establish that materials do not comply with Contract Documents, all costs of such tests and inspections shall be deducted from Contract Sum.
 3. If Work requiring inspection is covered by follow-on or follow-up Work before it is inspected, uncover Work so proper inspections can be performed. All costs of such tests and inspections shall be deducted from Contract Sum.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01500

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Temporary Electricity
 - 2. Temporary Telephone
 - 3. Temporary Water
 - 4. Temporary Sanitary Facilities
 - 5. Temporary Barriers and Enclosures
 - 6. Tree and Plant Protection
 - 7. Nesting Bird Protection
 - 8. Water Control
 - 9. Storm Water Pollution Prevention Plan
 - 10. Removal of Temporary Facilities and Controls

1.2 DEFINITIONS

- A. Dripline: The area on the ground from the trunk of any tree to the point directly below the outermost tips of the foliage of that tree.
- B. Tree damage: Tree damage shall include, but not be limited to, the following: significant injury to the root system or other parts of a tree including burning, application of toxic substances, damaging through contact with equipment or machinery, changing the natural grade within the Dripline, compacting the soil within the Dripline, interfering with the normal water requirements of the tree, unauthorized trenching or excavating within the Dripline, or unauthorized removal of more than 1/3 of the live wood, foliage, or roots.

1.3 TEMPORARY ELECTRICITY

- A. Provide, maintain, and pay for electrical power at the Site for construction purposes.

1.4 TEMPORARY TELEPHONE

- A. Provide, maintain, and pay for telephone service to field office at time of Project mobilization.

1.5 TEMPORARY WATER

- A. Contractor may use Owner-provided water from the parking lot irrigation system, as indicated, for use on this Project. Contact Owner three Days prior to commencement of Work to coordinate using Owner’s water. Owner will provide and install a backflow prevention device and water meter if Owner determines it to be necessary. Should Owner determine, in its sole discretion, that Contractor’s use of Owner’s water is excessive, Owner may terminate water delivery. If Owner terminates water deliver, provide, maintain, and pay for suitable quality water service required for construction operations. No other Owner-provided water will be made available to Contractor for this Project.

1.6 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required temporary buildings with sanitary toilets for use of all workers.

- B. Comply with all minimum requirements of the Health Department or other public agency having jurisdiction; maintain in a sanitary condition at all times.

1.7 TEMPORARY BARRIERS AND ENCLOSURES

- A. Provide barriers to prevent unauthorized entry to construction areas, to allow for Owner's use of Site, and to protect existing facilities and adjacent properties from damage from construction operations.
- B. Provide barricades required by governing authorities to control public access to existing buildings.
- C. Protect vehicular traffic, stored materials, Site, and structures from damage.

1.8 TREE AND PLANT PROTECTION

- A. Root protection: No storage of materials or equipment will be allowed within the Dripline. Whenever possible, excavation shall be on a radial line, diverging from the tree trunk.
- B. Exposure to harmful substances: No storage or dumping of any substances that may be harmful to trees shall occur at any location on the Site.
- C. Where construction is to be performed in the vicinity of trees and shrubbery, the Work shall be carried on in a manner that will cause minimum damage. Owner will designate trees that are to be removed. Under no circumstances are additional trees to be removed without written permission from Owner. Trees and shrubbery that are not to be removed shall be protected from injury or damage resulting from Contractor's operations.
- D. All damage shall be immediately reported to Owner, who will file a report so that penalties may be determined.
- E. Any tree that is removed without Owner's permission or is irreparably damaged, in the opinion of Owner, shall cost Contractor \$27.00 per square inch of cross section, measured at 4 ½ feet above ground, but not less than \$250.00, such cost to be deducted from monies due or to become due under the Contract. If tree protection is not performed or is not performed adequately, and Owner determines that a tree has been irreparably damaged, Owner will impose the same penalty as for unauthorized removal of a tree.
- F. Valley Oak Protection:
 - 1. Prior to construction, spread a 6-12 inch layer of mulch, such as wood chips, over the root zone and then place plywood sheets on top near the valley oak tree located by the proposed pump enclosure.
 - 2. After construction is complete, reduce the mulch layer to a depth of 4 inches to prevent smothering of roots.
 - 3. Trench 25-50 feet from the trunk of the valley oak tree at the southern end of the building adjacent to the Environmental Section entrance.
 - 4. During trenching, preserve roots with a diameter 2 inches or greater by hand-digging and tunneling under the root.

1.9 NESTING BIRD PROTECTION

- A. Owner will schedule (1) a common and special-status nesting bird survey prior to construction for ground disturbing activities occurring during the breeding season (February 1 to August 31). Owner's wildlife biologist will conduct the pre-construction surveys for nesting raptors within a 500-foot radius of construction activities, and for other nesting birds within a 250-foot radius of construction activities. The survey will be conducted within 14 days of the start of construction activities. If more than 14 days elapse

between performance of the pre-construction survey and the start of the construction of the sewer trunk main, Owner will re-conduct the survey.

- B. If Owner discovers active bird nests during pre-construction surveys, Contractor shall create a 500-foot no-disturbance buffer around active raptor nests during the breeding season. Contractor shall also create a 250-foot buffer zone around the nests of other special-status birds, or until it is determined that all young have fledged. No active nest shall be disturbed without a permit or other authorization from United States Fish and Wildlife Service and CDFG.

1.10 WATER CONTROL

- A. See Sections 02324 (Trenching) and 15600 (Ground Heat Exchanger) for information on ground water control.
- B. For trench groundwater, water used for flushing, testing, and purging of the ground loop, condenser water loop, and vertical well water:
 - 1. Wastewater discharge limitations, requirements, and application for discharge are included at the end of this Section 01500. Fees for permitted wastewater discharges into Owner's collection system are waived.
- C. Protect Site from puddling or running water.

1.11 STORM WATER POLLUTION PREVENTION PLAN

- A. Prior to commencement of Work at the Site, obtain Owner approval on a Storm Water Pollution Prevention Plan (SWPPP) prepared in accordance with:
 - 1. The Caltrans Storm Water Quality Handbooks:
 - a. Storm Water Pollution Prevention Plan (SWPPP) and Water Pollution Control Program (WPCP) Preparation Manual; and
 - b. Construction Site Best Management Practices (BMPs) Manual.
 - 2. State Water Resources Control Board (SWRCB), Order No. 99 - 08 - DWQ, National Pollutant Discharge Elimination System (NPDES), General Permit No. CAS000002, Waste Discharge Requirements (WDRs) for Discharges of Storm Water Runoff Associated with Construction Activity (General Permit). A copy of the WDRs is included at the end of Section 01100 (Summary).
- B. Develop and implement a monitoring program in accordance with the requirements of the General Permit to verify compliance with the General Permit.
- C. Submit SWPPP to Owner for review in accordance with Section 01330 (Submittal Procedures). Provide the SWPPP to Owner prior to commencement of Work at the Site.
- D. The SWPPP shall include all of the requirements in paragraphs 1.11A, 1.11B, and 1.11C of this Section 01500. Particular attention shall be paid to:
 - 1. Site Map
 - 2. Locations of all equipment and materials storage
 - 3. Location and containment for fueling area, construction entrances, and concrete washouts
 - 4. Locations of all other staging areas, stockpile areas, and disposal sites.
 - 5. Location of sanitation facilities
 - 6. All erosion and sediment control BMPs, as well as non-storm water BMPs
 - 7. Dewatering plan
- E. Water Pollution Control Drawings shall be of sufficient size and scale to detail BMP locations. Remove all extraneous information from the base sheets to improve clarity, including geometric equations, notes, details, and all data not related to water pollution control work. Use a copy of the appropriate Drawing(s) as a base sheet(s) with the pertinent

stage of construction drawn in as an overlay to accurately reflect Site conditions at various phases of construction. Provide enlarged detail mapping as necessary to detail BMP locations.

- F. Revise and update the SWPPP whenever there is a change in construction operations that may affect the Site drainage patterns or discharge of pollutants to surface waters, groundwaters, or a separate municipal storm sewer system.
- G. Failure to fully comply with the requirements of the General Permit shall subject Contractor to all fines, damages, and job delays incurred due to failure to implement the SWPPP.
- H. Keep a copy of the General Permit, together with updates and revisions at the Site. Furnish SWPPP to Owner upon Owner's request.

1.12 REMOVAL OF TEMPORARY FACILITIES AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, and materials prior to final inspection.
- B. Remove underground installations to a minimum depth of 3 feet.
- C. Clean and repair damage caused by installation or use of temporary Work.
- D. Restore existing facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

WASTEWATER LIMITATIONS, REQUIREMENTS, AND APPLICATION FOR DISCHARGE
FOLLOW THIS PAGE

SONOMA COUNTY WATER AGENCY
Standard Conditions for Discharging Groundwater

Sonoma County Water Agency Ordinance No. 28, Sections 6.05 (K) and (L) provide the authority to issue a discharge permit for the temporary discharge of special wastewater including but not limited to ground water, rain water, street drainage, and unpolluted water when no reasonable alternative is available

The general conditions required for discharging ground water to the sanitary sewer system are as follows:

1) Permit Fee and Sewer Service Charges:

These requirements may be waived by the Agency if deemed appropriate.

- a) The permittee is generally required to pay a one-time Temporary Discharge Permit and administrative fee of \$250.00.
- b) A non-resettable meter installed on the discharge line may be required to measure the volume of groundwater discharged to the sanitary sewer. If required, the meter reading shall be reported to the Agency at the end of each month.
- c) The Permittee may be billed on the Equivalent Single-Family Dwelling Billing Unit (ESD) at the rates for *Sonoma County Water Agency Zones at Airport/Larkfield/Wikiup found in Ordinance NO. 55*. These calculations shall be based on the BOD and TSS sample analyses of the final treated effluent, and the total gallons discharged.

2) Allowable Flow Rate

- a) The allowable discharge flow rate shall not exceed **7 gallons per minute** unless authorized by the Agency.
- b) At no time shall the discharge flow rate exceed the capacity of the sanitary sewer lines, nor shall it cause operational problems at the treatment plant or allow sediment to be discharged to the sanitary sewer.

3) General Standards

- a) All pretreatment equipment and flow meters utilized shall be maintained in proper working order.
- b) Sediment strainers shall be utilized to prevent the excessive discharge of solids to the sanitary sewer.

4) Treatment and Testing Prior to Discharge:

Prior to authorizing discharge of the groundwater to the sanitary sewer system, compliance with the discharge standards set forth in Resolution No. 96-0503, Limitations of Wastewater Strength (copy attached), must be demonstrated.

Treatment & Testing for Contaminated Groundwater

If there is evidence of contamination, the groundwater shall be processed through an approved treatment system for a minimum three (3) hour period. The entire volume of treated ground water shall be contained in a storage tank.

The system shall then be shut down and a representative sample of the treated groundwater shall be collected and analyzed for the parameters listed in ***Table A, Initial Monitoring Requirements***. All testing shall be performed by a California state certified laboratory.

A copy of the laboratory report for this initial sampling shall be provided to the Agency for review. **No further processing, discharge or transport of the groundwater shall be performed until the analytical laboratory report for the initial monitoring is submitted to and approved by the Agency.**

If the laboratory report demonstrates compliance with the discharge limits, authorization to begin system operation and discharge to the sanitary sewer shall be provided by the Agency. If compliance is not achieved, the groundwater may be re-treated and re-analyzed or it may be hauled off by a licensed waste hauler.

Treatment & Testing for Clean (non-contaminated) Groundwater

The groundwater shall be pumped directly into a holding tank to allow for any sediment to settle at the bottom of the tank.

A representative sample of the groundwater shall be collected and analyzed for the parameters listed in ***Table A, Initial Monitoring Requirements***. All testing shall be performed by a California state certified laboratory.

If the laboratory report demonstrates compliance with the discharge limits, authorization to begin system operation and discharge to the sanitary sewer shall be provided by the Agency. If compliance is not achieved, the groundwater may be treated and re-analyzed or it may be hauled off by a licensed waste hauler.

- After receiving authorization to discharge, the permittee may begin processing and discharging the groundwater either through the treatment system or from the holding/settling tank to the sanitary sewer.
- To verify continued compliance, representative samples of the ground-water discharge shall be collected at a frequency to be determined by the Agency (for example, one sample for every 25,000 gallons discharged).
- The permittee shall sample and analyze the groundwater as outlined in Table B. Analytical reports shall be faxed to the Agency's Environmental Compliance Inspector for review.
- If any parameter exceeds the Agency's discharge limits, any treatment system in use will be shut down and all discharge to the sanitary sewer shall immediately cease.
- In case of shut down due to discharge violation or other emergency, the Agency must be notified immediately by calling Environmental Compliance Inspector.

Contact Information:

For permit application, reporting and emergency notification contact:

Susan Keach
Environmental Compliance Inspector
Sonoma County Water Agency
P.O. Box 11628, Santa Rosa, CA 95406
Office: (707) 521-1820
Cell: (707) 975-5613
Fax: (707) 523-4322
24 Hour Emergency Desk: (707) 523-1070

Table A
Initial Monitoring Requirements

Parameter	Approved Methods	Required Detection Limits	Discharge Limits
BOD	405.1	<5.0 mg/L	350 mg/L
TSS	160.2	<1.0 mg/L	400 mg/L
COD	410.4	<5.0 mg/L	700 mg/L
pH	150.1	NA	5.5 to 10.0 units
TPH (gas)	8015	<0.05 mg/L	Non Detect
TPH (diesel)	8015	<0.05 mg/L	Non Detect
TPH (motor oil)	8015	<0.100 mg/L	Non-Detect
BTEX	8260 or 8021	<0.0005 mg/L	Non Detect
Arsenic	200.9	<0.002 mg/L	NA
Cadmium	200.7	<0.001 mg/L	NA
Chromium	200.7	<0.002 mg/L	NA
Copper	200.7	<0.002 mg/L	NA
Lead	200.9	<0.002 mg/L	NA
Mercury	245.1	<0.0002 mg/L	NA
Nickel	200.7	<0.002 mg/L	NA
Selenium	200.9	<0.005 mg/L	NA
Silver	200.9	<0.0002 mg/L	NA
Zinc	200.7	<0.010 mg/L	NA

**Table B
Compliance Sampling and Monitoring Requirements**

Parameter	Required Sampling Frequency	Analytical Method	Detection Limit (mg/L)	SCWA Limit (mg/L)
pH	One sample per 20,000 gallons discharged (1)	EPA 150.1	NA	5.5-10.0 units
TPH-gas		EPA 8015	<0.05	Non-Detect
TPH-diesel		EPA 8015	<0.05	Non-Detect
TPH-motor oil		EPA 8015	<0.100	Non-Detect
BTEX		EPA 8260	<0.0005	Non-Detect
Flow	Continuous	NA	NA	7 gpm

(1) Sampling frequency may be modified by the SCWA.

SONOMA COUNTY WATER AGENCY
LIMITATIONS OF WASTEWATER STRENGTH*
Resolution No. 96-0503 Effective April 23, 1996

Constituent / Characteristic	2APPROVED 3METHODS	Required Detection Limit **	DISCHARGE LIMITATIONS **
Antimony (Sb)	204.1, 200.9	<0.006	
Arsenic (As)	206.2, 200.9	<0.002	
Cadmium (Cd)	213.1, 200.7	<0.001	
Chromium (Cr - Total)	218.2, 200.7	<0.002	
Copper (Cu)	220.2, 200.7	<0.002	
Lead (Pb)	239.2, 200.9	<0.002	
Mercury (Hg)	245.1	<0.0002	
Nickel (Ni)	249.2, 200.7	<0.002	
Selenium (Se)	270.0, 200.9	<0.005	
Silver (Ag)	272.1, 200.9	<0.0002	
Thallium (Tl)	279.1, 200.9	<0.002	
Zinc (Zn)	289.2, 200.7	<0.010	
Cyanide (CN)	335.2	<0.005	
Phenol	604	<0.005	
Biochemical Oxygen Demand (BOD)	405.1	<5.0	350
Total Suspended Solids (TSS)	160.2	<1.0	400
Chemical Oxygen Demand (COD)	410.4	<5.0	700
pH	150.1		5.5 - 10.0 units
Ammonia	350.2	<1.0	125
Oil & Grease:			
Animal & Vegetable (Polar)	1664	<5.0	300
Mineral (Non - Polar)	1664	<5.0	100
Total Toxic Organics (TTO)	624 & 625 (run full lists on both)		2.10
Radioactivity			+Refer to CAC, Title 17, Section 30100
Closed-Cup Flashpoint	(test method 40CFR Part 261.21)		
Lower Explosive Limit (LEL)			
Two successive readings			5%
Single reading			10%
Temperature			150°F (65°C)
Benzene, Toluene, Ethylbenzene & Xylene (BTEX)	8260 or 8021	<0.0005	
Total Petroleum Hydrocarbons (TPH)			
Diesel	8015	<0.05	
Gasoline	8015	<0.05	
Motor Oil	8015	<0.100	

* These limits may change if; the Sanitation Code of the Sonoma County Water Agency changes, a new limit resolution is adopted, or a Local Limit Study is performed.

** Expressed in **mg/l** unless otherwise noted.

**SONOMA COUNTY WATER AGENCY
INDUSTRIAL WASTE DIVISION**

REQUEST FOR ONE TIME GROUNDWATER DISCHARGE

GENERAL INFORMATION			
1. Name of Generator:			
Assessor's Parcel Number:			
Address of Generation Site:			
Street:			
City:	State:	Zip:	
2. Business Mailing Address:			
Street or PO Box:			
City:	State:	Zip:	
3. Name/Address of Environmental Consultant (Contact):			
Name:			Title:
Address:			
City:	State:	Zip:	
Phone #:			
4. Description of Operation Generating Wastewater: (Attach Separate Sheets, If Necessary):			
Approximate Volume of Discharge:			
Description of Proposed Method of Treatment:			

**THE INDUSTRIAL WASTE DIVISION MUST BE NOTIFIED 24 HOURS IN ADVANCE OF DISCHARGE:
CALL (707) 521-1820**

RESULTS OF STATE CERTIFIED LABORATORY ANALYSES FOR BTEX, TPH (GAS), TPH (DIESEL), MTBE (LOW LEVEL), AND/OR TTO (EPA 601, 602) MUST BE ATTACHED. BOD AND TSS RESULTS REQUIRED FOR DISCHARGE OVER 2000 GALLONS. FOR MULTI-CONTAINER DISCHARGES REPRESENTATIVE TEST SAMPLES MUST BE PROVIDED.

CERTIFICATION	
<p>This document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct.</p>	
Signature Responsible Person/Title:	Date:
<p>THIS DOCUMENT MUST BE SIGNED BY THE MOST RESPONSIBLE PERSON OF THE COMPANY. THIS INCLUDES THE OWNER, PRESIDENT, CORPORATE OFFICER, OR ANY OTHER REPRESENTATIVE OF THE ORGANIZATION IN A DECISION MAKING CAPACITY. THE PERSON SIGNING THIS DOCUMENT IS LEGALLY RESPONSIBLE FOR ALL INFORMATION CONTAINED HEREIN, AND BECOMES LIABLE FOR ANY AND ALL FUTURE ENFORCEMENT ACTIONS RELATED TO THIS INFORMATION.</p>	

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SECTION 01540

SITE SECURITY AND SAFETY**PART 1 GENERAL****1.1 SUBMITTALS**

- A. Safety Program.
- B. Fire Protection Plan.

1.2 PROTECTION

- A. Continuously maintain protection as necessary to protect the Work, as a whole and in part, and adjacent property and improvements from accidents, injuries or damage.
- B. Properly protect the Work:
 - 1. With lights, guard rails, temporary covers and barricades.
 - 2. Enclose excavations with proper barricades.
 - 3. Brace and secure all parts of the Work against storm and accident.
 - 4. Provide such additional forms of protection that may be necessary under existing circumstances.
- C. Provide and maintain in good condition all protective measures required to adequately protect the public from hazards resulting from the Work and to exclude unauthorized persons from the Work. When regulated by Building Code, Cal OSHA, or other authority, such legal requirements for protection shall be considered as minimum requirements. Be responsible for the protection in excess of such minimum requirements as required.

1.3 CONTROL OF SITE

- A. Ensure that no alcohol, firearms, weapons, or controlled substance enters or is used at the Site. Immediately remove from the Site and terminate the employment of any employee found in violation of this provision.

1.4 SAFETY PROGRAM

- A. Prior to starting any Work at the Site, submit a Safety Program that has been reviewed and approved by an Industrial Hygienist certified by the American Board of Industrial Hygiene or by a Certified Safety Professional. The Safety Program shall include the name, certification number, and certification seal of the Industrial Hygienist or Certified Safety Professional. Comply with the Safety Program and all applicable federal, state, and local regulation codes, rules, law and ordinances.
- B. Receipt and/or review of the Safety Program by Owner, Engineer or Owner's Representative shall not relieve Contractor of any responsibility for complying with all applicable safety regulations.
- C. It is essential that Contractor and each Subcontractor implement an effective and vigorous Safety and Health Program to cover their respective portions of the Work. Subject to Contractor's overall responsibility for Project safety, it shall be understood that the full responsibility for providing a safe place to work with respect to their respective portions of the Work rests with each individual Contractor and Subcontractor.

- D. Safety Program components:
 1. Injury and Illness Prevention Program (IIPP): Conforming to the General Industrial Safety Orders (CCR Title 8, Division 1, Chapter 4, Subchapter 7, Section 3203), and the California Labor Code (Section 6401.7).
 2. Site-Specific Safety and Health Plan (SSHP): Describing health and safety procedures that shall be implemented during the Work in order to ensure safety of the public and those performing the Work. Follow the guidelines for a SSHP listed in CCR Title 8, Division 1, Chapter 4, Subchapter 7, Section 5192, Item (b)(4) f.
- E. The wearing of hard hats shall be mandatory at all times for personnel on Site. Supply sufficient hard hats to equip properly all employees and visitors.
- F. Whenever an exposure exists, appropriate personal protective equipment (PPE) shall be used by all affected personnel. Supply PPE to all personnel under Contractor's direction.

1.5 SAFETY REQUIREMENTS

- A. Standards: Maintain the Project in accordance with state and local safety and insurance standards.
- B. Hazards Control:
 1. Store volatile wastes in covered metal containers and remove from premises daily.
 2. Prevent accumulation of wastes that create hazardous conditions.
 3. Provide adequate ventilation during use of volatile or noxious substances.
- C. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.
 1. Do not burn or bury rubbish or waste material on the Site.
 2. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.
 3. Do not dispose of wastes into streams or waterways.
- D. Provide accident information on the forms provided by Contractor. This information shall be provided on the same Day as the occurrence of said incident.

1.6 SITE SAFETY OFFICER

- A. Designate one of Contractor's staff as "Site Safety Officer" whose duties shall include the responsibility for enforcing the environmental protection provisions of the Contract Documents including safety and health, the requirements of the Occupational Safety and Health Act, and other applicable federal, state and local standards. Submit for review by Owner Contractor's intended traffic flow plan, security plan, program for temporary structures, housecleaning plan, demolition program, and environmental safety and health plan. After review by Owner, the implementation and enforcement of these plans shall become the responsibility of the Site Safety Officer. Any changes in the plans shall be requested by Contractor through the Site Safety Officer for written concurrence by Owner.
- B. Owner's risk management representative(s) shall be allowed access to accident/injury and illness reports, inspection reports, scheduling and construction meetings, and safety meetings.

1.7 FIRE PROTECTION PLAN

- A. Prior to starting any Work at the Site, submit a fire protection plan that has been reviewed and approved by the Rincon Fire Protection District. It is recommended that the plan include, but not be limited to, a discussion of the following items:
 1. Equipment spark arresters
 2. Fire-extinguishing equipment on hand

3. Method of operation in case of fire
4. Notification to authorities of any fire
5. Access available during performance of Work
6. Educating workers of fire protection plan

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01600

PRODUCT REQUIREMENTS**PART 1 GENERAL****1.1 SECTION INCLUDES**

- A. Products
- B. Product Options and Substitutions
- C. Product Delivery Requirements
- D. Product Storage and Handling

1.2 PRODUCTS

- A. Products: New material, machinery, components, equipment, fixtures, and systems forming the Work. Does not include machinery and equipment used for preparation, fabrication, conveying, and erection of the Work. Products may also include existing materials or components required for reuse.
- B. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.
- C. For similar components, provide interchangeable components of the same manufacturer.

1.3 PRODUCT OPTIONS AND SUBSTITUTIONS

- A. Summary:
 - 1. This paragraph 1.3 describes procedures for selecting products and requesting substitutions of unlisted materials in lieu of materials named in the Specifications or approved for use in Addenda that were not already the subject of a Document 00660 (Substitution Request Form) submittal as provided in Document 00200 (Instructions to Bidders).
- B. For products specified by naming one manufacturer only, Owner believes that the manufacturer listed is capable of producing equipment or products that will satisfy the requirements of the associated Specification. This statement, however, shall not be construed as an endorsement of a particular manufacturer's product, nor shall it be construed that a named manufacturer's standard product will comply with the requirements of the associated Specification. In such cases, the Owner is not aware of an equal manufacturer.
- C. Contractor's Options:
 - 1. For products specified only by reference standard: Select any product meeting that standard.
 - 2. For products specified by naming one or more products or manufacturers:
 - a. Select products of any named manufacturer meeting Specifications.
 - b. If product becomes unavailable due to no fault of Contractor or if the product specified no longer complies with local regulations or laws, submit Request for Substitution (RFS), including all information contained in this Section 01600 and a fully executed Document 00660 (Substitution Request Form), but using the term "Contractor" each place the term "Bidder" appears in that form.
- D. Substitutions:
 - 1. Except as provided in Document 00200 (Instructions to Bidders) with respect to "or Approved Equal" items, Owner will consider Contractor's substitution requests only

- when product becomes unavailable due to no fault of Contractor or if the product specified no longer complies with local regulations or laws. Requests for review of proposed substitute items will not be accepted from anyone other than Contractor. The RFS shall state the extent, if any, to which the evaluation and acceptance of the proposed substitute will prejudice Contractor's achievement of Substantial Completion on time, and whether or not acceptance of the substitute for use in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for work on the Project).
2. Submit separate RFS for each product and support each request with:
 - a. Product identification.
 - b. Manufacturer's literature.
 - c. Samples, as applicable.
 - d. Name and address of similar projects on which product has been used, and dates of installation.
 - e. Name, address, and telephone number of manufacturer's representative or sales engineer.
 - f. For construction methods: Detailed description of proposed method; drawings illustrating methods.
 3. Where required, itemize a comparison of the proposed substitution with product specified and list significant variations including, but not limited to dimensions, weights, service requirements, and functional differences. If variation from product specified is not pointed out in submittal, variation will be rejected even though submittal was favorably reviewed. Identify all variations of the proposed substitute from that specified in the RFS and indicate available maintenance, repair, and replacement service.
 4. State whether the substitute will require a change in any of the Contract Documents (or provisions of any other direct contract with Owner for work on the Project) to adapt the design of the proposed substitute, and whether or not incorporation or use of the substitute in connection with Work is subject to payment of any license fee or royalty. Submit data relating to changes in construction schedule.
 5. Include accurate cost data comparing proposed substitution with product and amount of net change in Contract Sum including, but not limited to, an itemized estimate of all costs or credits that will result directly or indirectly from acceptance of such substitute, including costs of redesign and claims of other contractors affected by the resulting change, all of which will be considered by Owner in evaluating the proposed substitute. Owner may require Contractor to furnish additional data about the proposed substitute.
 6. Owner will not consider substitutions for acceptance (or, in Owner's sole discretion, Owner may make Contractor solely responsible for all resulting costs, expenses and other consequences) when a substitution:
 - a. Results in delay meeting construction Milestones or completion dates.
 - b. Is indicated or implied on submittals without formal request from Contractor.
 - c. Is requested directly by Subcontractor or supplier.
 - d. Acceptance will require substantial revision of Contract Documents.
 - e. Disrupts Contractor's job rhythm or ability to perform efficiently.
 7. Substitute products shall not be ordered without written acceptance of Owner.
 8. Owner will determine acceptability of proposed substitutions and reserve right to reject proposals due to insufficient information.

9. Accepted substitutions will be evidenced by a Change Order or a CCD. All Contract Document requirements apply to Work involving substitutions.
- E. Contractor's Representation and Warranty:
1. Contractor's RFS constitutes a representation and warranty that Contractor:
 - a. Has investigated proposed product and determined that it meets or exceeds, in all respects, specified product.
 - b. Will provide the same warranty for substitution as for specified product.
 - c. Will coordinate installation and make other changes that may be required for Work to be complete in all respects.
 - d. Waives claims for additional costs which may subsequently become apparent.
 - e. Will compensate Owner for additional redesign costs associated with substitution.
 - f. Will be responsible for Construction Schedule slippage due to substitution.
 - g. Will be responsible for Construction Schedule delay due to late ordering of available specified products caused by requests for substitution that are subsequently rejected by Owner.
 - h. Will compensate Owner for all costs; including extra costs of performing Work under Contract Documents, extra cost to other contractors, and any claims brought against Owner, caused by late requests for substitutions or late ordering of products.
- F. Owner's Duties:
1. Review Contractor's RFS with reasonable promptness.
 2. Notify Contractor in writing of decision to accept or reject requested substitution.
- G. Administrative Requirements:
1. Specified products, materials, or systems for Project may include engineering or on-file standards required by the regulatory agency. Contractor's substitution of products, materials or systems may require additional engineering, testing, reviews, approvals, assurances, or other information for compliance with regulatory agency requirements or both. Provide all agency approvals or other additional information required and pay additional costs for required Owner services made necessary by the substitution at no increase in Contract Sum or Contract Time, and as a part of substitution proposal.

1.4 PRODUCT DELIVERY REQUIREMENTS

- A. Deliver products in accordance with manufacturer's instructions.
- B. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.

1.5 PRODUCT STORAGE AND HANDLING

- A. Store products only in staging area per provisions of Section 01100 (Summary).
- B. Handle, store, and protect products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight, climate-controlled enclosures.
- C. For exterior storage of fabricated products, place on appropriate supports, above ground.
- D. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.
- E. Store loose granular materials on solid flat surfaces in a well-drained area.
- F. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- G. Arrange storage of products to permit access for inspection. Periodically inspect to assure products are undamaged and are maintained under specified conditions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01740

CLEANING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Progress Cleaning
 - 2. Final Cleaning
- B. Related Sections:
 - 1. Section 01500 (Temporary Facilities and Controls)

1.2 PROGRESS CLEANING

- A. Perform periodic cleaning to ensure that any streets and other Owner and public properties are maintained free from accumulation of waste materials, dust, mud, and debris.
- B. Where required, wet down surfaces to lay dust and prevent the blowing of dust to nearby residences or public properties.
- C. Keep all paved roads clean and free of dust, mud, and debris resulting from Contractor's operations. Daily cleanup throughout the job will be necessary as Contractor progresses with its Work, but extra attention to cleanup shall be made prior to weekends and holidays. Without limiting the foregoing, remove trench spoil along traveled ways daily; grade and vacuum broom surfaces initially where applicable and later water flush with high-pressure sprays, being careful to avoid downstream contamination.
- D. All dust, mud, spoils, and construction debris shall be removed daily from all roadways, ditches, shoulders, and private property (fills or spoils placed on private property at private property owner's written request excepted).
- E. Disposal of Materials:
 - 1. All waste materials, debris, and rubbish shall be disposed of at sites to be chosen by Contractor in accordance with applicable local, state, and federal regulations.
 - 2. Contractor is cautioned that the County of Sonoma and cities within the county have regulations governing the disposal of rubble, broken pavement, and similar materials.
 - 3. Become familiar with the requirements of the agency having jurisdiction over any contemplated disposal site and comply with all such requirements.
- F. All excess soil from performance of Work shall be disposed at sites to be chosen by Contractor in accordance with applicable local, state, and federal regulations, and, if applicable, in accordance with Contractor's soil disposal plan. If Contractor elects to dispose of soil on any private property, prior to any such disposal, a letter allowing such disposal shall be obtained from the property owner and presented to Owner. The letter shall state that the property owner has complied with all necessary local, state, and federal laws with respect to disposal on property owner's property. Contractor is advised that the property owner is required to obtain a fill permit from PRMD. Regardless of the location of the disposal area, Contractor shall specify the location in the Storm Water Pollution Prevention Plan (SWPPP) if required under Section 01500 (Temporary Facilities and Controls). Any requirements in the SWPPP that pertain to the area of Work shall also apply to the disposal area. In addition, placement of fill in wetland areas is subject to permit procedures of the US Army Corps of Engineers. At the completion of Work, a letter from

each affected property owner will be required releasing Contractor, Owner, [if CSD add: Agency,] and any Owner consultant from future liability.

- G. If Contractor does not properly clean the Site, in the opinion of Owner, then Owner shall have the option of using outside equipment to perform the cleanup and such cost will be withheld from the Contract Sum.

1.3 FINAL CLEANING

- A. Execute final cleaning prior to final inspection, using only properly skilled workers.
- B. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from exposed interior and exterior finished surfaces.
- C. Repair, patch, and touch up marred surfaces to match adjacent finishes.
- D. 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.
- E. Clean equipment and fixtures to a sanitary condition, clean or replace filters of mechanical equipment operated during construction, clean ducts, blowers and coils of units operated without filters during construction.
- F. Clean Site.
- G. Mechanically sweep paved areas.
- H. Remove waste and surplus materials, rubbish, and construction facilities from Site.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01750

STARTING AND ADJUSTING**PART 1 GENERAL - NOT USED****PART 2 PRODUCTS - NOT USED****PART 3 EXECUTION****3.1 CHECKOUT PROCEDURES**

- A. Upon completion of installation, conduct an initial inspection and checkout of all mechanical and electrical equipment and devices.
 - 1. Clean the interior of ductwork, piping, pumps, and other equipment and make free of foreign material. If applicable, lubricate equipment in accordance with the manufacturer's instructions.
 - 2. To the extent practicable, turn rotating equipment, operate valves and gates, and operate other equipment by hand to check for binding, and interference.
 - 3. Check incoming electric power for voltage amplitude and voltage balance.
 - 4. Check electric motor-driven equipment for correct rotation.
 - 5. Check all safety guards to insure they are in place.
- B. Conduct field tests including visual and mechanical inspection of the following:
 - 1. Proper grounding.
 - 2. Blockage of ventilating passageways.
 - 3. Pressure piping and equipment and check for leaks
 - 4. Electrical resistance testing for all wires and cables
 - 5. Loop testing of all instrumentation loops
 - 6. Manufacturer recommended pre-operational checkout procedures
 - 7. Operation of meters and instruments

3.2 STARTING AND ADJUSTING

- A. Once all affected equipment has been subjected to the required pre-operational checkout procedures, and Owner has not found any Work deficiencies, start and operate equipment and systems under simulated or actual operating conditions. Operate equipment continuously for a sufficient duration to confirm machine-operating characteristics such as noise, temperature, vibrations, etc.; to confirm performance characteristics; and to allow initial adjustment of operational controls.
- B. Where any doubt, dispute, or difference arises between Owner and Contractor regarding test results, or methods used in performance of such tests, repeat the test.
- C. Correct deficiencies found during testing. Retest to confirm proper operation in accordance with paragraph 3.2A above.

END OF SECTION

SECTION 01770

CONTRACT CLOSEOUT**PART 1 GENERAL****1.1 SUMMARY**

- A. Section Includes:
1. Description of Contract closeout procedures including:
 - a. Removal of Temporary Construction Facilities
 - b. Substantial Completion
 - c. Final Completion
 - d. Project Record Documents
 - e. Project Guarantee
 - f. Warranties
 - g. Turn-In
 - h. Computer Programs
 - i. Release of Claims
 - j. Fire Inspection Coordination
 - k. Building Inspection Coordination

1.2 REMOVAL OF TEMPORARY CONSTRUCTION FACILITIES

- 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 permanent facilities used during construction to specified condition.
- D. Comply with paragraph 1.12 of Section 01500 (Temporary Facilities and Controls).

1.3 SUBSTANTIAL COMPLETION

- A. When Contractor considers Work or designated portion of the Work as Substantially Complete, submit timely written notice to Owner, with list of items remaining to be completed or corrected.
- B. Within reasonable time, Owner will inspect to determine status of completion.
- C. Should Owner determine that Work is not Substantially Complete, Owner will promptly notify Contractor in writing, listing all defects and omissions.
- D. Remedy deficiencies and send a second written notice of Substantial Completion. Owner will reinspect the Work. If deficiencies previously noted are not corrected on reinspection, then Contractor shall pay the cost of the reinspection.
- E. When Owner concurs that Work is Substantially Complete, Owner will issue a Certificate of Substantial Completion, accompanied by Contractor's list of items to be completed or corrected as verified by Owner.
- F. Before a Certificate of Substantial Completion will be issued, Contractor must accomplish:
 1. Startup of manufactured units, equipment, and systems that require startup and run for periods prescribed by Owner.
 2. Commissioning.
 3. Training.
 4. Submittal of final Installation, Operation, and Maintenance Manuals.

- G. Submittal of complete Project set of survey notes of construction staking, including but not limited to field notes, maps, drawings, coordinate listings and all other survey information produced as a result of the Work.
- H. A punch list examination will be performed upon Substantial Completion. One follow-up review of punch list items for each discipline will be provided. If further Site visits are required to review punch list items due to incompleteness of the Work by Contractor, Contractor shall reimburse Owner for costs associated with these visits.

1.4 FINAL COMPLETION

- A. Final Completion occurs when Work meets requirements for Owner's Final Acceptance. When Contractor considers Work is Finally Complete, submit written certification that:
 - 1. Contractor has inspected Work for compliance with Contract Documents, and all requirements for Final Acceptance have been met.
 - 2. Except for Contractor maintenance after Final Acceptance, Work has been completed in accordance with Contract Documents and deficiencies listed with Certificate of Substantial Completion have been corrected. Equipment and systems have been tested in the presence of Owner, and are operative.
 - 3. Work is complete and ready for final inspection.
- B. In addition to submittals required by Contract Documents, provide submittals required by governing authorities and submit final statement of accounting giving total adjusted Contract Sum, previous payments, and sum remaining due.
- C. When Owner finds Work is acceptable and final closeout submittals are complete, Owner will issue final Change Order reflecting approved adjustments to Contract Sum not previously made by Change Order. Should Owner determine that Work is incomplete or Defective:
 - 1. Owner promptly will so notify Contractor, in writing, listing the incomplete or Defective items.
 - 2. Promptly remedy the deficiencies and notify the Owner when it is ready for reinspection.
 - 3. When Owner determines that the Work is acceptable under the Contract Documents, Owner will request Contractor to make closeout submittals.
- D. Final adjustments of accounts:
 - 1. Submit a final statement of accounting to Owner, showing all adjustments to the Contract Sum and complete and execute Document 00650 (Agreement and Release of Any and All Claims).
 - 2. If so required, Owner shall prepare a final Change Order for submittal to Contractor, showing adjustments to the Contract Sum that were not previously made into a Contract Modification.

1.5 PROJECT RECORD DOCUMENTS

- A. Contract Documents will not be closed out and final payment will not be made until completion and submittal of Project Record Documents described in Section 01780 (Project Record Documents).

1.6 PROJECT GUARANTEE

- A. Requirements for Contractor's guarantee of completed Work are included in Article 9 of Document 00700 (General Conditions). Guarantee Work done under Contract against failures, leaks, or breaks or other unsatisfactory conditions due to defective equipment,

- materials, or workmanship, and perform repair work or replacement required, at Contractor's sole expense, for period of one year from date of Final Acceptance.
- B. Neither recordation of Final Acceptance nor final certificate for payment nor provision of the Contract nor partial or entire use or occupancy of premises by Owner shall constitute acceptance of Work not done in accordance with Contract Documents nor relieve Contractor of liability in respect to express warranties or responsibility for faulty materials or workmanship.
 - C. Owner may make repairs to Defective Work as set forth in Document 00700 (General Conditions), paragraph 9.3.
 - D. If, after installation, operation, or use of materials or equipment to be provided under Contract proves to be unsatisfactory to Owner, Owner shall have right to operate and use materials or equipment until said materials and equipment can, without damage to Owner, be taken out of service for correction or replacement. Period of use of Defective materials or equipment pending correction or replacement shall in no way decrease guarantee period required for acceptable corrected or replaced items of materials or equipment.
 - E. Nothing in this Section 01770 shall be construed to limit, relieve, or release Contractor's, Subcontractors', and equipment suppliers' liability to Owner for damages sustained as result of latent defects in equipment caused by negligence of suppliers' agents, employees, or Subcontractors. Stated in another manner, warranty contained in the Contract Documents shall not amount to, nor shall it be deemed to be, waiver by Owner of any rights or remedies (or time limits in which to enforce such rights or remedies) it may have for Defective workmanship or Defective materials under laws of this State pertaining to acts of negligence.

1.7 WARRANTIES

- A. Execute Contractor's Submittals and assemble warranty documents and operation and maintenance manuals executed or supplied by Subcontractors, suppliers, and manufacturers.
 - 1. Provide table of contents and assemble in 8½ inches by 11 inches three-ring binder with durable plastic cover, appropriately separated and organized.
 - 2. Assemble in Specification Section order.
- B. Submit material prior to final Application for Payment.
 - 1. For equipment put into use with Owner's permission during construction, submit within 14 Days after first operation.
 - 2. For items of Work delayed materially beyond Date of Substantial Completion, provide updated Submittal within 14 Days after acceptance, listing date of acceptance as start of warranty period.
- C. Warranties are intended to protect Owner against failure of Work and against deficient, Defective, and faulty materials and workmanship, regardless of sources.
- D. Limitations: Warranties are not intended to cover failures that result from the following:
 - 1. Unusual or abnormal phenomena of the elements
 - 2. Vandalism after Substantial Completion
 - 3. Insurrection or acts of aggression including war
- E. Related Damages and Losses: Remove and replace Work which is damaged as result of Defective Work, or which must be removed and replaced to provide access for correction of warranted Work.

- F. Warranty Reinstatement: After correction of warranted Work, reinstate warranty for corrected Work to date of original warranty expiration or to a date not less than one year after corrected Work was done, whichever is later.
- G. Replacement Cost: Replace or restore failing warranted items without regard to anticipated useful service lives.
- H. Warranty Forms: Submit drafts to Owner for approval prior to execution. Forms shall not detract from or confuse requirements or interpretations of Contract Documents.
 - 1. Warranty shall be countersigned by manufacturers.
 - 2. Where specified, warranty shall be countersigned by Subcontractors and installers.
- I. Rejection of Warranties: Owner reserves right to reject unsolicited and coincidental product warranties that detract from or confuse requirements or interpretations of Contract Documents.
- J. Term of Warranties: For materials, equipment, systems, and workmanship, warranty period shall be one year minimum from date of Final Completion of entire Work except where:
 - 1. Detailed Specifications for certain materials, equipment or systems require longer warranty periods.
 - 2. Materials, equipment or systems are put into beneficial use of Owner prior to Final Completion as agreed to in writing by Owner.
- K. Transfer of Warranties: Any warranty shall automatically transfer, without charge, to a subsequent owner who acquires the Project. Any transfer of the Project shall not extend the duration of any warranty.
- L. Warranty of Title: No material, supplies, or equipment for Work under Contract shall be purchased subject to any chattel mortgage, security agreement, or under a conditional sale or other agreement by which an interest therein or any part thereof is retained by seller or supplier. Contractor warrants good title to all material, supplies, and equipment installed or incorporated in Work and agrees upon completion of all Work to deliver premises, together with improvements and appurtenances constructed or placed thereon by Contractor, to Owner free from any claim, liens, security interest, or charges, and further agrees that neither Contractor nor any person, firm, or corporation furnishing any materials or labor for any Work covered by Contract shall have right to lien upon premises or improvement or appurtenances thereon. Nothing contained in this paragraph, however, shall defeat or impair right of persons furnishing materials or labor under bond given by Contractor for their protection or any rights under law permitting persons to look to funds due Contractor in hands of Owner.

1.8 TURN-IN

- A. Contract Documents will not be closed out and final payment will not be made until all keys and locks issued to Contractor during prosecution of Work and letters from property owners, if required under paragraph 1.2.F of Section 01740 (Cleaning), are turned in to Owner.

1.9 COMPUTER PROGRAMS

- A. When any equipment requires operation by computer programs, submit 5 sets of the program, on appropriate electronic media, plus all user manuals and guides for operating the programs and making changes in the programs for upgrading and expanding the databases. Program shall be Windows XP compatible. Provide required licenses to Owner at no additional cost.

1.10 RELEASE OF CLAIMS

- A. Contract Documents will not be closed out and final payment will not be made until Document 00650 (Agreement and Release of Any and All Claims) is completed and executed by Contractor and Owner.

1.11 FIRE INSPECTION COORDINATION

- A. Coordinate fire inspection and secure sufficient notice to Owner to permit convenient scheduling (if applicable).

1.12 BUILDING INSPECTION COORDINATION

- A. Coordinate with Owner a final inspection for the purpose of obtaining an occupancy certificate (if applicable).

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01780

PROJECT RECORD DOCUMENTS**PART 1 GENERAL****1.1 SUMMARY**

- A. Section Includes:
 - 1. Administrative and procedural requirements for the following Project Record Documents:
 - a. Project Record Drawings and Shop Drawings
 - b. Project Record Specifications
 - c. Miscellaneous Project Record Submittals
- B. Specific Project Record Documents requirements that expand requirements of this Section may be included in the individual Sections of Divisions 2 through 16.

1.2 SUBMITTAL

- A. During construction, bring hard-copy updates of the Project Record Drawings (Field Set) to monthly Progress Payment Meetings.
- B. At completion of Project, deliver Project Record Documents to Owner. Project Record Documents required include:
 - 1. Marked-up copies of Drawings (Field Set)
 - 2. Final Project Record Drawings
 - 3. Marked-up copies of Specifications
 - 4. Marked-up copies of Shop Drawings, if applicable
 - 5. Miscellaneous Project Record Submittals
- C. Accompany submittal with transmittal letter containing:
 - 1. Date
 - 2. Project title and Owner's Contract number
 - 3. Contractor's name and address
 - 4. Number and title of each Project Record Document
 - 5. Certification that each document as submitted is complete and accurate, and signature of Contractor or Contractor's authorized representative.

1.3 GENERAL

- A. Prior to start of construction, Owner will provide one full size set of Drawings and one copy of the Project Manual for Contractor's use for recording as-built conditions.
- B. Post changes and Modifications to the Contract Documents as they occur. Do not wait until the end of the Project. Owner will review Project Record Documents on a monthly basis to assure compliance with this requirement.
- C. Refer instances of uncertainty to Owner for resolution.
- D. Maintenance of Documents:
 - 1. Store Project Record Documents in the field office apart from Contract Documents used for construction.
 - 2. Do not permit Project Record Documents to be used for construction purposes.
 - 3. Maintain Project Record Documents in good order and in a clean, dry, neat, and legible condition.
 - 4. Make Project Record Documents available at all times for inspection by Owner.

1.4 PROJECT RECORD DRAWINGS AND SHOP DRAWINGS

- A. Quality Draftsmanship: All Work on Project Record Drawings and Project Record Shop Drawings shall be performed by competent drafters and shall be clear and fully legible. Owner shall be the sole judge of the acceptability of the Project Record Drawings and Project Record Shop Drawings.
- B. Mark-up Procedure: During the construction period, maintain a set of full size prints of Drawings and Shop Drawings for Project Record Documents purposes ("Field Set"). Stamp each document (on each sheet or page) "PROJECT RECORD" in 2-inch high letters. Keep record documents current. Note: A reference by number to a Change Order, CCD, RFI, RFQ, RFP, Field Order or other such document is not acceptable as sufficient record information on any record document. Do not permanently conceal any Work until required information has been recorded.
1. Mark Drawings and Shop Drawings to indicate the actual installation where the installation varies appreciably from the installation shown originally. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later. Items required to be marked include but are not limited to:
 - a. Dimensional changes to the Drawings and Shop Drawings
 - b. Revisions to details shown on the Drawings and Shop Drawings
 - c. Depths of various elements of foundation in relation to main floor level or survey datum
 - d. Variable or concealed field conditions
 - e. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements
 - f. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure
 - g. Locations of underground Work, points of connection with existing utilities, changes in direction, valves, manholes, catch basins, capped stub outs, invert elevations, and similar items
 - h. Actual numbering and set points of each electrical circuit
 - i. Field changes of dimension and detail
 - j. Revisions to routing of piping and conduits
 - k. Revisions to electrical circuitry
 - l. Actual equipment locations
 - m. Duct, conduit, and cable size and routing
 - n. Changes made by Change Order or CCD
 - o. Details not on original Drawings or Shop Drawings
 2. Mark completely and accurately Drawings or Shop Drawings, whichever is the most capable of showing actual physical conditions. Where Shop Drawings are marked, show cross-reference on Drawings location.
 3. Mark important additional information that was either shown schematically or omitted from original Drawings.
 4. Use revision block to record information related to the mark-ups, including CCD numbers; Alternate numbers, Change Order numbers, and similar identification.
 5. Mark Drawing and Shop Drawing sets with red, erasable colored pencil.
 6. Responsibility for Mark-up: Where feasible, the individual or entity who obtained Project Record Drawing or Shop Drawing data, whether the individual or entity is the installer, Subcontractor, or similar entity, is required to prepare the mark-up on Project Record Drawings or Shop Drawings.

- a. Accurately record information in an understandable and legible drawing technique.
 - b. Record data as soon as possible after it has been obtained. In the case of concealed installations, record and check the mark-up prior to concealment.
- C. Preparation of Project Record Drawings and Project Record Shop Drawings: Immediately prior to inspection for Certification of Substantial Completion, review completed marked-up Project Record Drawings (Field Set) and Project Record Shop Drawings with Owner. When authorized, prepare final Project Record Drawings and Project Record Shop Drawings.
1. Project Record Drawings:
 - a. Prior to review of Contractor's Application for Payment, the Owner and Contractor will review updates to the Field Set of Project Record Drawings to verify that record documents are current.
 - b. Upon Certification of Substantial Completion, Contractor will transfer all updates from the "Field Set" to a clean set of full size contract drawings furnished by the Owner. Each sheet shall include a Project Record Drawing stamp which is dated and "wet signed" by the Contractor.
 - c. If Contractor chooses and Owner approves in advance, Contractor may submit electronic updates on final Project Record Drawings, so long as final Project Record Drawings preserve the integrity of the data and are compatible with Owner's software.
 2. Project Record Shop Drawings:
 - a. Transfer all information previously marked on Field Set to a separate clean set of Shop Drawings provided by Owner. Erase, redraw, and add details and notations where applicable. Identify and date each Shop Drawing; include the printed designation "PROJECT RECORD SHOP DRAWING" in a prominent location on each Shop Drawing. Bind the set with durable paper cover sheets, with appropriate identification, including titles, dates, and other information on cover sheet.
- D. In addition to requirements of this Section, comply with supplemental requirements of Divisions 15.
1. Division 15 of the Specifications may require the preparation of large scale, detailed layout drawings of the Work of that Division. These layout drawings are not Shop Drawings as defined by Section 01420 (References and Definitions), but together with Shop Drawings or layout drawings of all other affected Sections are used to check, coordinate, and integrate the work of the various Sections.
 2. Include these layout drawings as part of the Project Record Documents.

1.5 PROJECT RECORD SPECIFICATIONS

- A. During the construction period, maintain one copy of the Specifications, including Addenda and Modifications issued, for Project Record Documents purposes.
- B. Mark the Project Record Specifications to indicate the actual installation where the installation varies substantially from that indicated in Specifications issued. Note related Project Record Drawing information, where applicable. Give particular attention to substitutions, selection of product options, Change Order and CCD Work, and information on concealed installation that would be difficult to identify or measure and record later.
 1. In each Specification Section where products, materials or units of equipment are specified or scheduled, mark the copy with the proprietary name and model number of the product furnished.

2. Record the name of the manufacturer, catalog number, supplier and installer, and other information necessary to provide a record of selections made and to document coordination with Installation, Operation, and Maintenance Manuals.
 3. For each principal product specified, indicate whether data has been submitted in Installation, Operation, and Maintenance Manuals.
- C. Preparation of Project Record Specifications: Immediately prior to inspection for Certification of Substantial Completion, review completed Field Set Project Record Specifications with Owner. When authorized, prepare final Project Record Specifications.
1. After Substantial Completion and before Final Completion, carefully transfer all data shown on the Field Set to a separate clean set of Specifications provided by Owner. Include the printed designation "PROJECT RECORD SPECIFICATION" in a prominent location on the Specifications.

1.6 MISCELLANEOUS PROJECT RECORD SUBMITTALS

- A. Refer to other Specification Sections for miscellaneous record keeping requirements and submittals in connection with various construction activities. Immediately prior to Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for use and reference. Submit to the Owner for Owner's records. Categories of requirements resulting in miscellaneous records may include, but are not limited to, the following:
1. List all products used in the Project, organized by Specification section and article. Product list shall be submitted in an electronic format, compatible with Microsoft Excel 2000.
 2. Delivery records of materials incorporated into the Work
 3. Records of product lot numbers and expiration dates
 4. Quality Assurance/Quality Control records for field Work

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01825**TRAINING****PART 1 GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Requirements for training Owner's personnel, by persons retained by Contractor specifically for the purpose, on the proper operation and maintenance of the equipment and systems supplied under the Contract.

1.2 SUBMITTALS**A. Quality Assurance/Control Submittals:**

1. Lesson plans for each training session to be conducted by the manufacturer's representatives. Lesson plans shall include:
 - a. Subject of each training session
 - b. Identity and qualifications of individuals to be conducting the training
 - c. Proposed schedule of each training session including date, time, instructor and topic
 - d. All sessions shall be aligned with shift schedules of the operations and maintenance staff
2. Provide an electronic version of all training materials.

1.3 TRAINING - GENERAL

- A. Where specified, the Contractor shall conduct training sessions for Owner's personnel to instruct the staff on the proper operation, care, and maintenance of the equipment and systems installed under this Contract. Training shall take place under the conditions specified in the following paragraphs. Draft Installation, Operation, and Maintenance manuals shall be available at least 30 Days prior to the date scheduled for the individual training session.

1.4 LOCATION

- A. Unless otherwise approved by Owner, training sessions shall take place in a training room selected by Owner at Owner's office at 404 Aviation Boulevard.

1.5 LESSON PLANS

- A. Formal written lesson plans shall be prepared for each training session. Lesson plans shall contain an outline of the material to be presented along with a description of visual aids to be utilized during the session. Each plan shall contain a time allocation for each subject.
- B. One complete set of originals of the lesson plans, training manuals, handouts, visual aids, and reference material shall be the property of Owner and shall be suitably bound for proper organization and easy reproduction. The Contractor shall furnish ten copies of necessary training manuals, handouts, visual aids, and reference materials at least 7 Days prior to each training session.

1.6 FORMAT AND CONTENT

- A. Each training session shall be comprised of time spent both in the classroom and at the specific location of the subject equipment or system. As a minimum, training session shall cover the following subjects for each item of equipment or system:

1. Familiarization:
 - a. Review catalog, parts lists, drawings, etc., which have been previously provided for the plant files and Installation, Operation, and Maintenance manuals.
 - b. Review the installation of the specific equipment items.
 - c. Demonstrate the unit and indicate how all parts of the Specifications are met.
 - d. Answer questions.
2. Safety:
 - a. Using material previously provided, review safety references.
 - b. Discuss proper precautions around equipment.
3. Operation:
 - a. Using material previously provided, review reference literature.
 - b. Explain all modes of operation (including emergency).
 - c. Review with Owner's personnel proper use of the equipment.
4. Preventive Maintenance:
 - a. Using material previously provided, review preventive maintenance (PM) lists including:
 - 1) Reference material.
 - 2) Daily, weekly, monthly, quarterly, semiannual, and annual jobs.
 - b. Show how to perform PM jobs.
 - c. Show Owner's personnel what to look for as indicators of equipment problems.
5. Corrective Maintenance:
 - a. List possible problems.
 - b. Discuss repairs; identify special problems.
 - c. Open up equipment and demonstrate procedures, where practical.
6. Parts:
 - a. Show how to use previously provided parts lists and order parts.
 - b. Review spare parts on hand. Make recommendations regarding additional parts that should be available.
7. Local Representatives:
 - a. Where to order parts: name, address, telephone.
 - b. Service problems:
 - 1) Who to call.
 - 2) How to get emergency help.
8. Installation, Operation, and Maintenance Manuals:
 - a. Review any other material submitted.
 - b. Update material, as required.

1.7 VIDEO RECORDING

- A. Owner may retain the services of a commercial video taping service to record each training session. After taping, Owner may edit and supplement material with professionally produced graphics to provide a permanent record. Advise all manufacturers providing training sessions that the material will be video taped.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL

- A. Training shall be conducted no earlier than seven Days after starting and adjusting commences. Classes shall be scheduled such that classroom sessions are interspersed with field instruction in logical sequence. The Contractor shall arrange to have the training conducted on consecutive Wednesdays and Thursdays, with no more than eight hours of classes scheduled for any one Day. Concurrent classes will not be allowed.
- B. Visits to the Site by manufacturer's representatives for demonstration and training purposes shall be deemed to be a separate visit to the Site, independent of visits required for equipment checkout, testing, and startup unless prior approval of Owner is received to combine visits.
- C. The following services shall be provided for each item of equipment or system as required in individual Specification sections. Additional services shall be provided, where specifically required in individual Specification sections.
 1. Operations personnel classroom equipment training shall include, at a minimum:
 - a. Using slides and drawings, discuss the equipment's specific location in the plant and an operational overview.
 - b. Purpose and function of the equipment (or systems).
 - c. A working knowledge of the operating theory of the equipment.
 - d. Start-up, shutdown, normal operation, and emergency operating procedures, including a discussion on system integration and electrical interlocks, if any.
 - e. Identify and discuss safety items and procedures.
 - f. Routine preventative maintenance, including specific details on lubrication and maintenance of corrosion protection of the equipment and ancillary components.
 - g. Operator detection, without test instruments, of specific equipment trouble symptoms.
 - h. Required equipment exercise procedures and intervals.
 - i. Routine disassembly and assembly of equipment if applicable for purposes such as operator inspection of equipment.
 - j. Routing tests of electrical equipment, including schedule of tests.
 2. Operations personnel hands-on equipment training shall include, at a minimum:
 - a. Identify location of equipment and review the purpose.
 - b. Identifying piping and flow options.
 - c. Identifying valves and their purpose.
 - d. Identifying instrumentation:
 - 1) Location of primary element.
 - 2) Location of instrument readout.
 - 3) Discuss purpose, basic operation, and information interpretation.
 - e. Discuss, demonstrate, and perform standard operating procedures and operators' round checks.
 - f. Discuss and perform the preventative maintenance activities.
 - g. Discuss and perform start-up and shutdown procedures.
 - h. Perform the required equipment exercise procedures.
 - i. Perform routine disassembly and assembly of equipment if applicable.

- j. Identify and review safety items and perform safety procedures, if feasible.
 - k. Routine tests of electrical equipment.
 - l. Operation of electrical equipment and appurtenances.
3. Maintenance and repair personnel classroom equipment training shall include, at a minimum:
- a. Theory of operation.
 - b. Description and function of equipment.
 - c. Start-up and shutdown procedures.
 - d. Normal and major repair procedures.
 - e. Equipment inspection and troubleshooting procedures including the use of applicable test instruments and the "pass" and "no pass" test instrument readings.
 - f. Routine and long-term calibration procedures.
 - g. Safety procedures.
 - h. Preventative maintenance such as lubrication; normal maintenance such as belt, seal, and bearing replacement; and up to major repairs such as replacement of major equipment part(s) with the use of special tools, bridge cranes, welding jigs, etc.
 - i. Discuss preventative maintenance Work based on hours of run time.
 - j. Discuss predictive maintenance.
 - k. Maintenance and repair of electrical equipment and appurtenances.
4. Maintenance and repair personnel hands-on equipment training shall include, at a minimum:
- a. Locate and identify equipment components.
 - b. Review the equipment function and theory of operation.
 - c. Review normal repair procedures.
 - d. Perform start-up and shutdown procedures.
 - e. Review and perform the safety procedures.
 - f. Perform routine assembly and disassembly of equipment if applicable.
 - g. Identify and review safety items and perform safety procedures, if feasible.
 - h. Perform Owner-approved practice maintenance and repair job(s), including mechanical and electrical adjustments and calibration and troubleshooting equipment problems.

END OF SECTION

DIVISION 2

SITE CONSTRUCTION

SECTION 02230

SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Locate and mark existing utilities within the limits of Work.
2. Remove all existing surface improvements within the area indicated.
3. Install and maintain tree protective fencing around trees to be saved and remove tree stumps as indicated.
4. Properly dispose of all unsuitable material.

B. Related Sections

1. Section 02324 – Trenching

1.2 DEFINITIONS

A. Cleared Materials: Existing concrete, asphalt pavement, debris, and other deleterious materials within the proposed Work area.

B. Unsuitable Materials: Materials removed during trenching not used during trench backfill operations.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 PREPARATION

A. Locate, indentify, and protect utilities to remain free from damage.

B. Protect benchmarks, survey control points, and existing structures from damage or displacement.

C. Protect existing trees and other vegetation to remain against damage.

1. Do not smother trees by stockpiling construction materials or excavated materials within drip line.
2. Avoid foot or vehicular traffic or parking of vehicles with drip line.
3. Provide temporary protection as required.
4. Limb Protection: Use small construction equipment as necessary to minimize removal of or avoid damage to overhanging tree branches. Perform limb removal only when direct by Owner. Perform limb removal, if authorized, in accordance with ANSI A300. Owner will provide a copy of the guidelines upon request. If limbs are pruned, make the finish cut in accordance with the Tree Pruning Guidelines. "Heading" of any tree will not be permitted.
5. Do not wear climbing spurs when performing Work on any tree, unless the tree has been approved for removal.

3.2 DEMOLITION SEQUENCING

A. Conduct demolition operations in a manner that maintains utility services to the Owner's building at all times.

- B. Plan interruption of utility services in advance, in coordination with, and approved by the Owner.
- C. Coordinate any planned and/or necessary interruption of existing utilities with the Owner.
 - 1. Provide a minimum of one week's notice before any such interruption.
- D. Provide a detailed submittal as to the specific utility that will be disrupted, expectation of the duration of such interruption and how if necessary temporary means will be installed to minimize any major interruptions.
 - 1. Work shall not proceed unless Contractor has received written confirmation from the Owner.
- E. Perform demolition of surface improvements concurrent with the construction of the new facilities.
- F. Immediately repair damage done to existing utilities to limit disruption to Owner activities.

3.3 CLEARING AND GRUBBING

- A. Install tree protective fencing at locations as indicated prior to the start of demolition.
- B. Install fencing as far from the trunk as possible to allow for construction of proposed improvements.
- C. Maintain fencing throughout duration of construction.

3.4 SURFACE IMPROVEMENT REMOVAL

- A. Request that Underground Service Alert to mark all existing public utilities within Work area as a first order of Work.
- B. Retain and have a locating service mark all existing private utilities.
- C. Pothe each existing utility at its intersections with the new Work to confirm the actual locations and depths.
- D. Remove existing pavements, sidewalks, curbs, and appurtenances as indicated.

3.5 CLEAN UP

- A. Remove all debris and stains resulting from the Work of this section.

END OF SECTION

SECTION 02324

TRENCHING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Trenching and other excavation needed for the installation of pipe and appurtenances.
2. Bedding material.
3. Backfill of trenches and excavations.

1.2 QUALITY ASSURANCE

- A. Owner: Responsible for monitoring bedding, verifying backfill compaction, and advising the Contractor if unsatisfactory conditions or test results are observed.
- B. Rework areas where compaction is unsatisfactory until the required density is obtained.

1.3 REFERENCES

A. Reference Data:

1. ASTM C-33 Standard Specification for Concrete Aggregates.

1.4 SUBMITTALS

A. Shop Drawings:

1. Bedding material.
2. Backfill material.

1.5 PROTECTION FROM CAVING

A. Construction Safety Orders

1. Nothing in this section shall be deemed to allow the use of a shoring, sloping, or protective system less effective than that required by the Construction Safety Orders.
2. Take all necessary measures to protect the workmen and adjacent areas and structures from the hazards of the trenching or excavation operations.
3. Withdraw sheet piling and other sheeting in such a manner as to prevent caving at the walls of excavation or damage to piping or other structures.
4. Except as may be hereinafter modified, no sheeting shall be left in the trench and no backfill shall be made against the sheeting before it is removed.
5. Leave in place any sheeting extending below the invert of piping by cutting off in a manner satisfactory to the Owner.

PART 2 PRODUCTS

2.1 BEDDING MATERIAL

- A. Bedding Material: Concrete sand per ASTM C-33.

2.2 BACKFILL MATERIAL

- A. Backfill Material: Well graded gravel/sand material with a minimum sand equivalent value of 30 and conform to the following gradations.

1. When tested with the following series of sieves, no more than 25% of the material will be retained between any adjacent sieves: 3", 2-1/2", 2", 1-1/2", 1", 3/4", 1/2", 3/8", No. 4, No. 8, No. 16, No. 30, No. 50, No. 100, and No. 200.

<u>Percent Passing</u>					
<u>3"</u>	<u>3/4"</u>	<u>3/8"</u>	<u>No. 4</u>	<u>No. 16</u>	<u>No. 200</u>
100	100	80-100	30-70	5-40	30-70

PART 3 EXECUTION

3.1 GENERAL

- A. Conform all trench excavation Work to the Division of Industrial Safety Construction Safety Orders.

3.2 TRENCH EXCAVATION

- A. Make all necessary excavation to construct the Work as indicated in accordance with the dimensions shown thereon.
- B. Remove all materials or surface obstructions of any nature that would interfere with the execution of the Work.
- C. Special Trenching:
 1. Notify Owner at least 48 hours prior to excavation in Special Trenching areas.
 2. Special Trenching
 3. Trenches indicated as having "Special Trenching" will generally be through areas in close proximity to significant trees. Large structural roots are expected to be encountered, and shall be carefully avoided. For the top 36 inches of excavation, Work shall proceed using only hand or pneumatically driven tools. Trench excavation within the top 36 inches of excavation shall proceed using cuts no more than 6 inches in depth. Below the top 36 inches proceed using cuts no more than 6 inches in depth. Below the top 36 inches of excavation, standard trench excavation equipment will be permitted. Trench excavation below the top 36 inches of excavation shall proceed using cuts no more than 6 inches in depth until no longer in the root zone, as determined by the Owner.
 4. Protect roots larger than 1 inch but less than 2 inches in diameter from damage and carefully expose using hand tools only. Exposed roots less than or equal to 1 inch shall be cleanly cut as close as possible to both sides of the trench using a sharp hand saw (or lopping pruners may be used for small roots). Owner will determine course of action for roots 2 inches or larger. Owner may require tunneling under roots larger than 2 inches to install piping. Owner may direct Contractor to cut roots if tunneling or other means of installing piping is impractical.

3.3 TRENCH WIDTH AND DEPTH

- A. Excavate trenches to the minimum widths and depths as indicated.

3.4 CONTROL OF WATER

- A. Provide sufficient pumping equipment and the operation thereof to remove ground water from the excavation during the progress of Work until the pipe or other structures are installed and until backfilling has progressed to a sufficient height to anchor the Work against possible flotation or leakage.
 - 1. Have a minimum of two working pumps available for immediate use at all times.
- B. Discharge water to the sanitary sewer under the conditions set forth in a discharge permit obtained from the Airport Larkfield Wikiup Sanitation Zone (707) 526-5370.
- C. Dispose of said water in such a manner as to cause no injury to public or private property, or be a menace to the public health.
- D. Remove sediment from water to be disposed of by placing the pump inlet hose into a sump filled with clean gravel, or a perforated bucket filled with clean gravel and by providing whatever additional means is required to meet the requirements of the discharge permit.
- E. Install a filter sock on the outlet of the pump to retain residual sediment.
- F. Do not allow any pumped groundwater into any watercourse or storm drain system.

3.5 BRACING EXCAVATIONS

- A. Brace and support excavation so that they will be safe, and the ground alongside the excavation will not slide or settle, and all existing improvements of any kind will be fully protected from damage.
- B. Make all necessary repairs or reconstruction if any damage does result to such improvements with no additional compensation.

3.6 PIPE BEDDING

- A. Ensure that bedding material has the proper moisture content to assure maximum compaction by using hand or pneumatic tampers.
- B. Accomplish bedding in a manner that will not disturb the piping but will obtain a relative compaction of 90 percent.
- C. Install bedding to the depth indicated.

3.7 TRENCH BACKFILL

- A. Place backfill material after the Owner has inspected the pipe and bedding material.
- B. Compact trench backfill to at least 90 percent relative compaction.
 - 1. Jetting of trench backfill will not be permitted.

3.8 RESURFACING

- A. Saw-cut the existing surfacing six inches wider than the trench along both sides where trenches occur in existing surfaced areas.
- B. Surface the trenches to match the surrounding surfacing, following backfill and compaction.
 - 1. In parking stalls and parking isles minimum trench surfacing shall be 8" Class 2 AB and 2-½" asphalt concrete.
 - 2. In travel isle (isle most adjacent to the building and used to access parking isles and stalls) minimum trench surfacing shall be 12" Class 2 AB and 2" asphalt concrete.

3.9 CLEAN UP

- A. Remove all debris and stains resulting from the Work of this section.

END OF SECTION

SECTION 02680

SEDIMENTATION CONTROL

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Installation of sediment control devices within the Site.
 - 2. Removal of sediment from drainage structures.

1.2 SUBMITTALS

- A. Shop Drawings:
 - 1. Sediment barrier with low flow bypass.

PART 2 PRODUCTS

2.1 SEDIMENT BARRIER

- A. Sediment Barrier: ERTEC Combo Guard for curb inlets or Approved Equal.

PART 3 EXECUTION

3.1 GENERAL

- A. Install sediment control devices for the period between October 15 and May 15 of each year.
 - 1. Maintain devices throughout the Work until permanent surfacing is installed on all trenches.
 - 2. Failure to install or maintain sediment control measures will result in the Work being halted until such measures are corrected.
- B. Check sediment control devices after each storm event.
- C. Maintain or replace each device if sediment accumulation has reached half the device capacity.
- D. Clean out all storm drain structures following removal of sediment control devices.

3.2 CLEAN UP

- A. Remove all debris and stains resulting from the Work of this section.

END OF SECTION

SECTION 02721

ASPHALT BASE COURSES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Provide, spread and compact aggregate.

1.2 REFERENCES

- A. Reference Data:
1. Caltrans Standard Specification Section 26: Aggregate Bases
 2. ASTM D1557 Standard Test Methods for Laboratory Compaction

1.3 QUALITY ASSURANCE

- A. Testing and inspection of the aggregate base shall be done by a testing laboratory retained and paid for by the Owner.
- B. Contractor to rework any areas receiving failing tests to achieve the minimum specified degree of compaction.
- C. Test Methods: Unless otherwise indicated, tests shall be made in conformance with the following standard methods:
1. Caltrans Standards and Specifications except relative compaction shall be determined by ASTM D1557 test procedure.

PART 2 PRODUCTS

2.1 AGGREGATE BASE

- A. Aggregate for aggregate bases shall be clean and free of vegetable matter and other deleterious substances.
- B. Aggregate base shall be of such a nature that it can be compacted readily under watering and rolling to form a firm, stable base.
- C. Aggregate base shall be Class 2, and the combined aggregate shall conform to the ¾ -inch maximum grading specified in Caltrans Standard Specification Section 26.

2.2 RECYCLED AGGREGATE BASE

- A. Aggregate for recycled aggregate bases shall be clean and free of vegetable matter and other deleterious substances.
- B. Recycled aggregate base shall be of such a nature that it can be compacted readily under watering and rolling to form a firm, stable base.
- C. At the Contractor's option, the existing pavement and base sections to be removed may be processed into Class 2 aggregate base and used in lieu of virgin material provided it is ground and processed to meet all specified requirements for Class 2 aggregate base.

PART 3 EXECUTION

3.1 SPREADING

- A. Deliver aggregate base to the trench as a uniform mixture.
- B. Avoid segregation and ensure the base is free of pockets of coarse or fine material.
- C. Place the aggregate base in such thickness that after watering and compacting the completed base will conform to the required grade, cross section, and compaction.
- D. Spread, water, and compact the base in layers not to exceed 6 inches in compacted thickness to achieve the specified thickness.

3.2 COMPACTION AND TOLERANCE

- A. Ensure that the relative compaction of the base is not less than 95 percent.
- B. Do not vary the finished surface of the aggregate base more than 0.01 foot above or 0.05 foot below from the design grades.
- C. Reshape, rewater and recompact aggregate base that fails to meet the specified compaction.

3.3 CLEAN UP

- A. Remove all debris and stains resulting from the Work of this section.

END OF SECTION

SECTION 02740

ASPHALT PAVING**PART 1 GENERAL****1.1 SUMMARY**

A. Section Includes:

1. Provide, spread and compact asphaltic concrete pavement.

1.2 REFERENCES

A. Reference Data:

1. Caltrans Standard Specification Section 39: Asphalt Concrete
2. ASTM D1557 Standard Test Methods for Laboratory Compaction

1.3 QUALITY ASSURANCE

A. Testing and inspection of the asphaltic concrete shall be done by a testing laboratory retained and paid for by Owner.

B. Contractor to remove and replace any areas receiving failing compaction tests.

C. Test Methods: Unless otherwise indicated, tests shall be made in conformance with the following standard methods:

1. Caltrans Standards and Specifications except relative compaction shall be determined by ASTM D1557 test procedure.

PART 2 PRODUCTS**2.1 ASPHALT CONCRETE**

A. The asphalt concrete shall be Type A and shall conform to the applicable portions of Section 39 of the Caltrans Standard Specifications.

B. Aggregate gradation shall be ½ inch maximum medium.

PART 3 EXECUTION**3.1 SUBGRADE PREPARATION FOR ASPHALT CONCRETE**

A. Complete all construction beneath the subgrade, including pipeline testing, prior to asphalt concrete placement.

B. Do not vary subgrade more than 0.01 foot above or 0.05 foot below design grade.

3.2 TACK COAT

A. Apply tack coat of RS-1 or CRS1 Emulsion to vertical surfaces of existing surfacing that will come into contact with asphalt concrete.

3.3 SPREADING AND COMPACTING

A. Perform all Work in accordance with Section 39 of the Caltrans Standard Specifications.

B. Place asphalt concrete in minimum 1-1/2-inch and 2-inch thick compacted lifts for ½-inch and ¾ inch mixes, respectively, and maximum 3-inch thick lifts.

3.4 CLEAN UP

- A. Remove all debris and stains resulting from the Work of this section.

END OF SECTION

SECTION 02745

SLURRY COAT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Placement of Type I Slurry Seal on asphalt concrete surfacing throughout the parking lot located on the westerly side of the Owner's building and ending at the easterly terminus of the curb transitions to the two access roadways into the lot.

1.2 REFERENCES

A. Reference Data:

1. Caltrans Standard Specification Section 37: Bituminous Seals

PART 2 PRODUCTS

2.1 SLURRY SEAL MATERIAL

- A. Comply with Caltrans Standard Specification Section 37.

PART 3 EXECUTION

3.1 PLACING

- A. Place slurry seal in accordance with Caltrans Standard Specification Section 37.

3.2 CLEAN UP

- A. Remove all debris and stains resulting from the Work of this section.

END OF SECTION

SECTION 02750

CONCRETE PAVING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Concrete curbs
 - 2. Concrete walkways.

1.2 REFERENCES

- A. Reference Data:
 - 1. Caltrans Standard Specification Section 19: Earthwork
 - 2. Caltrans Standard Specification Section 52: Reinforcement
 - 3. Caltrans Standard Specification Section 73: Concrete Curbs and Sidewalks
 - 4. Caltrans Standard Specification Section 90: Portland Cement Concrete
 - 5. ASTM A615 Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
 - 6. ASTM D1751 Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
 - 7. City of Santa Rosa Standard 235 – Typical Spacing: Weakened Planes, Score Marks and Expansion Joints

PART 2 PRODUCTS

2.1 CONCRETE

- A. Comply with the applicable provisions of Sections 19, 73 and 90 of the Caltrans Standard Specifications.
- B. Class 1, with a maximum slump of 3 inches and a 28-day compressive strength of 3000 psi minimum.
- C. All references to Class A concrete on the plans shall be Class 1 concrete.

2.2 BAR REINFORCEMENT

- A. Deformed billet-steel bars for concrete reinforcement conforming to the specifications of ASTM Designation: A615, Grade 40 and as set forth in Caltrans Standard Specification Section 52.

2.3 FORMWORK AND ACCESSORIES

- A. Formwork - matched, tight fitting and adequately stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of concrete.
- B. Expansion joint filler - minimum 1/2-inch thick asphaltic impregnation fiberboard, ASTM D1751.

PART 3 EXECUTION**3.1 GENERAL**

- A. Conform curbs to the details indicated.

3.2 SUBGRADE PREPARATION

- A. Provide minimum 6 inches in compacted thickness of Class 2 aggregate base material under walkways.
- B. Wet subgrade and forms immediately before concrete placement.

3.3 EXISTING CURBS AND SIDEWALKS

- A. Cut joint to a minimum depth of 1-1/2 inches with an abrasive type saw.
- B. Locate joint at first scoring line or beyond the planned joint location.

3.4 FORMS

- A. To conform with the following criteria:
 - 1. Smooth face is against concrete,
 - 2. True smooth upper edge,
 - 3. Rigid enough to withstand pressure of fresh concrete without distortion.
 - 4. Ensure that forms are clean and oil coated.
- B. Set forms carefully to alignment, grade and required dimensions.
- C. Secure adequately from movement by stakes, clamps, spreaders and braces.

3.5 CURB AND WALKWAY CONSTRUCTION

- A. Construct in dimensions as indicated.
- B. Install weakened plane joints at intervals shown on City of Santa Rosa Standard 235.
- C. Install expansion joints, 1/4 inch wide where the new walkway joins existing curbs, drainage structures, other fixed objects and where shown on City of Santa Rosa Standard 235 and applicable details in the drawings.
- D. Install 1/4-inch thick premolded joint fillers the full thickness of concrete in the expansion joints.
- E. Finish the top and face of curbs with a steel trowel.
- F. Give the top and face of curbs a final fine brush finish.
- G. Ensure that the top and face of curb is true and straight and do not vary more than 0.01 foot above or below the grade of segment being replaced.
- H. Finish concrete walkways with a steel trowel.
- I. Give concrete walkways a final fine brush finish.
- J. Cure concrete as provided in California Standard Specification, Section 90.
- K. Make repairs by removing and replacing the entire unit between scoring lines or joints.

3.6 CLEAN UP

- A. Remove all debris and stains resulting from the Work of this section.

END OF SECTION

SECTION 02763

PAVEMENT MARKINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Furnish materials and replace painted traffic striping, markings and pavement markers in the entire parking lot located on the westerly side of the Owner's building.

1.2 REFERENCES

A. Reference Data

1. Caltrans Standard Specification Section 84: Traffic Stripes and Pavement Markings
2. Caltrans Standard Specification Section 85: Pavement Markers
3. Caltrans Manual on Uniform Traffic Control Devices (MUTCD)

PART 2 PRODUCTS

2.1 TRAFFIC STRIPING, MARKINGS AND PAVEMENT MARKERS

- A. The paint to be used for traffic striping and markings shall be water borne and shall comply with the applicable provisions of Caltrans Standard Specification Section 84.
- B. Pavement markers shall be Type A per Caltrans Standard Specification Section 85.
- C. Utilize paint that dries "track free" in not less than thirty (30) minutes and not more than ninety (90) minutes.

PART 3 EXECUTION

3.1 TRAFFIC STRIPING, MARKINGS AND PAVEMENT MARKERS

- A. Commence parking stall striping and marking after all paving and seal coat Work on the entire job has been completed, and the various finished surfaces are sufficiently cured to prevent undue tracking onto new striping.
- B. Use an air compressor with a capacity of 60 cubic feet per minute.
- C. Apply paint at the rate of application of 215 square feet per gallon per coat.
- D. Clean and sharpen all lines and other shapes to dimensions as indicated. Paint all lines and other shapes at the locations as indicated. Do not permit ragged ends of segments, fogginess along the sides, or objectionable dribbling along the unpainted portions of the stripe.
- E. Ensure that the finished product has an opaque, well painted appearance with no black or other discolorations showing through. Paint out any smears with black paint to the satisfaction of Owner.
- F. Take all reasonable precautions to protect the paint during drying time. Paint out all objectionable tracking. Provide appropriate traffic control necessary to insure non-tracking as well as reasonable traffic flows.
- G. Apply two coats of paint to the painted stripes and markings.
- H. Place pavement markers at handicap crossings and match existing spacing.
- I. Place pavement markers in accordance with Caltrans Standard Specification Section 85 after all striping and marking have been completed and the finished surfaces are cured.

J. Do not work when the pavement is appreciably damp.

3.2 CLEAN UP

A. Remove all debris and stains resulting from the Work of this section.

END OF SECTION

DIVISION 4

MASONRY

SECTION 04220

CONCRETE UNIT MASONRY

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Concrete unit masonry and water repellent coating.

1.2 SUBMITTALS

- A. Product data:
 - 1. Materials list of items proposed to be provided under this Section;
 - 2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units above ground on level platforms which allow air circulation under the stacked units.
- B. Cover and protect against wetting prior to use.

1.5 REFERENCES

- A. ASTM A82, Standard Specification for Steel Wire
- B. ASTM C150, Standard Specification for Portland Cement
- C. ASTM A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- D. ASTM C5, Standard Specification for Quicklime for Structural Purposes
- E. ASTM C90, Standard Specification for Hollow Load Bearing Concrete Masonry Units
- F. ASTM C144, Standard Specification for Aggregate Masonry Mortar
- G. ASTM C207, Standard Specification for Hydrated Lime for Masonry Purposes
- H. ASTM C270, Standard Specification for Mortar for Unit Masonry
- I. ASTM C476 Standard Specification for Grout for Masonry
- J. ACI 318 Building Code Requirements for Structural Concrete
- K. CRSI Manual Of Standard Practices

PART 2 PRODUCTS

2.1 CONCRETE MASONRY UNITS

- A. Provide lightweight hollow load-bearing concrete masonry units complying with ASTM C90, grade N, type I, in color "natural gray."
- B. Dimensions:
 - 1. Provide units of the dimensions as indicated.
 - 2. Where dimensions are not indicated, provide units having nominal face dimensions of 400 mm (16") long by 200 mm (8") high by the depth shown or otherwise required.
- C. Provide accessory shapes as indicated or otherwise required.

2.2 REINFORCEMENT AND ACCESSORIES

- A. Comply with the following as minimums.
 - 1. Bars: ASTM A615, grade 40, unless otherwise indicated, using deformed bars for number 3 and larger.
 - 2. Bending: ACI 318.
 - 3. Wire reinforcement: ASTM A82.
- B. Fabricate reinforcement in accordance with recommendations contained in CRSI "Manual of Standard Practices."

2.3 MORTAR

- A. Ingredients:
 - 1. Portland cement: Comply with ASTM C150, type II.
 - 2. Lime:
 - a. Provide hydrated lime complying with ASTM C207, or quicklime complying with ASTM C5.
 - b. When quicklime is used, slake and then screen through a 16 mesh sieve. After slaking and screening, but before using, store and protect for not less than ten days.
 - 3. Aggregate: Provide clean, sharp, well graded aggregate free from injurious amounts of dust, lumps, shale, alkali, surface coatings, and organic matter, and complying with ASTM C144.
 - 4. Admixtures: Do not use admixtures unless specifically approved in advance by the Owner.
 - 5. Water: Provide water free from deleterious amounts of acids, alkalis, and organic materials.
- B. Mixing:
 - 1. Provide mortar type "S", as indicated or otherwise directed by the Owner, and in accordance with ASTM C270.
 - 2. Proportions:

- a. For type "S" mortar, provide one part portland cement to 1/2 part hydrated lime and 4-1/2 parts sand by volume.
3. Mechanically mix in a batch mixer for not less than three minutes, using only sufficient water to produce a mortar which is spreadable and of a workable consistency.
4. Retemper mortar with water as required to maintain high plasticity.
 - a. On mortar boards, retemper only by adding water within a basin formed with mortar, and by working the mortar into the water.
 - b. Discard and do not use mortar which is unused after 1-1/2 hours following initial mixing.

2.4 GROUT

A. Ingredients:

1. Portland cement: Comply with ASTM C150, type I.
2. Aggregate: Provide clean, sharp, well graded aggregate free from injurious amounts of dust, lumps, shale, alkali, surface coatings, and organic matter.
3. Admixtures: Do not use admixtures unless specifically approved in advance by the Owner.
4. Water: Provide water free from injurious amounts of acids, alkalis, and organic materials.

B. Mixing:

1. Provide "fine grout" or "coarse grout" as indicated or otherwise directed by the Owner, and in accordance with ASTM C476.
2. When the minimum grout compressive strength is required to be more than 2000 psi, provide laboratory design mix prepared as required per the approved design mixes.
3. Proportions:
 - a. For "fine grout," provide one part portland cement to 2-1/4 parts minimum to 3 parts maximum of damp loose sand, with sufficient water to achieve fluid consistency.
 - b. For "coarse grout," provide one part portland cement to 3 parts maximum of damp loose sand to two parts coarse aggregate, with sufficient water to achieve fluid consistency.
4. "Fluid consistency" is interpreted as meaning as fluid as possible for pouring intimately in place without segregation.

- ### C. Use "fine grout", where the grout space is less than 75 mm (3") in its least dimension, and where otherwise directed by the Owner or required by governmental agencies having jurisdiction.

2.5 WATER REPELLENT COATING

- ### A. At all exterior wall surfaces, provide VIP Umbrella 9100 water repellent coating manufactured by the Momentive Performance Materials, (866) 275-4372, or Approved Equal.

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

- 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.

3.2 ENVIRONMENTAL CONDITIONS

- A. Do not place masonry units when air temperature is below 4.4 degrees C (40 degrees F).
- B. Protect masonry construction from direct exposure to wind and sun when erected in ambient air temperature of 36 degrees C (99 degrees F) in the shade, with relative humidity less than 50%.

3.3 INSTALLATION

- A. General
 1. Do not commence installation of the Work of this Section until horizontal and vertical alignment of foundation is within 25 mm (1") of plumb and the lines are as indicated.
 2. Lay only dry masonry units.
 3. Use masonry saws to cut and fit masonry units.
 4. Set units plumb, true to line, and with level courses accurately spaced.
 5. Clean the top surface of foundation free from dirt, debris, and laitance, and expose the aggregate prior to start of installing first course.
 6. Accurately fit the units to plumbing, ducts, openings, and other interfaces, neatly patching all holes.
 7. Keep the walls continually clean, preventing grout and mortar stains. If grout does run over, clean immediately.
- B. Unless otherwise indicated, provide running bond with vertical joints located at center of masonry units in the alternate course below.
- C. Do not use chipped or broken units. If such units are discovered in the finished wall, the Owner may require their immediate removal and replacement with new units at no additional cost to the Owner.
- D. Laying up:
 1. Place units in mortar with full shoved bed and head joints.
 2. Align vertical cells of hollow units to maintain a clear and unobstructed system of flues.
 3. Hold racking to an absolute minimum.
 4. Provide cleanouts at the bottom of each cell of hollow units for removing mortar droppings. Do not close the cleanouts until they have been inspected and approved by the Owner.
- E. Reinforcement:
 1. Provide reinforcement as indicated, fully embedded in grout and not in mortar or mortar joints.

2. Provide required metal accessories to ensure adequate alignment of steel during grout filling operations.
- F. Tooling:
1. Tool joints to a dense, smooth surface.
 2. Unless otherwise indicated, provide joints of “concave” pattern throughout.

3.4 GROUTING

- A. Perform grouting in strict accordance with the provisions of the governing building code.
1. Solidly fill vertical cells containing reinforcement.
 2. Consolidate grout at time of pour by puddling with a mechanical vibrator, filling all cells of the masonry, and then reconsolidating later by puddling before the plasticity is lost.

3.5 CLEANING

- A. Inspection and adjustment:
1. Upon completion of the Work of this Section, make a thorough inspection of installed masonry and verify that units have been installed in accordance with the provisions of this Section.
 2. Make necessary adjustments.
- B. Clean surfaces of masonry as required for proper application of the specified finishes.

3.6 WATER REPELLENT COATING

- A. Apply sufficient coats of the approved material to achieve a consistent and uniform appearance, free from runs and sags, and with a uniformly resistive surface which will prevent penetration of water through the walls for the required period of warranty.

END OF SECTION

DIVISION 7

THERMAL AND MOISTURE PROTECTION

SECTION 07510

REBUILD / REPAIR BUILT-UP ROOFING (BUR) MEMBRANE**PART 1 GENERAL****1.1 SUMMARY**

- A. This Section includes:
1. Replacement of the areas where the existing built-up roof system and flashings have been removed.

1.2 REFERENCE STANDARDS

- A. ASTM Standards
1. ASTM C 836, Standard Specification for High Solids Content.
 2. ASTM D 36, Standard Test Method for Softening Point of Bitumen
 3. ASTM D 92, Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester.
 4. ASTM D 412, Standard Test Method for Vulcanized Rubber and Thermoplastic Elastomers- Tension
 5. ASTM D 1079, Standard Terminology Relating to Roofing and Waterproofing
 6. ASTM D 2240, Standard Test Method for Rubber Property- Durometer Hardness
 7. ASTM D 3617, Standard Practice for Sampling and Analysis of Built-Up Roof Systems During Application.
 8. ASTM D 4060, Standard Method for Abrasion Resistance of Organic Coatings
 9. ASTM E 96, Standard Test Methods for Water Vapor Transmission
- B. ASCE 7, Minimum Design Loads for Buildings and Other Structures
- C. FMG - Factory Mutual Global (Safety Standards)
- D. NRCA - National Roofing Contractors Association, Roofing and Waterproofing Manual.
- E. PIMA - Polyisocyanurate Insulation Manufacturers Association, Bethesda, MD
- F. SMACNA - Architectural Sheet Metal Manual.

1.3 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D 1079 "Terminology Relating to Roofing and Waterproofing"; glossary of NRCA's "The NRCA Roofing and Waterproofing Manual"; and the Roof Consultants Institute Glossary of Roofing Terms for definition of terms related to roofing Work in this Section.
- B. Sheet Metal Terminology and Techniques: SMACNA Architectural Sheet Metal Manual.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.
- B. General: Submittal of systems that are not of a design very similar to that which is specified will not be accepted. Value-engineered proposals will not be accepted unless specifically requested in writing to the Owner.
- C. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.
- D. Roofing System Design: Provide a membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE 7.
- E. UL Listing: Provide membrane roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test methods mandated by UL. Identify materials with appropriate markings of applicable testing and inspecting agency.

1.5 SUBMITTALS

- A. Product Data
 - 1. Catalog sheets, Specifications and installation instructions for each material specified
- B. Shop Drawings
 - 1. Submit detail of proposed deviations from the Contract Documents. On the revised detail show existing conditions, referenced directly to the related details on the Contract Drawings and label detail "Deviation Submitted for Approval."
 - 2. Submit an accurate layout of the tapered insulation, showing the slopes to the drains.
 - a. Show cross section drawings illustrating the location and thickness of tapered insulation pieces and filler pieces.
 - b. Show the thickness of the insulation system at high and low points.
 - 3. Submit a layout of the wood nailers showing their required locations, and required spacing between nailers. Show the direction of the laps in relation to the slope of the deck and the wood nailers.
- C. Samples
 - 1. All submitted samples must be labeled and supplied by manufacturer:
 - a. Roofing Membrane: One 6 inch square of each type
 - b. Insulation: One 6 inch square each type
 - c. Coverboard: One 6 inch square each type
 - d. Fasteners: Three each type

- D. Test Reports:
 - 1. Roof deck fastener pullout test
 - 2. Roof drain and leader test or submit plumbers verification
 - 3. Roof flood test

- E. Submit an intent to warrant, executed by authorized officer of the system manufacturer, indicating that manufacturer has reviewed drawings, specifications and conditions affecting the Work and, and proposes to provide warranties as referenced herein without further stipulation.

- F. Manufacturer's Warranty: Submit a sample copy of the membrane manufacturer's warranty covering workmanship and materials.

- G. Certifications
 - 1. Provide letter from the roofing membrane manufacturer certifying the proposed roofing assembly, compatibility of materials and total R-value of the insulation system.

- H. Membrane Manufacturers Certifications:
 - 1. Submit written certification that the manufacturer subscribes to a quality assurance process, or equivalent, in order to optimize product quality. Manufacturer must demonstrate and verify a defined Process Capability Potential (CPK) program designed to ensure continuous improvement. A certificate of analysis of the quality assurance process will be mandatory upon the written request to the manufacturer from the Owner. 3.
 - 2. Roofing system manufacturer must provide inspection of guaranteed roofing systems by company employed, salaried, personnel dedicated to Technical Services.
 - a. Sales representatives or sales agents will not be permitted to conduct quality assurance inspections or grant final manufacturer's acceptance.

1.6 QUALITY ASSURANCE:

- A. Mock-up
 - 1. Full roof mock-up measuring not less than twelve by twelve inches accurately representing the entire assembly including the deck, insulation types and thickness, all membranes and adhesives.

- B. Membrane Manufacturers Certifications:
 - 1. All components of the system above the existing roof deck will be from the roof system manufacturer with the manufacturer's label on every item.

- C. Preliminary Roofing Conference:
 - 1. Before starting roof deck construction, conduct special meeting at Site. Review methods and procedures related to roof deck construction and roofing system including, but not limited to, the following:

- a. Meet with Owner, Owner's insurer (if applicable), testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.
- b. Review means, methods, and procedures related to roofing installation, including manufacturer's written instructions.
- c. Review Safety Program for Site conditions, enforcement, compliance, or Owner imposed restrictions that may be required.
- d. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
- e. Examine Site for approved staging areas, disposal sites, and document existing conditions prior to contractor mobilization. Establish scope of Work for site restoration and responsibilities.
- f. Examine Site for condition and completion of areas adjacent to work area. Establish protection required for existing surfaces.
- g. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
- h. Review structural loading limitations of roof deck during and after roofing operations.
- i. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
- j. Review governing regulations and requirements for insurance and certificates if applicable.
- k. Review temporary protection requirements for roofing system during and after installation.
- l. Review Work limitation by contractor including; start times, end times, days of the week, noise mitigation, fume control and any part of the Work that would effect normal building operations.
- m. Review trade coordination necessary for job completion.
- n. Review roof observation and repair procedures after roofing installation.

1.7 DELIVERY, STORAGE, HANDLING & DISPOSAL

- A. Delivery:
 1. Deliver roofing materials to the Site in the manufacturer's unbroken containers bearing the manufacturer's printed labels.
 2. All bitumen delivered in cartons must have the following printed on the carton:
 - a. Manufacturer
 - b. Type (ASTM)
 - c. SP (Softening Point)
 - d. FP (Flash Point)
 - e. FBT (Finished Blowing Temperature)
 - f. EVT (Equiviscous Temperature)
 3. For all bitumen delivered in tanker trucks, provide same manufacturer's certifications listed above.

- B. Storage and Handling
 - 1. Store materials a minimum of 6" off the ground, in a dry, well ventilated place protected from the weather.
 - a. Enclosed trailers are recommended.
 - b. Temperature conditioned storage is required for temperature sensitive items.
 - 2. Mark for clear and evident identification all material that has been subject to moisture.
 - a. Remove such materials from the Site.
 - 3. Handle roll goods with care.
 - a. Do not use roll goods which have been damaged.
 - b. Leave materials in their packaging until ready for use.
 - 4. Allow no unlabeled materials on Site.
 - 5. In event of damage, immediately make all repairs and replacements required by Owner.
- C. Disposal
 - 1. All removed materials become the property of the contractor.
 - 2. Inspect ground areas surrounding roof on a daily basis for loose debris.
 - 3. Immediately move all debris off roof and into approved dumpster.
 - 4. Dumpster staging areas must be kept neat and tidy.
 - a. Do not allow dumpster to overflow.
 - 5. All debris must be transported to a legal dumpsite or recycling facility and documentation of each load must be maintained by the Contractor.

1.8 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to Manufacturer's written instructions and guarantee requirements.
 - 1. Do not start roofing if rain is imminent, or ambient temperature is below 45°F.
 - 2. If rain occurs during roof membrane application, cease operations and protect deck, insulation, penetrations and membrane from water damage and intrusion.
- B. Flame-heated Equipment:
 - 1. Locate and use flame-heated equipment so as not to endanger the structure or other materials on the site or adjacent property.
 - 2. Do not place flame heating equipment on roof.
 - 3. Provide and maintain fire extinguisher.
- C. Comply with all fire regulations. Ensure properly rated, charged, and inspected fire extinguishers are on the roof and staging area.

1.9 WARRANTY

- A. Applicator's guarantee:
 - 1. Special Project Warranty: Submit roofing Installer's warranty, signed by Installer, covering Work of this Section, including all components of membrane roofing

system such as roofing membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, and walkway products, for a period of two (2) years. The warranty shall cover all repairs to the entire assembly so that it meets the system manufacturer's requirements at the time of approval.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. The new areas of the built-up roof system must be tied together with the surrounding existing built-up roof system. Install the following roof system to the higher standard of this specification, the requirements and recommendations of the roof system manufacturer, local code, the recommendations of both the NRCA and SMACNA in every detail which shall only be provided as a complete system:
1. Existing Wood Deck
 2. Roofing Membrane
 - a. Six -ply, hot applied, built up roof system.
 - 1) One layer of base sheet, mechanically fastened.
 - 2) One layer of the base ply, fully adhered.
 - 3) 4 layers of fiberglass ply sheet, fully adhered.
 - i) Two layers to match existing, fully adhered
 - ii) Two additional layers, fully adhered, to ensure that the replaced area is higher than the surrounding existing surface and to provide the tie-in by being staggered over the existing roof surface.
 - 4) 1 layer of mineral surfaced cap sheet, fully adhered.
- B. Provide system in compliance with products and installation of UL Approval:
- 1 4GNC by Johns Manville, Class A.
 - 2 Or Approved Equal
- C. Other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
1. Products: Subject to compliance with requirements, provide the products specified or Approved Equal
 2. Manufacturers: Subject to compliance with requirements, provide products to match existing.

2.2 MATERIALS

- A. Thermal Barrier
1. None.
- B. Membrane Layer
1. Base Sheet / Base Ply
 - a. Glas Base Plus by Johns Manville or Approved Equal.
 2. Ply Sheet
 - a. Glas Ply Premier by Johns Manville or Approved Equal.
 3. Mineral Surfaced Cap Membrane

- a. Glas Kap by Johns Manville or Approved Equal.
- C. Flashings
- 1. Modified Base Flashing Sheet
 - a. DynaFlex or Approved Equal
 - 2. Liquid Applied Flashing
 - a. A liquid and fabric reinforced flashing system created with a stitchbonded polyester scrim and a two-component, moisture cured, elastomeric, liquid applied flashing material, consisting of an asphalt extended urethane base material and an activator.
 - b. Product
 - 1) PermaFlash System or Approved Equal
 - c. Typical Physical Properties
 - 1) ASTM D 412, Tensile strength: 1100 psi
 - 2) ASTM D 412, Elongation: > 40%
 - 3) ASTM E 96 Method E [100°F (38°C), 100 mil (2.5 mm) sheet], Permeability to water vapor: 0.03 perms
 - 4) Working time @ 75°F (25°C): 30 min
 - 5) Rainproof after @ 75°F (25°C): 4 h
 - 6) ASTM D 2240, Hardness @ 77°F (25°C): 65 Shore A
 - 7) Crack bridging after heat aging: 1/8" (3 mm)
 - 8) ASTM D 36, Softening point, ring and ball: 275°F (135°C)
 - 9) ASTM C 836 Elastomeric waterproofing: Exceeds all criteria
 - 10) ASTM D 4060, Abrasion resistance [1,000 gr./1,000 rev., CS-17 wheel]: 1.2 mg loss
- D. Accessories
- 1. Acrylic Coating
 - a. TopGuard 4000 or Approved Equal
 - 2. Walk Pad
 - a. DynaTred Plus or Approved Equal
 - 3. Cant
 - a. FesCant Plus or Approved Equal

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that Work of other trades which penetrates the roof deck or requires personnel and equipment to traverse the roof deck has been completed.
- B. Examine surfaces for inadequate anchorage, foreign material, moisture, and unevenness that would prevent the execution, and quality of application, or the roofing system as specified.
 - 1. Do not proceed with application of roofing system until defects are corrected.
 - 2. This includes the new roof deck, the edges where the existing roof system has been cut and removed, and all related flashings.

3.2 PREPARATION

A. Surface Preparation

1. Inspect wood deck closely for:
 - a. Proper securement of panels to joists,
 - b. Proper space between panels,
 - c. Damaged panels,
 - d. Delamination,
 - e. Warping or rotting.
2. Unacceptable panels should be brought to the attention of the Owner and must be corrected prior to installation of roofing system.
3. Examine underside of deck to ensure all joints are blocked.
4. Insure that wood blocking has been installed at perimeter and as required by specifications and primary roofing manufacturer.
5. Make sure that all counterflashing receivers, curbs, etc., are constructed in such a manner as to provide a minimum 8-inch base flashing height measured from the finished roof's surface to the top of the base flashing membrane.

3.3 HEATING BITUMEN

A. Preparation

1. Use separate kettles or tankers for heating different types of asphalt.
2. Strictly regulate the heating process by means of an automatic thermostatic control of an approved type for positive temperature control.
3. Provide kettles or tankers with the following features:
 - a. Immersion tube,
 - b. Fired by liquid propane gas,
 - c. 100% safety shutoff.
4. Equip each kettle or tanker with a recording thermometer that will graphically indicate and record on a chart the maximum and minimum temperatures to which materials have been heated.
 - a. Provide recording thermometers capable of accurately recording temperatures as high as 600°F and as low as 0°F.
 - b. Properly maintain the thermometer at all times. Do not use kettles or tankers without recording thermometers in good working condition.
 - c. At the end of each workday, turn the chart from the thermometer on each kettle or tanker over to the Owner.
 - 1) If any bitumen is overheated, remove it from the site in the presence of the Owner.
 - 2) If any underheated or overheated bitumen has been applied on the roof, remove and re-apply that portion of the roof.
5. Preferred location for locating and heating the kettle is to place on the ground, with the asphalt pumped to the roof.
 - a. Submit alternative heating kettle location and methods to Owner for approval prior to implementing.

B. Heating Asphalt Bitumen

1. Heat the bitumen in accordance with the Equiviscous Temperature information furnished by the bitumen manufacturer for that specific run of bitumen.
 - a. Do not heat the asphalt to or above the actual COC Flash Point (ANSI/ASTM D92); or the finished blowing temperature for more than 4 hours, in any circumstance.
 - b. Maintain the temperature of the bitumen at the point of application within the Equiviscous Temperature Range.
 - 1) Use insulated pipes, buckets, luggers, and other insulated roofer's equipment as required by the field conditions.
 - 2) Contractor must have at least one hand held thermometer for each crew installing hot asphalt in order to ensure compliance with EVT.
2. The accepted application temperature range for asphalt is the equiviscous temperature (EVT), $\pm 25^{\circ}\text{F}$. All felt installation must occur in this range to be acceptable.

3.4 INSTALLING ROOFING MEMBRANE

A. Preparation

1. Trim all edges of the remaining built-up roof system where removal of a portion of the system has occurred so they are straight and will fit neatly with the new membrane to be installed.
2. Add two rows of one inch cap sheet nails along the perimeter edge where this removal has occurred to ensure that the remaining membrane is well secured to the deck. The fasteners shall be in two parallel rows that are six inches apart. Fasteners shall be installed in not less than twelve inches o. c. along each of the two rows.
3. Clean the immediate four feet of membrane surface surrounding the areas to be installed.
4. Prime the immediate three feet of the membrane surface surrounding the areas to be installed using an acceptable asphalt primer that when dry provides a very tacky surface for the new membrane to adhere to.

B. Installation Summary

1. Fiberglass reinforced base sheet.
 - a. Lay one layer of the base sheet within the removed
 - b. Securement
 - 1) Mechanically-fastened using approved one-inch cap nails and following approved fastening pattern and density.
2. Membrane Installation Sequencing (from substrate to uppermost ply)
 - a. 1 layer of fiberglass reinforced base ply.
 - b. 2 layers of fiberglass reinforced interply sheets
 - c. 1 layer of fiberglass reinforced cap sheet
 - d. Securement
 - 1) Hot asphalt
 - 2) All plies, including cap, will be immediately broomed after being laid into the hot asphalt bitumen to ensure complete imbedment.
 - 3) There will not be less than $\frac{1}{4}$ " bleed-out of the asphalt bitumen at all laps.

- 4) For the cap only: all bleed-out will be immediately surfaced with ceramic roofing granules while the bleed-out is still very hot.

C. Substrate

1. Verify that all requirements for examination and preparation have been met before commencing installation

D. Placing Membrane Layers

1. Start at low edge of the tie-in and work upslope or towards the middle of the area to be replaced.
 - a. Apply full width of base ply in hot asphalt within the defined replacement area following all directions established for the ply sheet.
 - b. The use of half-sheets is not required for this layer.
2. Start at low edge of the tie-in and work upslope or towards the middle of the area to be replaced.
 - a. Apply 1/2 width ply sheet at perimeter of tie-in area.
 - b. Apply all subsequent membrane sheets full width
 - 1) End Laps: 6 inch minimum
 - i) Stagger end laps a minimum of 3 feet
 - 2) Side Laps: 4 inch minimum
 - c. Apply two layers of the ply sheet within the area to be rebuilt and finish at a height equal to the existing roof surface.
 - d. Apply two additional layers over the repair area and stagger them onto the remaining surrounding roof surfaces with the first layer extending two feet and the second six inches beyond the first.
3. Surfacing cap sheet.
 - a. Apply in full width beginning at the low edge of the tie-in and six inches below the last tie-in ply.
 - b. Follow all standards for proper application.

E. Securing Membrane

1. Install each layer so that it is firmly and uniformly set, in hot asphalt, without voids
 - a. Installation Procedure
 - 1) Install at EVT to achieve manufacturer's required mopping weight.
 - 2) Asphalt must bleed out from the sidelaps and endlaps at all locations
 - i) Correct dry edges of any depth
 - ii) Cut out all such edges and patch with an equal number of plies
 - b. Cold Weather Considerations: Strictly follow manufacturer's guidelines for cold weather installation to insure a wrinkle-free installation
 - 1) Utilize a close mopping technique
 - i) Limit mop lead to a maximum of 4 feet in front of the roll and immediately unroll the sheet into the hot asphalt
 - 2) Edges should be 'scuffed in' immediately after rolling the sheet in the asphalt

3.5 INSTALLING FLASHINGS, ACCESSORIES

- A. Temporary Flashings:
1. Provide a temporary waterproof seal at all membrane edges, penetrations, drains, etc. Unless complete flashings are installed immediately (same workday) following the membrane application.
- B. Preparation:
1. Inspect walls, curb heights, counterflashings, etc., and check for conformance with minimum base flashing height of eight (8").
 2. Bring non-conforming areas to the attention of the Owner and correct.
- C. Primer:
1. Prepare and prime substrate surfaces per manufacturer's instructions.
 - a. Abrade and grind surfaces and clean metal surfaces to bare metal when recommended by the manufacturer.
 - b. Follow manufacturer's recommendations for required temperature of substrate and materials, and for filling of voids.
 2. Prime all masonry, metal, or concrete surfaces from the top of the roof membrane to the termination of the flashing level with asphalt primer at the rate of one (1) gallon per 100 square feet or as recommended by the manufacturer.
 3. Allow the primer to dry thoroughly.
 4. Ensure that bonding surfaces to which the seal or flashing are to be placed are clean and free of moisture, dirt, grease, oil, loose material, foreign material, and debris.
- D. Installing Flashings:
1. In addition to guidelines below, consult manufacturer for general flashing guidelines and project specific flashing design.
 2. Provide seals or flashing at penetrations of the roof membrane as required for a watertight roof system, and as indicated, and as approved by the roof system manufacturer for inclusion in the roofing warranty. All seals shall be created using the PermaFlash System or Approved Equal.
 3. Install two ply base flashing system using specified ply sheet and the designated flashing modified bitumen sheet at all intersections formed by changes of plane, and wherever curbed roof openings, wall, parapets, or other structure joint penetrates the roof.
 4. Reference the following diagrams:
 - a. DFE-8 Flashing to Prefabricated Curbs (also applies to on-site constructed wood curbs).
 - b. PMF-4 Curb Corner Detail.
- E. Fluid-Applied Flashing System
1. The fluid-applied flashing system is to be utilized for all vertical penetrations in place of any type of metal penetration flashing (lead or galvanized steel).
 2. Based on PermaFlash System. Follow manufacturer's instructions.

- a. Lay out reinforcement fabric around penetration and cut to fit. Wrap fabric around penetration and bridge all vertical to horizontal transitions.
 - b. Apply fluid-applied flashing directly to prepared substrate. Adhere fabric by pressing into the fluid-applied flashing while still wet.
 - c. Completely cover fabric with at least 60 mil coat wet film thickness of fluid-applied flashing, and as required by the manufacturer.
 - d. Extend top coat of fluid-applied flashing system 2 inches beyond edges of reinforcement fabric.
 - e. Wherever possible apply the fluid applied flashing over the ply sheets and install the surfacing cap membrane over the field portion of the fluid applied flashing.
 - f. Reference the following diagrams:
 - 1) PMF-6 Pipe Penetration Detail
 - 2) PMF-6S Pipe Penetration Scrim Detail (shows part of PMF-6 in greater detail)
 - 3) PMF-4 Curb Corner Detail
 - 4) PMF-1S I-Beam Detail
 - 5) PMF-2S Angle Iron Detail
- F. Acrylic Coating, Final Surfacing (Field, Penetrations, Walls):
1. Based on TopGuard 4000.
 - a. After surfaces have been properly prepared apply the designated acrylic to all roof liquid applied flashings.
 - b. Apply in two coats at a rate of 1.5 gal./sq. per coat for a total application rate of not less than 3.0 gal./sq.
 - c. Allow the first application to fully dry prior to application of the second coat. The coating will only be applied with proper spray equipment.
- G. Internal Cast-Iron Drains:
1. Re-use all drains that are in suitable condition.
 2. All drains will have cast-iron screens that are without defect.
 3. Reference the following diagram:
 - a. DFE-11 Cast Iron Drain Detail (modified by PMF-5S).
 - b. PMF-5S PermaFlash Drain Scrim (shows PermaFlash System used in place of sheet lead as shown in DFE-11).
 4. Flashing to metal drain: Run the membrane plies to the edge of the drain opening. Prime a 30" min. square piece of lead flashing (min. 2-1/2 lbs/sf) on both sides with JM metal primer and apply to the roof surface in MBR flashing cement, MBR utility cement or hot asphalt. Cover the lead flashing with a layer of modified bitumen membrane sheet, set in MBR flashing cement, MBR utility cement or hot asphalt. Extend the modified bitumen flashing piece 4" min in all directions. The membrane, lead flashing, and flashing piece should all extend under the clamping ring. Attach the clamping ring and tighten uniformly.
- H. Installing Walkway Pads/Splash Block/Protection Pad:
1. Set the pads in a five 1/4"x6" applications of the acceptable SBS modified plastic cement compatible with the cap sheet material.

2. Leave adequate space between pads so that positive drainage is not affected from installation.

3.6 FIELD QUALITY CONTROL

- A. Field Samples
 1. Draw a quart sample from each load of bitumen arriving at the job site in the presence of the Owner, who will take it for laboratory analysis. (if required)
- B. Test Strip (if requested by the Owner):
 1. When and where directed by the Owner, and before surfacing is applied to the completed membrane:
 - a. Cut a strip 3" wide by 40" long thru all plies of the roofing system. Number of such test strips may be as required by the Owner.
 - b. After removal of the strip, immediately repair the area by applying the same number of plies of the same kind of felt and bitumen over the filled strip with the first ply.
 - 1) Lap each edge 12" and each succeeding ply lapping the preceding ply by at least 3" on all edges.
 - c. Approximate quantities of components within roofing membrane will be determined according to ASTM D 3617.
- C. Non-Compliance:
 1. Failure of the bitumen samples or the test strip samples to meet the Specification requirements will be cause for rejection of the Work.

3.7 INSPECTION

- A. After all roofing system Work is completed, provide an inspection by the roofing system manufacturer's representative. Representative must be employed expressly as a technical employee and not concurrently function in a sales role. Provide, via the representative, documentation verifying that roofing system has been installed according to the Specifications.

3.8 CLEANING

- A. Keep newly installed roofing membrane clean and new in appearance under the assumption that all areas of roofing are aesthetically essential. Contractor may be directed to remedy – and if no remedy available – replace, newly roofed areas that are not maintained as such during the balance of installation.
- B. Restore all other building surfaces and areas affected by roofing application to same condition of aforementioned on day of job start.
- C. Remove all debris from roof and staging areas.

END OF SECTION

DIVISION 8

DOORS AND WINDOWS

SECTION 08112

STEEL DOORS

PART I GENERAL

1.1 DESCRIPTION

- A. Section Includes: steel doors and associated accessories.

1.2 REFERENCES

- A. ASTM A653/ A653M. Standard Specification for Steel sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- B. SDoI 100. "Recommended Specifications for Standard Steel Doors and Frames".

1.3 SUBMITTALS

- A. Steel Door:
 - 1. Manufacturer's literature describing products.
 - 2. Samples: Only as requested by Owner.
 - 3. Shop Drawings: Show door type, location, material, construction, finishing, accessories, and preparation for installing hardware.
 - 4. Certificates: Certify compliance with standards designated, governing codes, and applicable labeling agencies.
- B. Hardware
 - 1. Templates: Furnish hardware templates to be factory prepared for installation of hardware.
 - 2. Upon completion of installation and adjustment, turn over to the Owner all factory furnished installation aids, instructions and maintenance guides.

1.4 PRODUCT DELIVERY AND STORAGE

- A. Deliver all materials in protective packaging and store as recommended by the manufacturer within a dry enclosed space in a manner that will prevent rust and damage. Do not create a humidity chamber by using plastic or canvas shelter that is not adequately vented.

PART 2 PRODUCTS

2.1 PRODUCTS

- A. Door Manufacturers: Steelcraft Manufacturing Co.; Titan; Amweld Building Products; Fenestra Division of the Marmon Group; or Approved Equal
- B. Flush Doors:
 - 1. (Pair) 2880 x3/4" Steelcraft B14, with Galvannealed finish, shop welded 14 ga astragal. Door faces shall be flush and seamless.
- C. Hardware Manufacturers:
Manufacturers listed have been used to establish quality standards in the hardware schedule. Approved Equals may be substituted in all cases.
 - 1. Butts: Stanley; Hager; McKinney.
 - 2. Locksets, Latchsets, Cylinders: Schlage.
 - 3. Drip: Builders Brass; Ives; Sargent.

2.2 MATERIALS

- A. Sheet Steel:
 - 1. Exterior Doors: Galvannealed sheet steel, zinc coated (galvanized) to meet requirements of ASTM A653 coating designation. Top of doors will be exposed to weather. Seal top of door by adding a metal top cap to doors, seal cap to the door edges.
- B. Door Frame: Commercial grade, cold-rolled steel, extra heavy duty, Galvannealed, double rabbet. 10-1/2" jamb depth. Two jambs, no head, prep for hinges. Steel Craft, F-Series, F-16. or Approved Equal. Weld a galvanized cap to cover top of each jamb to exclude water from entering the jamb.
- C. Sound-Deadening Material: Chemically inert, incombustible, moisture-resistant; as recommended by accepted door manufacturer.
- D. Primer: As standard with accepted manufacturer.

2.3 FABRICATION

- A. Preparation:
 - 1. Coordinate details with other work supporting or adjoining doors.
 - 2. Verify frame details; obtain approved hardware schedule, templates, and other information.
 - 3. Verify size, and design of each opening.
- B. Material Usage:
 - 1. Fabricate exterior doors from galvanized sheet steel.

- C. General:
 - 1. Reinforce and weld joints. Use no exposed fasteners.
 - 2. Bevel striking edge 1/8-inch in two inches.
 - 3. Exterior Doors: Provide weep holes at bottoms; make tops waterproof; provide astragals at pair of doors.
 - 4. Door Edges: Fabricate flush. Seams will be permitted only if uniform and run continuous from top to bottom of door.

- D. Flush Doors:
 - 1. Face Sheet Gauges: Use minimum 16 gauge at exterior doors.
 - 2. Typical Construction:
 - a. Weld face sheets to minimum 16 gauge internal framing running full height of door with members spaced no more than six inches apart.
 - b. Weld face sheets continuous to 16 gauge channel to form edges.
 - c. Fill voids between face sheets and framing members with sound-deadening material.

- E. Astragals: Provide on pair of exterior doors.

2.4 FINISHES

- A. Preparation: Grind smooth all edges and rough spots; apply metallic filler and sand where necessary to achieve smooth surface; thoroughly clean surfaces of rust, grease, and other impurities.
- B. Exterior Doors: After fabrication, touch up abraded galvanizing, chemically etch, and apply one coat primer paint.

2.5 HARDWARE

- A. Hinge: (3 pair) Stanley FBB full-mortised hinges, stainless steel, with ball-bearings and non-removeable pins.
- B. Lockset: Trimco 1098 safety and security lockset with storeroom function, interchangeable core. Provide keys coordinated with Water Agency keying standard. Schlage D80 Rhodes 626 or Approved Equal.
- C. Cane bolt mounted on inside face of inactive leaf.
- D. Door bottom: Pemko 345a
- E. Or Approved Equals

PART 3 EXECUTION

3.1 INSPECTION

- A. Examine receiving frames and reviewed hardware schedules to verify proper coordination with doors.

3.2 INSTALLATION

- A. Install doors at correct opening, insure smooth swing and proper closure with frame.
- B. Hardware: All Hardware Items shall be set in a precise manner. Hinge leaves shall set snug and flat in mortises, screws shall be turned (not driven) to a flat seat and all moving parts shall operate freely without excessive play. All hardware shall be installed with Phillips head type screw, with screw alloy to match hardware.
- C. Check each operating item of hardware and each door to ensure proper operation of function of every unit. Lubricate moving parts with lubrication type recommended by the manufacturer (graphite type if no other is recommended). Replace units which cannot be adjusted and lubricated to operate freely and smoothly as intended.

3.3 DEFECTIVE WORK

- A. Replace, rework, or otherwise make good as required doors or finish hardware found defective as follows:
 - 1. Items broken, damaged, disfigured, or defaces.
 - 2. Incomplete, misaligned, or incorrectly located items.

END OF SECTION

DIVISION 9

FINISHES

SECTION 09223

PORTLAND CEMENT STUCCO

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Three coat cement plaster with finish coat.
- B. The types of stucco basecoat assembly include: Factory blended cement plaster basecoat for Site mixing to provide scratch and brown coats to receive cement colored stucco finish

1.2 REFERENCES

- A. ASTM C926 "Standard Specification for Portland Cement and Portland Cement-Lime Plastering, Exterior (Stucco) and Interior".
- B. ASTM C1063 "Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster"

1.3 DEFINITIONS

- A. Definitions of Plaster Thickness: Minimum overall thickness measured from face of support to face of finish coat. Thickness includes lath

1.4 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. Scratch and Brown stucco that is a factory blended formulation of portland cement, lime, and proprietary ingredients. For use with jobsite added ASTM C 897 stucco sand and clean potable water.
 - 2. Plaster systems shall provide suitable base for finishes.
- B. Performance Requirements:
 - 1. Exposed finish surfaces shall be true, even, without waves, cracks, or imperfections. Cracks, blisters, pits, or discoloration will not be acceptable. C. Allowable Tolerances: Surface tolerance shall be limited to 3/16-inch in 8 feet with maximum inward and maximum outward allowance not occurring in less than 20 feet.

1.5 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's literature describing stucco cement plaster product.
 - 2. Samples: Color and texture material sample 3" round.
- B. Quality Assurance/Control Submittals:
 - 1. Certification: Manufacturer's certification that materials meet the Specification requirements.
 - 2. Manufacturer's Instructions:

- a. Stucco base and finish coat installation

1.6 QUALITY ASSURANCE

A. Delivery, Storage, and Handling

1. Deliver manufactured materials in original packages or containers.
2. Remove wet, frozen, damaged or detrimental materials from Site immediately.
3. Storage and Protection: Keep materials dry, above freezing, stored off ground, under cover and away from damp surfaces.

1.7 PROJECT CONDITIONS

A. Project Environmental Requirements: Environmental Conditions:

1. Installation Ambient Air Temperature: Minimum of 40°F (4°C) and rising, and remain so for 48 hours thereafter. Maximum Ambient Air Temperature of 120°F (49°C).
2. Protect stucco from uneven and excessive evaporation during hot, dry weather.
3. Do not use frozen materials in cement stucco.
4. Do not apply cement stucco to frozen surfaces or surfaces containing frost or ice.
5. Inclement Weather: Do not apply basecoat during inclement weather, unless appropriate protection is employed.
6. Wall and Substrate Temperatures: Avoid, when possible, installation of the basecoat and the finish coats over substrates that are over 120°F (49°C).

1.8 SCHEDULING

- A. Coordinate Work with all trades so as to effect the earliest completion of the Work in conformance with the Specifications and Drawings. Ascertain that all required inspections and installations by other trades have been made prior to proceeding with the Work.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Stucco base and finish coats: LaHabra Stucco, by ParexLahabra, Inc., 4125 E. LaPalma Ave, Anaheim, CA 92807 (877) LHSTUCCO or Approved Equal
- B. Existing Products.
 1. New stucco to match existing electrical enclosure in finish texture and color.

2.2 MATERIALS

- A. Lath and Trim Accessories: Conform to ASTM C1063 lathing and furring.
 1. Terminations: J-metal or stucco stop, general purpose type with expanded or perforated flanges.
 2. Corner reinforcement: (galvanized welded wire, minimum 18 gage): Manufacturer's standard pre-formed corner reinforcement made from 1.7 lbs. (0.059 kg/m²) per square yard of diamond mesh lath.
 3. Square edge corner beads: expanded or flanged to suit application (for square corners).
 4. Round-edged corner beads: expanded or flanged to suit application (for rounded corners).

5. Control joints: single component control joints with 1/4-inch (6.35mm) slots and 3/4-inch (19.05mm) grounds, or Approved Equal.
 6. Expansion joints: Two piece adjustable expansion joints, free floating adjustments from 1/4 inch (6.35mm) to 5/8 inch (15.88mm) or Approved Equal
 7. Weep screeds: foundation weep screed, with perforations and minimum 3-1/2 inch (88.9mm) vertical attachment flange.
- B. Fasteners for Attaching Trim and Accessories
1. Concrete and Concrete Masonry: Power driven pins of sufficient length to penetrate 3/4 inch (19mm) or threaded fasteners inserted to the fastener manufacturer's specified depth. Washer diameter for fasteners as specified by the fastener manufacturer.
- C. Portland cement stucco basecoat: LaHabra's proprietary and factory-blended BasiC926 scratch and brown basecoat assembly.
1. BasiC926 Sanded or Approved Equal: Manufacturer's standard factory formulated, sanded scratch and brown stucco basecoats consisting of portland cement, lime, properly graded aggregate, fibers, and proprietary ingredients.
- D. Water: Potable.
- E. Finish Coat, Cement Stucco
1. LaHabra Colored Stucco: Colored stucco finish coat, consisting of portland cement, lime properly graded aggregate, colorant and proprietary ingredients.
 2. Or Approved Equal
 3. FogCoat: Colored Fog-coat spray, (as needed for color uniformity) consisting of portland cement, lime, colorant, and proprietary ingredients.
 4. Or Approved Equal

PART 3 EXECUTION

3.1 INSPECTION

- A. Substrate Examination: Examine prior to basecoat installation as follows:
1. Substrate shall be of a type listed in International Building Code or as required by local codes and agency's having jurisdiction. Substrate shall be examined for soundness, and/or other harmful conditions.
 2. Substrate shall be free of dust, dirt, efflorescence, and other harmful contaminants.
 3. Notify Owner of discrepancies preventing installation of the stucco assembly.
 4. Verify that weather resistive barrier and flashing are installed in compliance with requirements of applicable codes, regulations, and agencies having jurisdiction.
 5. Examine substrates, grounds and accessories to insure that finished stucco work will be true to line, plane, level and plumb.

3.2 PREPARATION

- A. Protection:
1. Protect adjacent finished surfaces prior to stuccoing.
 2. Maintain protection in place until completion of Work.

3. Protect finished work when stopping for the workday or when completing an area

B. Surface Preparation:

1. Conform to preparation requirements of ASTM C926.
2. Verify that masonry and concrete surfaces to receive direct bond applications of stucco basecoats are rough, free from form release agents and otherwise properly prepared to provide for adequate bond.
3. Apply a uniform coating of the acrylic bonding agent in accordance with manufacturer's recommendations and instructions.

3.3 INSTALLATION

- A. At the time they are mixed, all materials shall be at a minimum temperature of 40°F (4°C)

- B. Interrupt stucco application only at junctions of stucco planes, at openings and at control joints

C. Basecoat:

1. Apply scratch coat to a thickness of 3/8 inch (10mm) using sufficient trowel pressure to key stucco into lath or onto direct bond substrate.
2. Scratch horizontally in order to provide for a key with the brown coat.
3. Apply Brown coat after 48 hour curing over scratch coat to a thickness of 3/8 inch (9.5mm) using sufficient trowel pressure or spray velocity to key brown coat into scratch coat.
4. Darby, then rod surface to true plane.
5. Float or lightly broom surface to provide bond with cement finish coat.
6. Tool brown coat to provide a V-joint at intersection of stucco with frames or other items of metal, wood, or plastic that act as stucco grounds.

D. Finish Coat: Cement Stucco Finish

1. Apply exterior wall finish coat after 7 - 10 days to thickness recommended by manufacturer to achieve texture indicated, using sufficient trowel pressure or spray velocity to bond finish coat to basecoat.
2. Apply exterior wall finish in number of coats and consistency required to achieve texture to match approved sample.
3. Fog Coat: As needed, apply sufficient coats to ensure uniform color and consistency. Let dry, then mist with water 2 times a day for 2 days.
4. Water Repellent: After cement stucco finish has fully cured for 28 days, apply water repellent by brush, roller, or spray at a rate that is recommended by manufacturer. Apply from corner to corner, starting at bottom and working to top.

3.4 CURING

- A. Moist cure cement basecoat with a fog spray of clean water in sufficiently frequent applications to maintain stucco uniformly moist for a minimum of 48 hours following applications.
- B. Moist cure cement finish coats a fog spray of clean water in sufficiently frequent applications to maintain stucco uniformly moist for a minimum of 48 hours following applications.

3.5 CLEANING

- A. Patching:
 - 1. Repair damaged exterior wall finish coat to match surrounding finish.
- B. Cleanup:
 - 1. Remove excess finish and protective materials from adjacent surfaces.
 - 2. Remove all excess materials from the Site.

END OF SECTION

SECTION 09510

ACOUSTICAL CEILINGS

PART 1 GENERAL**1.1 DESCRIPTION**

- A. Section Includes: acoustical ceiling work and associated accessory items including, but not necessarily limited to, the following:
 - 1. Non-fire rated suspended metal grid system complete with wall trim.
 - 2. Acoustical ceiling panels

1.2 REFERENCES

- A. ASTM C635, "Standard Specification for 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 Panels", except as otherwise specified herein.
- C. Standards for Terminology and Performance: Applicable publications by Acoustical and Insulating Materials Association (AIMA), including "Performance Data, Architectural Acoustical Materials.
- D. ASTM A641 Standard Specification for Zinc-Coated Carbon Steel Wire.
- E. Federal Specifications SS-B-118B Sound Controlling (Acoustical) Tiles and Panels
- F. ASCE Simplified Seismic Design Procedure
- G. Acoustical Material Association Bulletin

1.3 QUALITY ASSURANCE:

- A. Standards of Manufacture: Manufacturers designated herein indicate quality of materials to be used on the Site. Equivalent products of other manufacturers may be provided.
 - 1. Types of Materials shall be as indicated herein. Each type shall be the product of one manufacturer, with identical color and texture throughout. All acoustical materials approved for use on the Site shall be guaranteed to provide the acoustical characteristics, within plus or minus 10% of the coefficients as published in the current issue of the Acoustical Materials Association Bulletin.

1.4 SUBMITTALS

- A. Product Data: Acoustical material and suspension system.
- B. Samples: Samples show full range of exposed color and texture variations to appear in finished work.

1. Submit two (2) 12" x 12" samples each of acoustical panels.
 2. Submit one (1) 6" long full size sample of suspension system member (include joint connection) and mouldings.
- C. Certificates: Furnish certification that all materials and systems conform to specification requirements.
- D. Quality Assurance/Control Submittals:
1. Manufacturer's Instructions:
 - a. Acoustical material and suspension system.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in original, unopened protective packaging with manufacturer's labels indicating brand name, pattern, size and thickness; legible and intact.
- B. Store materials in original protective packaging to prevent soiling, physical damage or wetting. Store cartons open at each end to stabilize moisture content and temperature.
- C. Handle materials in such a manner as to prevent damage to products or finishes.

1.6 WORK SEQUENCE

- A. Do not install acoustical work until building areas are enclosed, heating and air conditioning system is operating, dust generating activities have terminated., and overhead mechanical (tested and approved) and electrical work are completed.
- B. Permit wet work to dry prior to commencement of installation.

1.7 EXTRA MATERIALS

- A. Replacement Panels: Furnish the Owner with a minimum of one (1) box (minimum of 8 panels), each of acoustical lay-in panels from the same "run" and matching units installed on the Site. Plainly mark the color, pattern and manufacturer of the replacement panels.

PART 2 PRODUCTS

2.1 CEILING SUSPENSION SYSTEM

- A. Match existing exposed metal grid system construction, style, finish and color, except where required to meet current code.
- B. Acoustical ceiling tiles, removed from areas subject to renovation, which are in good condition, shall be re-used. Place tiles in locations to provide matching coloration, pattern and texture with adjacent existing tiles.
- C. Comply with ASTM C635, as applicable to type of suspension system required for ceiling units indicated.

1. Main and Cross Members and Wall Angles: Galvanized steel or extruded aluminum alloy 6063-T5.
 2. Structural Class: Heavy-duty system
 3. Attachment Devices: Size for 5 times design load indicated in ASTM C635, Table 1 Direct Hung.
 4. Hanger Wires: Galvanized carbon steel, ASTM A641, soft temper, prestretched, yield-stress load of at least 3 times design load, but not less than 12 gauge (0.106 inch).
 5. Acceptable System Manufacturers:
 - a. Chicago Metallic Corp.
 - b. Donn Products, Inc.
 - c. Armstrong
 - d. Or Approved Equal
- D. System Type: Direct-hung T-bar suspension system; Manufacturer's standard exposed runners, crossrunners and accessories, of type and profiles indicated, with exposed cross-runners coped to lay flush with main runners.
- E. Finish of Exposed Members: Provide uniform factory applied finish on exposed surfaces of ceiling suspension system including mouldings, trim and accessories; color white.

2.2 LAY-IN ACOUSTICAL PANELS

- A. General: lay-in panels as manufactured by Armstrong, or Approved Equal, conforming to Fed. Spec. SS-B-118B, Class A (incombustible). The material shall also be classified by UL under hazard classification for flame spread of 0 to 25.
1. Acoustical lay-in board shall have noised reduction coefficient (NRC) of 50 to 60, and ceiling sound transmission class (STC) of 35-39 (continuous ceiling).

PART 3 EXECUTION

3.1 INSPECTION

- A. Examine areas to receive acoustical treatment and verify that:
1. Installation of building components located above ceiling is complete.
 2. Spacing, direction, and details of grid members and supports to accommodate installation of light fixtures, diffusers, and other items.
 3. Areas are clean and free of materials or rubble that could damage acoustical work.
- B. Do not proceed with work until unsatisfactory conditions have been corrected to the satisfaction of the installer. Work in progress on any surface shall be assumed as acceptable to the acoustical contractor.

3.2 PREPARATION

A. Coordination with Other Work:

1. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Pattern shall be uniform and symmetrical, square with the building. Avoid use of less-than half width units at borders, and comply with reflected ceiling plans wherever possible.

3.3 SUSPENSION SYSTEM INSTALLATION

A. The ceiling suspension system shall be installed straight and level to within 1/8" in 12' with joints neat and uniform, and fitted to hairline joints between adjoining members. Grid shall be rigid and free of burrs, dents, rough edges or defects of any kind, and of one uniform color.

B. Install lateral bracing (seismic restraint) for all acoustical ceilings as required by CBC, ASTM C635, ASTM C636 and ASCE 7-05.

1. Lateral force bracing shall be 12' o. c. maximum and begin not farther than 6' from walls.
2. Lateral force bracing is not required for ceilings less than 144 square feet provided they are surrounded by 4 walls and braced to structure.
3. Seismic splay wires shall be attached to the grid and to the structure such that they can support a design load of not less than 200 pounds or the actual design load, with a safety factor of 2 which ever is greater.
4. Seismic splay wires are to be (4) 12 gage wires attached to the main beam. Wires are arrayed 90° from each other and at an angle not exceeding 45° from the plane of the ceiling.
5. Ceilings with plenums less than 12" to structure are not required to have lateral force bracing.

C. Hanger Wires

1. Hanger wires shall be 12 gage and spaced 4 feet o. c. or 10 gage spaced 5 feet o. c.
2. Saddle-tied hanger wires shall be wrapped around itself a minimum of three (3) times.
3. Hanger wires shall be provided for all main runners and cross runners within 8 inches of ceiling perimeters.
4. Hanger wires and unbraced ducts, pipes, etc. must be separated by at least 6 inches.
5. Hanger wires that are more than 1 in 6 out of plumb shall have counter sloping wires.
6. Hanger wires shall not attach to or bend around interfering material or equipment. A trapeze or equivalent device shall be used where obstructions preclude direct suspension. Trapeze suspension shall be minimum back to back 1-1/4" cold rolled channels for spans exceeding 48".

D. Compression Struts

1. Struts may be EMT conduit, metal studs or a proprietary compression post.
2. Struts must be positively attached to the suspension systems and the structure above.
3. Maximum length for compression struts:

METAL STUDS

- Single stud 1-5/8" (20 ga.) up to 12'-0"
- Back to back 1-5/8" (20 ga.) up to 15'-0"
- Single stud 2-1/2" (20 ga.) up to 13'-6"
- Back to back 2-1/2" (25 ga.) up to 15'-0"

EMT CONDUIT

- 1/2" EMT conduit up to 5'-10"
- 3/4" EMT conduit up to 7'-8"
- 1" EMT conduit up to 9'-9"

Plenum areas higher than 15'-0" require engineering calculations.

4. Referenced sources: IBC, ASTM C635, ASTM C636, ASCE 7-05
- D. Hanger Wire Anchorage to Structure:
1. Do not hang wires from ductwork, pipes, electrical or telephone conduits.
 2. Anchor to structure as indicated, or to existing metal deck with concrete fill, drill holes in concrete approved expansion eye bolt. Anchor wires to bolt.
 3. Any connection device at the supporting construction shall be capable of carrying no less than 100 lbs.
 4. Powder driven shot-in anchors are an approved method of attachment for hanger wires
- E. Suspension System (Exposed Grid): Securely fasten wall angles to wall surfaces to provide a rigid and level installation. Suspend main tees from structure above with wires near each end and spaced 4'-0" o.c. Main runners shall be spaced at 4'-0" o.c. with cross runners spaced at 2'-0" o.c.
1. Cope exposed flanges of intersecting suspension system members so that flange faces will be flush (cope flange of member supported by other member).
 2. Install edge mouldings at intersection of ceiling and vertical surfaces, using maximum lengths, straight, true to line and level. Miter corners.
 3. Terminal ends of each main beam and cross tees must be supported within 8" of each wall with a perimeter wire.
- H. Seismic Separation Joints
1. For ceilings areas exceeding 2,500 s.f., a seismic separation joint of full height wall partition that breaks the ceiling shall be provided.
 2. In lieu of seismic separation joints, the ceiling may be divided into areas less than 2,500 s.f. by the use of partitions or soffits as follows: partitions shall extend a minimum of 6" above the level of the plane of the grid and shall be independently supported and laterally braced to the structure above.
 3. Other than partitions and soffits, seismic joints may not be used as a part of a fire rated ceiling assembly unless substantiated documentation is provided.

- I. Electrical Fixtures
 - 1. Light fixtures weighing less than 10 lbs. shall have one 12 gage hanger wire connected from the fixture to the structure above. This wire may be slack.
 - 2. Light fixtures weighing more than 10 lbs. and less than 56 lbs. shall have two 12 gage wires attached at opposing corners of the light fixture to the structure above. These wires may be slack.
 - 3. Light fixtures weighing more than 56 lbs. shall be supported by two 12 gage wires directly from the structure above these wires must be taut.
 - 4. Pendant mounted fixtures shall be directly supported from the structure above using a 9 gage wire or an approved alternate support without using the ceiling suspension system for direct support.
 - 5. Tandem fixtures may utilize common wires

- J. Mechanical Services
 - 1. Terminals or services weighing 20 lbs. but not more than 56 lbs. must have two 12 gage wires connecting them to the ceiling system hangers or the structure above. These wires may be slack.
 - 2. Terminals or services weighing more than 56 lbs. must be independently supported directly from the structure above. These wires must be taut.

- K. Sprinklers
 - 1. For ceilings without rigid bracing, sprinkler head penetrations shall have a 2" oversize ring, sleeve or adapter through the ceiling to allow free movement of at least 1" in all horizontal directions. Flexible head design that can accommodate 1" free movement shall be permitted as an alternate.

3.4 ACOUSTICAL PANEL INSTALLATION

- A. Fit acoustical lay-in panels in place, free from damaged edges or other defects detrimental to appearance and function. Lay directionally patterned units one way with pattern parallel to shortest room axis. Fit border units neatly against abutting surfaces.
- B. Install lay-in panels level, in uniform plane and free from twist, warp and dents.
- C. Install hold-down clips for each lay-in unit, spaced as recommended by unit manufacturer for application indicated, except do not exceed spacings required by governing regulations.
- D. Scribe and cut units accurately at penetrations and edges requiring cut units.

3.5 ADJUST AND CLEAN

- A. Cleaning and Finishing: Upon completion of ceiling work clean ceiling board surfaces and exposed portions of suspension system, removing any discoloration or foreign matter, and touch up all exposed, abraded or cut areas and exposed edges with finishing material recommended by manufacturer. Touch-up shall not be obvious.

- B. Adjustments and Defective Work: Adjust any sags or twists which develop in ceiling systems; remove and replace damaged or improperly installed suspension system components or acoustical panels.
- C. Protect installed-acoustical work against damage from other construction work.

END OF SECTION

SECTION 09900

PAINTING

PART 1 GENERAL

1.1 DESCRIPTION

- A. Section Includes: Paints and finishes
1. Work includes, but is not limited to, painting of following items, materials, and spaces:
 - a. All exposed surfaces, except as otherwise specified or indicated.
 - b. Exposed mechanical and electrical items, such as piping, conduit, ductwork, panelboards, grilles, and other similar items including their supports except items noted as factory-finished.
 - c. The following exposed mechanical and electrical items shall be field painted to match adjacent surfaces even if the items are factory-finished: Wall and ceiling diffusers/registers; flush-mounted electrical panelboards and cabinets.
 - d. Semi-visible areas behind registers, grilles, diffusers and screen vents.
 2. Work does not include painting following items, materials or spaces:
 - a. Surfaces concealed within furred areas, except insulated pipes and ducts that have insulation primed.
 - b. Concrete traffic or walking decks, walks, steps, and ramps; unless specified or indicated otherwise.
 - c. Finished metal, such as stainless steel, chromium plated, bronze, aluminum, and similar finished materials, unless noted otherwise.
 - d. Factory-finished equipment and materials, such as resilient and rubber floor coverings, sheet vinyl flooring, plastic laminated covered wood doors, carpet, ceramic tile, vinyl wall covering, preformed metal roofing, plastic laminate covered casework, metal lockers, tackboards and acoustical materials.
 - e. Interior spaces, interior and exterior areas or surfaces specifically noted not to be painted.
 - f. Operating Parts: Moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sinkages, sensing devices, motor and fan shafts, unless otherwise indicated.
 3. Surfaces for which painting is prohibited:
 - a. Do not paint over any code-required labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.
 - b. Elastomeric sealants.
 - c. Fire sprinkler heads, fire and smoke detectors and fire detector wiring.

B. Definitions:

1. The term "paint" as used throughout these Specifications includes emulsions, enamels, paints, stains, varnishes, sealers, fillers and, other coatings whether used as prime, intermediate or finish coat.
2. Factory Finish: Factory-applied painting system consisting of primer and finish coats.

1.2 REFERENCES

- A. NFPA
- B. SSPC SPI 1, Surface Preparation
- C. SSPC-SP 6-63 Commercial Blast Cleaning.

1.3 QUALITY ASSURANCE

- A. Paint Coordination: Provide finish coats which are compatible with prime coats used. Review other Sections of these Specifications in which prime paints are to provided to ensure compatibility of total coatings system for various substrates. Upon request from others, furnish information characteristics of finish materials proposed for use, to ensure that compatible prime coats are used. Provide barrier coats over incompatible primers or remove and reprime as required. Notify Owner in writing of any anticipated problems using coating systems as specified with substrates primed by others.

1.4 REGULATORY REQUIREMENTS

- A. Color-code the painted components of fire protection systems in accordance with National Fire Protection Association (NFPA) Standards and local Fire Department.

1.5 SUBMITTALS

- A. Product Data: Manufacturer's technical information describing products, including paint label analysis and application instructions for each material proposed for use.
- B. Samples: Except where paint color is to "to match existing", selection of colors and finishes will be made by Owner from manufacturer's standard color fan. Submit (4) 8x10 color samples (paint out) of each color selected by Owner.
- C. Quality Assurance/ Quality Control Submittals, Certificates:
 1. Compliance to EPA Policy: Furnish certification that all paint coatings furnished for the Site comply with the EPA Clean Air Act for permissible levels of volatile organic content for architectural coatings applied in California as designated by California Air Resources Board (CARB).

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. All materials shall be delivered to the Site and stored in their original containers with seals unbroken and labels intact until time of use. Labels shall contain the following information:
 - 1. Name or title of material.
 - 2. Manufacturer's stock number and date of manufacture.
 - 3. Manufacturer's name.
 - 4. Contents by volume, for major pigments and vehicle constituents.
 - 5. Thinning instructions.
 - 6. Application instructions.
 - 7. Color name and number.

- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.
 - 1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.7 JOB CONDITIONS

- A. Environmental Requirements:
 - 1. Apply water-base paints only when temperature of surfaces to be painted and surrounding air temperatures are between 50 degrees F and 90 degrees F unless otherwise permitted by paint manufacturer's printed instructions.
 - 2. Apply solvent-thinned paints only when temperature of surfaces to be painted and surrounding air temperatures are between 45 degrees F and 95 degrees F, unless otherwise permitted by paint manufacturer's printed instructions.
 - 3. Apply paint under dry and dust-free conditions. Do not apply paint in rain, fog, or mist; or when relative humidity exceeds 85%; or to damp or wet surfaces; unless otherwise permitted by paint manufacturer's printed instructions.
 - 4. Painting may be continued during inclement weather only if areas and surfaces to be painted are enclosed and heated within temperature limits specified by paint manufacturer during application and drying periods.
 - 5. Provide adequate ventilation so that humidity cannot rise above the dew point of the walls.

- B. Illumination: Perform work under adequate and approved lighting conditions.

- C. Protection: Properly protect floors and other adjacent work by drop cloths or approved coverings during painting operations.

1.8 WARRANTY

- A. Provide (2) year warranty period for exterior painting covering paint failure due to surface conditions, materials or application.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Materials for use on this Site shall be “best” grade products of the types specified and listed below as regularly manufactured by the specified paint and varnish manufacturers. Materials not bearing the manufacturer’s identification as a standard “best” grade product of their regular line will not be considered for use. Materials listed hereunder are taken from manufacturers listed and shall be used as the standards required.
- B. Manufacturers include the following:
1. Vista Paints;
 2. Fuller-O’Brien;
 3. Kelly Moore;
 4. Sherwin-Williams;
 5. Textured Coatings of America.
 6. Or Approved Equal
- C. Materials (including primers and undercoats) selected for use for each type of surface shall be the product of a single manufacturer wherever possible. Product numbers listed are as manufactured by Vista Paints unless indicated otherwise.
1. Cement Plaster (Stucco), Concrete Surfaces indicated to be painted and Concrete Masonry Units:
 - a. One (1) coat 4600 Uniprime II Primer
Two (2) coats 1900 Weathermaster 100% Acrylic Flat Latex.
 2. Exposed Steel and Metal: On all exterior steel and metal surfaces (except surfaces specified to be factory prefinished) including steel columns, steel doors and frames, steel guardrails and railings, sheet metal items, gutters, metal downspouts, steel grilles and framing, pipe vents, all screeds and items not prefinished apply the following paint system. Where semi-gloss finish is directed by the Owner, mix finish coat with flattening paste as recommended by the manufacturer to produce semi-gloss finish.
 - a. Galvanized Metal:
Pretreatment Jasco Prep-N-Prime
One (1) coat: 4800 Metal Pro White, or 4810 Red Oxide if not previously primed
Two (2) coats: 9700 Protec Water-based Semi-Gloss Enamel
 - b. Ferrous Metal (except as otherwise specified):
One (1) coat: 4800 Metal Pro White, or 4810 Red Oxide if not previously primed
Two (2) coats: 9700 Protec Water-based Semi-Gloss Enamel
 - c. Machinery and Equipment:
One (1) coat: 4800 Metal Pro White, or 4810 Red Oxide if not previously primed
Two (2) coat: 9700 Protec Water-based Semi-Gloss Enamel
 - d. Top Side of Preformed Galvanized Metal Roof Panels and Gutter:
Two (2) coat: 4800 Metal Pro Coating Primer/Finish
Custom color to match existing building
 - e. Structural Steel:
Two (2) coat: 4800 Metal Pro Coating Primer/Finish
One (1) coat 9900 Water-based Gloss Enamel
Custom color to match existing building.

Or

Two (2) coats Amerlock 2 VOC Compliant Epoxy by PPG Amercoat

<http://ppgamercoatus.ppgpmc.com>

Custom color finish coat to match existing building.

- f. Semi-visible areas behind registers, grilles, diffusers and screen vents, etc. paint flat black.

D. Cleaning Solvent: Steel Structures Painting Council SSPC-SPI 1.

PART 3 EXECUTION

3.1 INSPECTION

- A. Applicator must examine areas and conditions under which painting Work is to be performed and notify Owner in writing of conditions detrimental to proper and timely completion of Work. Do not proceed with Work until unsatisfactory conditions have been corrected in manner acceptable to applicator.
- B. Application of the first coat of any finishing process shall constitute applicator's acceptance of surfaces within any particular area except gypsum wallboard, which shall be inspected after painter applies the seal coat.
- C. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of durable paint film.

3.2 SURFACE PREPARATION

- A. General:
 - 1. Perform preparation and cleaning procedures in strict accordance with paint manufacturer's instructions and as herein specified, for each particular substrate condition.
 - 2. Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place not to be finish painted, or provide surface-applied protection prior to surface preparation and painting operations. Remove if necessary, for complete painting of items and adjacent surfaces. Following completion of painting of each space or area, reinstall removed items by workmen skilled in trades involved.
 - 3. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease with clean cloths and cleaning solvents prior to mechanical cleaning. Program cleaning and painting so that dust and other contaminants from cleaning process will not fall on wet, newly painted surfaces.
- B. Cementitious Materials:
 - 1. Prepare cementitious surfaces of cement plaster and concrete to be painted by removing all efflorescence, chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze.
 - 2. Determine alkalinity and moisture content of surfaces to be painted by performing appropriate tests. If surfaces are found to be sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application of paint.

3. Do not paint over surfaces where moisture content exceeds 8 percent, unless otherwise permitted in manufacturer's printed directions.
- C. All Ferrous Surfaces required to be painted under this section shall be cleaned and treated as follows:
1. Clean all rust, loose mill scale, grease, dirt, wax, and other deleterious matter by any effective means. Use solvent or mechanical cleaning methods that comply with recommendations of the Steel Structures Painting Council.
 2. Abraded or corroded spots on shop-coated surfaces shall be wire brushed and touched up with material similar to shop coat. Special care shall be exercised to remove wax, lubricants, and other coatings from roll-form coated metals prior to painting.
 3. Blast steel surfaces clean as recommended by the paint system manufacturer and in accordance with requirements of SSPC specification SSPC-SP 6-63 Commercial Blast Cleaning.
 4. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming
- D. Galvanized Surfaces: Clean galvanized surfaces with non- petroleum-based solvents so that the surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- E. Aluminum and Aluminum Alloy Surfaces to be painted shall be solvent cleaned to remove oil and grease and then treated with chromate metal primer as herein specified. Cleaning solvents and procedures shall conform to the Steel Structures Council Painting Specification SSPC-SP-I-63.
- F. Gypsum Wallboard: Fill all pin holes, cracks, and other surface imperfections with spackle prior to application of seal coat. Sand smooth and dust all taped wallboard joints and nail heads.
- G. Equipment Installed with Factory Finish: Sand or etch finished surface to increase adherence of finish coats specified to be applied over factory finish.
- H. Other Surfaces: Prepare surface as recommended by paint manufacturer.

3.3 MATERIALS PREPARATION

- A. Mix and prepare painting materials in strict accordance with manufacturer's directions in room or area assigned for that purpose.
1. Floor slabs used for storage and mixing of any paint materials shall be protected by temporary coverings that will not permit penetration or saturation of paint materials. Painting contractor shall be solely responsible for this protection.
- B. Stir materials before application to produce mixture of uniform density, and as required during application of materials. Do not stir film which may form on surface into material. Remove film and, if necessary, strain material before using.

- C. Use only thinners approved by the paint manufacturer, and only within recommended limits.

3.4 PAINT APPLICATION AND WORKMANSHIP

- A. Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.
- B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
 - 1. Paint colors, surface treatments, and finishes as indicated.
 - 2. Provide finish coats that are compatible with primers used.
 - 3. The number of coats and film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where sanding is required to produce an even smooth surface in accordance with the manufacturer's directions.
 - 4. Apply additional coats when undercoats, stains, or other conditions show through final coat of paint until paint film is of uniform finish, color, and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.
 - 5. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned tube radiation, grilles, and similar components are in place. Extend coatings in these areas as required to maintain the system integrity and provide desired protection.
 - 6. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only before final installation of equipment.
 - 7. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, nonspecular black paint.
 - 8. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
 - 9. Sand lightly between each succeeding enamel or varnish coat.
 - 10. Omit primer on metal surfaces that have been shop-primed and touch up painted.
- C. Mix and apply paint in clean condition, free of foreign materials and residue.
- D. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
 - 1. Allow sufficient time between successive coats to permit proper drying. Do not recoat until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure and where application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.
- E. Minimum Coating Thickness: Apply materials at not less than the manufacturer's recommended spreading rate. Provide a total dry film thickness of the entire system as recommended by the manufacturer.

- F. Mechanical and Electrical Work: Painting mechanical and electrical work is limited to items exposed in mechanical equipment rooms and in occupied spaces.
- G. Mechanical items to be painted include but are not limited to:
 - 1. Piping, pipe hangers, and supports.
 - 2. Heat exchangers.
 - 3. Tanks.
 - 4. Exposed ductwork.
 - 5. Insulation.
 - 6. Supports.
 - 7. Motors and mechanical equipment.
 - 8. Accessory items.
- H. Electrical items to be painted include but are not limited to:
 - 1. Conduit and fittings.
 - 2. Switchgear.
- I. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled free of pinholes.
- J. Prime Coats: Before application of finish coats, apply a prime coat of material as recommended by the manufacturer to material that is required to be painted or finished and has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to assure a finish coat with no burn through or other defects due to insufficient sealing.
- K. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling such as laps, irregularity in texture, skid marks, or other surface imperfections.
- L. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

3.5 ALTERATIONS AND TOUCH-UP

- A. All new Work in the existing building areas and all existing painted surfaces of the existing structures that are damaged as a result of demolition, removals, cutting, patching, alterations, new construction, or the installation and removal of temporary facilities of any nature shall be painted and/or finished to match the existing finish. Preparation of surfaces, priming and painting shall be done in the same manner as specified for new Work.
- B. Where existing rooms are not required to be repainted and where touch-up work occurs on any surface, new finish shall extend from floor to ceiling and to the nearest corner so that the entire surface finish has the same color and tone.

- C. Where existing rooms are not required to be repainted and where existing surfaces have been damaged, the painting on that surface shall extend from the floor to the ceiling and from vertical corner to vertical corner. All surfaces on walls or ceilings shall be repainted.
- D. Where existing rooms are not required to be repainted and where existing work is extended or relocated, the Work shall be repainted to match the finish of new Work.
- E. All painting required as a result of the alteration and touch-up shall have finish coats or paint necessary to match the existing color scheme, including any wainscots and decoration.

3.6 CLEANING AND PROTECTION

- A. Provide "Wet Paint" signs as required to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their Work after completion of painting operations.

3.7 CLEAN-UP

- A. During progress of Work, remove from Site discarded paint materials, rubbish, cans and rags at end of each work day.
- B. Upon completion of painting Work, clean window glass and other paint-splattered surfaces. Remove splattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.
- C. At completion of Work of other trades, touch-up and restore damaged or defaced painted surfaces.

END OF SECTION

DIVISION 15

MECHANICAL

SECTION 15010

MECHANICAL SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected Site elements.
3. Demolition and removal of mechanical equipment.

B. Related Sections:

1. Section 07510 (Rebuild/Repair Built-Up Roofing (BUR) Membrane)

1.2 REFERENCES

- A. American National Standards Institute, ANSI A10.6, Safety Requirements for Demolition Operations
- B. National Fire Protection Association, NFPA 241, Standard for Safeguarding Construction, Alteration, and Demolition Operations
- C. Code of Federal Regulations, 40 CFR 82, Title 40, Part 82- Protection of Stratospheric Ozone.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.
- C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

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

1.5 SUBMITTALS

- A. Qualification Data: For refrigerant recovery technician.
- B. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals, property, and environment. Also include measures for dust and noise control. Indicate proposed locations and construction of barriers.
- C. Schedule of Selective Demolition Activities: Coordinate Demolition with new equipment installation. Contractor to provide the following:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
 - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shutoff, capping, and continuation of utility services.
 - 4. Coordination of Owner's continuing occupancy of existing building and of Owner's occupancy of completed Work.
- D. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.
- E. Pre-demolition Photographs or Video: Submit before Work begins.
- F. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
- G. Warranties: Documentation indicated that existing warranties are still in effect after completion of selective demolition.

1.6 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.
- B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.7 QUALITY ASSURANCE

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

1.8 FIELD CONDITIONS

- A. Building shall be occupied during selective demolition process. Conduct selective demolition so operations will be minimally disrupted.
- B. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

1.9 REPAIR OF EXISTING ROOF

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties. Notify Owner before proceeding.
- B. Notify Owner on completion of selective demolition, and obtain documentation verifying that existing system has been inspected.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

2.2 ROOFTOP REPAIR MATERIALS

- A. Roofing Materials:
 - 1. New materials
 - 2. Repair per Section 07510 (Rebuild/Repair Built-Up Roofing (BUR) Membrane) ensuring compatibility with the existing building roofing materials.
 - 3. Construct or repair pipe, drain, or steel member roof penetrations per Details on sheet A4.0 through A4.3.
- B. Roof Curbs:
 - 1. New materials

2. Provided by manufacturer of a particular piece of mechanical equipment.
3. Construct or repair roof curbs per Detail 1, Sheet A4.3.

2.3 PARKING LOT REPAIR MATERIALS

- A. Concrete/Asphalt: Shall match the existing parking lot materials and colors.
- B. "Cool" parking lots, such as StreetPrint may be implemented with the permission of the Owner. If such surfacing is applied to part of the parking lot, it shall be applied to the entire parking lot for uniformity.
- C. Replace all planters or other landscaping which was damaged or removed during construction. Landscaping shall match existing landscaping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- B. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to the Owner.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 1. Notify Owner prior to need for shut-off of any service or system.
 2. Arrange to shut off indicated utilities with utility companies.
 3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 4. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.

- d. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
 - e. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - f. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
- B. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
- 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 - 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
- C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
- 1. Strengthen or add new supports when required during progress of selective demolition.

3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
- 1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings.

2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
4. Maintain adequate ventilation when using cutting torches.
5. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
6. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
7. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
8. Cover and seal all existing unused roof penetrations left by removal of equipment, unless otherwise noted.

B. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's designated storage area.
5. Protect items from damage during transport and storage.

C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Owner, items not critical to ongoing building operation may be removed to a suitable, protected storage location during selective demolition, cleaned, and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDUES FOR EXISTING SYSTEMS

- A. All VAV boxes to be removed. Connect existing ductwork to new heat pumps as indicated.
- B. All AC units to be removed. Cap all existing gas connections.
1. Cover and seal existing roof penetrations, unless otherwise indicated.
- C. Existing AC-1 & existing AC-2 supply duct to remain for outside air source to new heat pumps.
1. Connect existing and new ductwork as indicated.
 2. Remove return duct plenum and repair roof at the existing duct penetration.
- D. Remove VAV box conduit and connectors from damper actuator back to panel, as indicated.

- E. All existing hot water supply and return piping to be drained, capped, & abandoned in place.
- F. Remove all existing Metasys Control System components, including thermostats and temperature sensors.
- G. All existing exhaust fans, exhaust ductwork, and exhaust fan roof penetrations to remain.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR ROOFING

- A. Repair roof (or alter for new curb use) as quickly as possible where mechanical equipment was removed. The building shall remain watertight and weathertight at all times during construction.
 - 1. Remove existing roof membrane, flashings, copings, and roof accessories where necessary.
 - 2. Remove existing roofing system down to substrate where necessary.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be recycled, reused, salvaged, or otherwise indicated to remain Owner's property, remove demolished materials from Site and legally dispose of them in an EPA-approved landfill.
 - 1. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 2. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.8 CLEANING

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

3.9 SELECTIVE DEMOLITION SCHEDULE

- A. Description of mechanical equipment to be removed, existing to remain, or otherwise noted: as indicated.
- B. Coordination of demolition with new mechanical equipment installation: as indicated.

END OF SECTION

SECTION 15050

BASIC MECHANICAL MATERIALS AND METHODS**PART 1 GENERAL****1.1 SUMMARY**

- A. Section includes:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Mechanical sleeve seals.
 - 3. Sleeves.
 - 4. Escutcheons
 - 5. Vibration Isolation
 - 6. Equipment installation requirements common to equipment sections.
 - 7. Painting and finishing.
 - 8. Supports and anchorages.

- B. Related Sections
 - 1. Section 15181 (Hydronic Piping and Specialties)

1.3 REFERENCES

- A. American Society of Mechanical Engineers, ASTM B1.20.1, Pipe Threads, General Purpose
- B. American Society for Testing and Materials, ASTM B32, Standard Specification for Solder Metal,
- C. American Society for Testing and Materials, ASTM B813, Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
- D. American Society for Testing and Materials, ASTM B828, Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings
- E. American Society for Testing and Materials, ASTM D 2657, Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings
- F. Metal Framing Manufacturers Association, MFMA-3, Metal Framing
- G. Manufacturer's Standardization Society, MSS SP-58, Pipe Hangers and Supports - Materials, Design and Manufacture
- H. Manufacturer's Standardization Society, MSS SP-69, Pipe Hangers and Supports - Selection and Application
- I. UL Fire Resistance Directory

- J. American Society for Testing and Materials, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples
- K. American Society for Testing and Materials, ASTM A307, Standard Specification for Carbon Steel Bolts and Studs
- L. American Society for Testing and Materials, ASTM A36, Standard Specification for Carbon Structural Steel
- M. American Society for Testing and Materials, ASTM A193, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications
- N. American Society for Testing and Materials, ASTM A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces, mechanical equipment rooms, and mechanical enclosures.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples included above ceilings and in duct shafts.
- E. PE: Polyethylene plastic.

1.4 SUBMITTALS

- A. Product Data:
 - 1. Dielectric fittings.
 - 2. Mechanical Sleeve seals.
 - 3. Escutcheons.
- B. Quality Assurance/Quality Control Submittals
 - 1. Welding certificates.
 - 2. Vibration Isolation:
 - a. Schedule of Materials
 - b. Equipment Details
 - 1) Equipment Bases or hangers

- 2) Piping
- 3) Ductwork

- c. Include natural frequency, spring diameters, deflection, compressed spring height, and damping tests.
- d. Submittals shall include a hanger drawing showing the 30° capability.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Vibration Isolation Materials
 1. Mason Industries
 2. Or Approved Equal
- B. Fill Caulk/Sealant
 1. 3M COMPANY - IC 15WB, CP 25WB+ caulk or FB-3000 WT sealant.
 2. Or Approved Equal
- C. Firestop Caulk
 1. MINNESOTA MINING & MFG CO - FireDam 150+
 2. Or Approved Equal

2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to Section 15181 (Hydronic Piping and Specialties) for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 PIPE CASINGS

- A. Provide rigid nonmetallic conduit and fittings (PVC) as pipe casings at floor penetrations and underground building entries for the entry of ground heat exchanger piping. The conduit shall serve as a casing for ease of installation and removal of the piping into the building

2.4 BUILDING PENETRATIONS

- A. Metallic Pipe Through fire Rated Stud Wall - System Design Number W-L-1296
 1. Wall Assembly for Penetrations: The 1 or 2 hr fire rated gypsum board/stud wall assembly shall be constructed of the materials and in the manner described in the

individual U300 or U400 Series Wall or Partition Design in the UL Fire Resistance Directory and shall include the following construction features:

- a. Studs: Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 in. by 4 in. (51 mm by 102 mm) lumber spaced 16 in. (406 mm) OC. Steel studs to be min 3-1/2 in. (89 mm) wide spaced max 24 in. (610 mm) OC.
 - b. Gypsum Board: Type, thickness, number of layers, fastener type and sheet orientation as specified in the individual U300 or U400 Series Design in the UL Fire Resistance Directory. Max diameter of opening is 10-5/8 in. (270 mm).
 - 1) The hourly F Rating of the firestop system is equal to the hourly fire rating of the wall assembly in which it is installed.
 - 2) The hourly T Rating is 0 and 1/4 Hr for 1 and 2 Hr rated assemblies, respectively.
2. Through Penetrants: One metallic pipe, conduit, tubing or flexible metal pipe. Installed concentrically or eccentrically within opening. Annular space between penetrant and periphery of opening to be min 0 in. (point contact) to max 2 in. (0 mm to max 51 mm). Penetrant to be rigidly supported on both sides of wall. The following types and sizes of penetrants may be used:
- a. Steel Pipe: Nom 8 in. (203 mm) diameter (or smaller) Schedule 5 (or heavier) steel pipe.
 - b. Iron Pipe: Nom 8 in. (203 mm) diameter (or smaller) cast or ductile iron pipe.
 - c. Conduit: Nom 4 in. (102 mm) diameter (or smaller) steel electrical metallic tubing (EMT) or nom 6 in. rigid steel conduit.
 - d. Copper Tubing - Nom 4 in. (102 mm) diameter (or smaller) Type L (or heavier) copper tubing.
 - e. Copper Pipe: Nom 4 in. (102 mm) diameter (or smaller) Regular (or heavier) copper pipe.
3. Fill, Void or Cavity Material (bearing UL Classification Mark) - Caulk or Sealant - Min 5/8 in. (16 mm) thickness of caulk or sealant applied within annulus, flush with both surfaces of wall. Min 1/4 in. (6 mm) diameter bead of caulk or sealant applied to gypsum board/penetrant interface at point contact location on both sides of wall
- B. Metallic Pipe with Sleeve Through Concrete Floor or Wall – System Design Number C-AJ-1366
1. Floor or Wall Assembly: Min 2-1/2 in. thick reinforced lightweight or normal weight (100-150 pcf) concrete. Wall may also be constructed of any UL Classified Concrete Blocks. Max diameter of opening is 11-5/8 in.
 - a. See Concrete Blocks (CAZT) category in the Fire Resistance Directory for names of manufacturers.
 2. Steel Sleeve: 10 in. diameter (or smaller) Schedule 10 (or heavier) steel pipe sleeve cast into concrete floor or wall. Sleeve to be flush with top and bottom surfaces of floor or both surfaces of wall. The inside of the sleeve shall be such that the annular space shall not exceed 7/8 in. from the OD of the penetrant to the ID of the steel sleeve.
 3. Through Penetrants: One metallic pipe, tubing or conduit to be installed either concentrically or eccentrically within the firestop system. The annular space between tube and periphery of opening shall be min 0 in. to max 7/8 in. Penetrants to be rigidly

supported on both sides of floor assembly. The following types and sizes of metallic pipes, tubing or conduit may be used:

- a. Steel Pipe - Nom 8 in. diameter (or smaller) Schedule 10 (or heavier) steel pipe.
 - b. Iron Pipe - Nom 8 in. diameter (or smaller) cast or ductile iron pipe.
 - c. Conduit - Nom 6 in. diameter (or smaller) rigid steel conduit.
 - d. Conduit - Nom 4 in. (or smaller) electrical metallic tubing.
 - e. Copper Tubing - Nom 4 in. diameter (or smaller) Type L (or heavier) copper tube.
 - f. Copper Pipe - Nom 4 in. diameter (or smaller) Regular (or heavier) copper pipe.
 - g. See M4.2 and A3.0 for pipe type, size, locations and details of pipe penetrations.
4. Firestop System - The details of the firestop system shall be as follows:
- a. Packing Material - Min 2 in. thickness of min 4 pcf mineral wool batt insulation firmly packed into opening as a permanent form. Packing material to be recessed from top surface of floor to accommodate the required thickness of fill material.
 - b. Fill, Void or Cavity Materials (Bearing the UL Classification Mark) - Caulk - Min 1/2 in. thickness of caulk applied within the annulus, flush with top surface of floor and/or both surfaces of the wall. Min 1/2 in. diameter bead of caulk applied to the penetrant/concrete interface at the point contact location on the top surface of floor.

2.5 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast Brass Type: With set screw.
 1. Finish: Polished chrome-plated.
- D. One-Piece, Stamped Steel Type: With set screw or spring clips and chrome-plated finish.
- E. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- F. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 1. New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast brass type with polished chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped steel type.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type and set screw.
 - f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - g. Bare Piping in Equipment Rooms; One-piece, stamped-steel type with set screw or spring clips.

2.6 PIPE HANGERS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Trapeze Pipe Hangers

1. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.7 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

B. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Seismic Supports:

1. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
2. Restraint Cables: ASTM A 603 galvanized or ASTM A 492 stainless-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

2.8 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

C. Nails:

1. Conform to requirements of ASTM F 1667.
- D. Machine Bolts and Anchor Bolts:
1. Conform to requirements of ASTM A-307.
- E. All-Thread Rod:
1. 3/8" Diameter.
 2. Conform to requirements of ASTM A36 or ASTM A193.
- F. Connectors and fasteners exposed to weather shall be one of the following:
1. Hot-dipped galvanized, zinc-coated steel conforming to ASTM A153.
 2. Stainless steel.

2.9 VIBRATION ISOLATION

- A. Vibration Isolation for Mechanical Equipment:
1. Spring isolators shall be free standing and laterally stable without any housing and complete with a molded neoprene cup or 1/4"(6mm) neoprene acoustical friction pad between the baseplate and the support. All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Installed and operating heights shall be equal. The ratio of the spring diameter divided by the compressed spring height shall be no less than 0.8. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection.
 2. Neoprene mountings shall have a minimum static deflection of 0.35"(9mm). All metal surfaces shall be neoprene covered and have friction pads both top and bottom. Bolt holes shall be provided on the bottom and a tapped hole and cap screw on top. Steel rails shall be used above the mountings under equipment such as small vent sets to compensate for the overhang.
 3. Hangers shall consist of rigid steel frames containing minimum 1-1/4"(32mm) thick neoprene elements at the top and a steel spring with general characteristics as in mechanical details, seated in a steel washer reinforced neoprene cup on the bottom. The neoprene element and the cup shall have neoprene bushings projecting through the steel box. In order to maintain stability the boxes shall not be articulated as clevis hangers nor the neoprene element stacked on top of the spring. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30° arc from side to side before contacting the cup bushing and short circuiting the spring.
 4. Hangers shall be pre-compressed and locked at the rated deflection by means of a resilient upstop to keep the piping or equipment at a fixed elevation during installation. The hangers shall be designed with a release mechanism to free the spring after the installation is complete and the hanger is subjected to its full load. Deflection shall be clearly indicated by means of a scale.

5. The first four pipe hangers in the main lines near the mechanical equipment shall be isolated from vibration. Hangers supporting piping 2"(50mm) and larger in all other locations throughout the building shall be isolated by spring hangers. Floor supported piping shall rest on neoprene or spring isolators. The first four isolators from the isolated equipment shall have the same static deflection as specified for the mountings under the connected equipment.
6. All air ducts with a cross section of 2ft² or larger shall be isolated from the building structure by acoustical hangers or floor supports, installed per Mason Industries (or Approved Equal) recommendations, with a minimum deflection of 0.75".

2.10 ELECTRICAL CHARACTERISTICS FOR MECHANICAL EQUIPMENT

- A. Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

PART 3 EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. See Section 15181 (Hydronic Piping and Specialties) for other piping requirements.
- B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms, service areas, and pump enclosure.
- C. 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.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Piping Sleeves: Installed as described in this section.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Permanent sleeves are not required for holes formed by removable PE sleeves.

- M. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- N. Verify final equipment locations for roughing-in.
- O. Pump enclosure:
 - 1. Piping may be secured to the masonry wall where approved by code.
 - 2. Heavy point loads shall not be applied to the roof deck.

3.2 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping 2-inches and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping 2-1/2 inches and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - 3. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.3 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. All equipment and ductwork shall be laterally restrained according to the requirements of Chapter 16 of UBC or SMACNA Guidelines for the Seismic restrains of mechanical equipment and piping systems, whichever is most stringent shall govern.
- E. Install equipment to allow right of way for piping installed at required slope.
- F. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.
- G. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- H. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces.
- I. Pump enclosure:
 - 1. Heavy equipment shall be mounted on the floor and seismically restrained where required.

- 2. Heavy point loads shall not be applied to the roof deck.

3.4 PAINTING

- A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.5 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- B. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
 - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
 - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
 - 4. Spring hangers to support vertical runs.
 - 5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for copper and steel piping with the following maximum spacing and minimum rod sizes.

Pipe Size (inches)	Rod Size (inches)	Hanger Spacing	
		Steel Pipe (feet)	Copper Pipe (feet)
1 and smaller	3/8	8	6
1-1/4 to 1-1/2	3/8	10	8
2	3/8	10	8
2-1/2 to 3-1/2	1/2	12	12
4 to 5	5/8	16	14
6	3/4	16	16

- D. Support vertical runs at roof, at each floor, and at 10 foot intervals between floors.

END OF SECTION

SECTION 15088

HVAC PIPING INSULATION**PART 1 - GENERAL****1.1 SUMMARY**

A. Section includes insulating the following HVAC piping systems:

1. Condenser-water piping.

B. Related Sections

1. Section 09900 (Painting)
2. Section 15050 (Basic Mechanical Materials and Methods)
3. Section 15181 (Hydronic Piping)
4. Section 15600 (Ground Heat Exchanger)

1.2 REFERENCES

- A. American Society for Testing and Materials, ASTM A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- B. American Society for Testing and Materials, ASTM A240, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
- C. American Society for Testing and Materials, ASTM B 209, Specification for Aluminium and Aluminium-Alloy Sheet and Plate.
- D. American Society for Testing and Materials, ASTM C196, Standard Specification for Expanded or Exfoliated Vermiculite Thermal Insulating Cement.
- E. American Society for Testing and Materials, ASTM C335, Standard Test Method for Steady-State Heat Transfer Properties of Pipe Insulation.
- F. American Society for Testing and Materials, ASTM C450, Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.
- G. American Society for Testing and Materials, ASTM C547, Standard Specification for Mineral Fiber Pipe Insulation.
- H. American Society for Testing and Materials, ASTM C585, Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing.

- I. American Society for Testing and Materials, ASTM C647, Standard Guide to Properties and Tests of Mastics and Coating Finishes for Thermal Insulation.
- J. American Society for Testing and Materials, ASTM C795, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
- K. American Society for Testing and Materials, ASTM C871, Standard Test Methods for Chemical Analysis of Thermal Insulation Materials for Leachable Chloride, Fluoride, Silicate, and Sodium Ions.
- L. American Society for Testing and Materials, ASTM C1136, Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
- M. American Society for Testing and Materials, ASTM E 84, Standard Test Method for Surface Burning Characteristics of Building Materials.
- N. American Society for Testing and Materials, ASTM E96, Standard Test Methods for Water Vapor Transmission of Materials.
- O. Code of Federal Regulations, 40 CFR 82, Title 40, Part 82- Protection of Stratospheric Ozone.
- P. Underwriters Laboratories, UL 723, Tests for Surface Burning Characteristics of Building Materials

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail insulation application at pipe expansion joints for each type of insulation.
 - 2. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 3. Detail removable insulation at piping specialties.
 - 4. Detail application at linkages of control devices.

1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

- 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 15050 (Basic Mechanical Materials and Methods.)
- B. Coordinate clearance requirements with piping installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

- A. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Fiberglass Insulation
 - 1. Knauf
 - 2. Or Approved Equal
- B. Field-Applied Jackets or Fitting Covers:
 - 1. Proto Corporation
 - 2. Or Approved Equal

2.2 INSULATION MATERIALS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- D. Foam insulation materials shall not use Chloroflourocarbon (CFC) or Hydrochloroflourocarbon (HCFC) blowing agents in the manufacturing process.
- E. Glass Fiber:
 - 1. Meeting ASTM C 547, ASTM C 585, and ASTM C 795.
 - 2. Rigid, molded, and noncombustible.
 - 3. 'K' ('ksi') Value: ASTM C 335, 0.23 at 75 deg F (0.033 at 24 deg C) mean temperature.
 - 4. Maximum Service Temperature: 1000 deg F. (538 deg F)
 - 5. Vapor Retarder Jacket: ASJ/SSL conforming to ASTM C 1136 Type I, secured with self-sealing longitudinal laps and butt strips.
- F. Field-Applied Jackets or Fitting Covers
 - 1. PVC:
 - a. 25/50 or Indoor/Outdoor.
 - b. UV-resistant fittings, jacketing and accessories, white.
 - c. Fittings: Pre-molded, high-impact PCV materials with fiber glass inserts. Inserts shall have a thermal conductivity ('K') of 0.26 at 75 deg F. ('ksi' - 0.037 at 24 deg C) mean temperature.
 - d. Closures: stainless steel tacks, matching PVC tape, or PVC adhesive per manufacturer's recommendations.
 - 2. Metal:
 - a. Type: 0.016-inch thick Aluminum or 0.010-inch thick steel.
 - b. Smooth, corrugated, or embossed finish with factory applied moisture barrier.
 - c. Overlap: 2-inch minimum.
 - d. Fittings: Die-shaped with factory-applied barrier.
 - 3. Laminated Self-Adhesive Water and Weather Seals:
 - a. Permanent acrylic self-adhesive system. Weather resistant, high puncture and tear resistance.
 - b. Meets or exceeds requirements of UL 723.
 - c. Apply in strict accordance with manufacturer's recommendations.
 - 4. Fitting Insulation:

- a. Pre-formed fiberglass, preformed perlite, mitered fiberglass, mitered perlite, or calcium silicate in lieu of PVC systems.
- b. Protect by field-applied fitting covers or metal fittings as necessary.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. General Adhesive Properties: (Applies to all except Polystyrene Adhesive.)
 1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 1. Verify that systems to be insulated have been tested and are free of defects.
 2. Verify that surfaces to be insulated are clean and dry.
 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.

- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below-ambient temperature surfaces, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

- O. 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.
- P. Do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Handholes.
 - 5. Cleanouts.

3.3 PENETRATIONS

- A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 - 1. Firestopping and fire-resistive joint sealers, as indicated.

3.4 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe

insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 INSTALLATION OF FIBERGLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. Locate all seams in the least visible location.
4. Insulation installed on piping operating below ambient temperatures must have a continuous vapor retarder.
5. All joints, seams, and fittings must be sealed.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

E. Exposed Pipe Insulation:

1. Exposed insulation in mechanical rooms or high traffic areas shall be protected from abuse by the use of appropriate thickness PVC or metal jacketing.
2. Insulation exposed to the elements shall be jacketed:
 - a. Type: Outdoor weatherable 0.020 inch thick PVC or 0.016 inch thick aluminum or stainless steel with factory applied moisture barrier.
 - b. Fittings shall have similar protection as straight pipe lengths.
 - c. Secure jacketing with friction type Z lock or minimum 2" overlap joint. Seal all joints along the longitudinal seam.
 - d. Circumferential joints shall be sealed by use of preformed butt strips; minimum 2" wide or a minimum 2" overlap. Butt strips shall overlap the adjacent jacketing a minimum 1/2-inch and be completely weather sealed.
 - e. A 6" to 10" unsealed slide joint shall be installed every 25 to 30 linear feet for the thermal expansion of pipe and insulation. Provide a bead of silicone grease to the overlap.
 - f. Where the distance between fittings exceeds 8 feet, provide an unsealed slide joint.
 - g. The surface temperature of the PVC shall not exceed 125 deg F.

3.6 FINISHES

- A. Do not field paint aluminum or stainless-steel jackets.

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Owner, by removing field-applied jacket and insulation in layers in reverse order of their installation.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 1. Drainage piping located in crawl spaces.
 2. Underground piping.

3.9 INDOOR PIPING INSULATION SCHEDULE

A. All pipe sizes: Condenser-Water Supply and Return:

1. Insulation shall be:
 - a. Fiberglass: 1 inch thick.

3.10 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Condenser-Water Supply and Return:

1. All Pipe Sizes: Insulation shall be:
 - a. Fiberglass: 2 inches thick

END OF SECTION

SECTION 15181

HYDRONIC PIPING AND SPECIALTIES**PART 1 GENERAL****1.1 SUMMARY**

- A. Section Includes:
1. Condenser water piping (above ground).
 2. Make-up water piping.
 3. Condensate drain piping.
 4. Air vent piping.
 5. Safety-valve inlet and outlet piping.
 6. Valves
 7. Strainers
 8. Backflow Prevention Devices
 9. Pipe Identification
 10. Bag-Type Filters
 11. Chemical Feed Systems

1.2 REFERENCES

- A. American National Standards Institute Standards (Piping and Flanges)
- B. American Society of Mechanical Engineers, ASME B16.1, Standard for Classes 25, 125, and 250 Cast Iron Pipe Flanges and Flanged Fittings.
- C. American Society of Mechanical Engineers, ASME B16.3, Standard for threaded malleable iron fittings Classes 150, and 300.
- D. American Society of Mechanical Engineers, ASME B16.4, Standard for gray iron threaded fittings, Classes 125 and 250.
- E. American Society of Mechanical Engineers, ASME B16.5, Standard for Pipe Flanges and Flange Fittings.
- F. American Society of Mechanical Engineers, ASME B16.21, Standard for nonmetallic flat gaskets for bolted flanged joints in piping.
- G. American Society of Mechanical Engineers, ASME B16.22, Standard establishes specifications for wrought copper and wrought copper alloy, solder-joint, seamless fittings, designed for use with seamless copper tube.
- H. American Society of Mechanical Engineers, ASME B16.39, Standard for threaded malleable iron unions, classes 150, 250, and 300.
- I. American Society of Mechanical Engineers, ASME B18.2.1, Square and Hex Bolts and Screws

- J. American Society of Mechanical Engineers, ASME B31.9, Building Services Piping.
- K. ASME Boiler and Pressure Vessel Code
- L. American Society for Testing and Materials, ASTM A47, Standard Specification for Ferritic Malleable Iron Castings.
- M. American Society for Testing and Materials, ASTM A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- N. American Society for Testing and Materials, ASTM A106, Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.
- O. American Society for Testing and Materials, ASTM A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
- P. American Society for Testing and Materials, ASTM A234, Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
- Q. American Society for Testing and Materials, ASTM A536, Standard Specification for Ductile Iron Castings.
- R. American Society for Testing and Materials, ASTM A733, Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples.
- S. American Society for Testing and Materials, ASTM B32, Standard Specification for Solder Metal.
- T. American Society for Testing and Materials, ASTM B88, Standard Specification for Seamless Copper Water Tube.
- U. American Society for Testing and Materials, ASTM B306, Standard Specification for Copper Drainage Tube (DWV).
- V. American Society for Testing and Materials, ASTM B813, Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube.
- W. American Society of Safety Engineers, ASSE 1015, Performance Requirements for Double Check Backflow Prevention Assemblies and Double Check Fire Protection Backflow Prevention Assemblies
- X. American Welding Society, AWS A5.8, Specification for Filler Metals for Brazing and Braze Welding.
- Y. American Welding Society, AWS D1.1/D1.1M, Structural Welding Code – Steel.
- Z. California Mechanical Code, CMC 310.1, Condensate Disposal.
- AA. California Plumbing Code, CPC 603, Backflow Prevention Devices

1.3 SUBMITTALS

- A. Product Data:
 - 1. Piping Materials.
 - 2. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
 - 3. Air control devices.
 - 4. Chemical treatment.
 - 5. Hydronic specialties.
- B. Qualification Data: For installers.
- C. Installation, Operation, and Maintenance Manuals:
 - 1. Hydronic Piping and Specialties
 - 2. Special-duty valves

1.5 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1/D1.1M.
- B. ASME Compliance: Comply with ASME B31.9 for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division I.
- C. Identification: Provide piping specialties with manufacturer's name or trademark and pressure rating clearly on valve body.
- D. Field Reports
 - 1. Hydrostatic system pressure tests.
 - 2. System start-up test.
- E. Qualification Data: For installers.

1.6 EXTRA MATERIALS

- A. Water-Treatment Chemicals: Furnish enough chemicals for initial system start-up and for preventative maintenance for one year from date of Substantial Completion.
- B. Bag-Type Filter Bags: Furnish enough bags for initial testing and balancing, bag change after testing and balancing, and 200% extra the amount of bags installed.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Grooved Mechanical-Joint Fittings and Couplings:

1. Victaulic Company.
 2. Anvil International, Inc.
 3. S. P. Fittings; a division of Star Pipe Products.
 4. Or Approved Equal
- B. Steel Pressure-Seal Fittings:
1. Victaulic Company.
 2. Or Approved Equal
- C. Wrought-Copper Fittings: ASME B16.22.
1. Anvil International, Inc.
 2. S.P. Fittings: a division of Star Pipe Products.
 3. Victaulic Company of America.
 4. Or Approved Equal
- D. Expansion Joints
1. Victaulic Company
 2. Flexicraft Industries
 3. Proco Products, Inc.
 4. Or Approved Equal
- E. Expansion Tanks
1. Wessels Company
 2. Bell & Gossett; Div. of ITT Industries
 3. Or Approved Equal
- F. Dielectric Unions:
1. Central Plastics Co.
 2. Watts Industries, Inc.; Water Products Div.
 3. Zurn Industries, Inc.; Wilkins Div.
 4. Or Approved Equal
- G. Dielectric Flanges:
1. Capitol Manufacturing Co.
 2. Central Plastics Co.
 3. Watts Industries, Inc.; Water Products Div.
 4. Or Approved Equal
- H. Dielectric-Flange Kits:
1. Advance Products & Systems, Inc.
 2. Calpico, Inc.
 3. Central Plastics Co.
 4. Or Approved Equal

- I. Dielectric Couplings:
 - 1. Calpico, Inc.
 - 2. Lochinvar Corp.
 - 3. Or Approved Equal

- J. Dielectric Nipples:
 - 1. Precision Plumbing Products, Inc.
 - 2. Sioux Chief Manufacturing Co., Inc.
 - 3. Victaulic Co. of America
 - 4. Or Approved Equal

- K. Bronze, Calibrated-Orifice, Balancing Valves:
 - 1. Bell & Gossett
 - 2. Griswold Controls
 - 3. Taco
 - 4. Or Approved Equal

- L. Diaphragm-Operated, Pressure Reducing Valves:
 - 1. Bell & Gossett
 - 2. Conbraco Industries, Inc.
 - 3. Watts Regulator Co.
 - 4. Or Approved Equal

- M. Diaphragm-Operated Safety Valves:
 - 1. Bell & Gossett
 - 2. Conbraco Industries, Inc.
 - 3. Watts Regulator Co.
 - 4. Or Approved Equal

- N. Air control Devices:
 - 1. Amtrol, Inc.
 - 2. Bell & Gossett
 - 3. Taco
 - 4. Or Approved Equal

- O. Air/Dirt Separator:
 - 1. Spirotherm, Inc.
 - 2. Wessels Company
 - 3. Or Approved Equal

- P. Bag-Type Filters:
 - 1. Hayward Industrial Products, Inc.
 - 2. Eden Equipment Company.
 - 3. Neptune, a Dover Company
 - 4. Or Approved Equal

- Q. Chemical Feed Tanks:

1. Vector Industries
 2. Neptune, a Dover Company
 3. J. L. Wingert Co.
 4. Or Approved Equal
- R. Y-Pattern Strainers
1. Bell & Gossett
 2. Zurn
 3. Or Approved Equal
- S. Backflow Preventers
1. Watts Industries, Inc.; Water Products Div.
 2. Zurn Plumbing Products Group; Wilkins Div.
 3. Of Approved Equal

2.2 PERFORMANCE REQUIREMENTS

- A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature:
1. Condenser Water Piping: 125 psi at 150 deg F.
 2. Makeup Water Piping: 80 psi at 150 deg F.
 3. Condensate Drain Piping: 150 deg F.
 4. Air Vent Piping: 200 deg F.
 5. Safety-Valve Inlet and Outlet Piping:
 - a. Equal to the temperature and pressure of the piping system to which it is attached.

2.3 PIPING APPLICATIONS

- A. Condenser-water piping, aboveground, 2 inches and larger shall be any of the following:
1. Steel Pipe: ASTM A 53/A 53M, black steel.
 2. High density polyethylene pipe (HPDE) PE3408, with heat fused butt or socket fittings.
- B. All Condenser-water piping, belowground, shall be:
1. High density polyethylene pipe (HPDE) PE3408, with heat fused butt or socket fittings.
- C. Makeup water piping installed above ground shall be one of the following:
1. Type B, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
- D. Condensate Drain Piping:
1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
- E. Air-vent Piping:
1. Inlet: Same as service where installed according to the piping manufacturer's written instructions.
 2. Outlet: Annealed-temper copper tubing with soldered or flared joints.

- F. Safety-Valve Inlet and outlet piping for Hot Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed according to the piping manufacturer's written instructions.

2.4 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel; type, grade, and Schedule 10 wall thickness.
- B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250.
- C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300.
- D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300.
- E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced.
- F. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.
- G. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - 1. Material Group: 1.1.
 - 2. End Connections: Butt welding.
 - 3. Facings: Raised face.
- H. Grooved Mechanical-Joint Fittings and Couplings:
 - 1. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47/A 47M, Grade 32510 malleable iron; ASTM A 53/A 53M, Type F, E, or S, Grade B fabricated steel; or ASTM A 106, Grade B steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
 - 2. Couplings: Ductile- or malleable-iron housing and synthetic rubber gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
 - 3. Subject to approval by local code.
- I. Steel Pressure-Seal Fittings:
 - 1. Housing: Steel.
 - 2. O-Rings and Pipe Stop: Ethylene Propylene Diene M-class rubber (EPDM)
 - 3. Tools: Manufacturer's special tool.
 - 4. Minimum 300-psig working-pressure rating at 230 deg F.
- J. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.

2.5 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tubing: ASTM B 88.
- B. Annealed-Temper Copper Tubing: ASTM B 88.
- C. Drain, Waste, and Vent (DWV) Copper Tubing: ASTM B306, Type DWV.
- D. Wrought-Copper Fittings: ASME B16.22.
- E. Wrought-Copper Unions: ASME B16.22

2.6 HDPE PIPE AND FITTINGS

- A. All ground loop piping shall be high density polyethylene (HDPE), PE3408.
 - 1. Pipe with diameters of less than 1-1/4 inch shall be DR 11.
 - 2. Pipe with diameters greater than or equal to 1-1/4 inches and less than 3 inches shall be DR 15.5.
 - 3. Pipe with diameters of 3 inches or larger shall be DR 17.
 - 4. Pipe used in vertical boreholes shall be DR 11.
- B. HDPE shall not be used within the building.
- C. All shut-off valves for the ground loop (exterior) piping shall be HDPE ball valves. Conform to NSF Standard 61 and relevant fitting clauses of AWWA C906.

2.7 JOINING MATERIALS

- A. Expansion Joints: For pipe diameter of 6", use one type:
 - 1. Slip-Type:
 - a. Pressure Rating: 350 psi
 - b. Temperature Rating: 230 deg F
 - c. Total Movement: 3"
 - d. Weight: 75 lbs
 - e. Housing: ASTM A-536 ductile iron.
 - f. Body, End: ASTM A-53 Schedule 40 carbon steel.
 - g. Slide: AISI 1015 or 1018 Schedule 40, cold drawn.
 - h. Gasket: Grade "E" EPDM.
 - i. Connection Type: Grooved Coupling
 - 2. Flexible Rubber Spool Type:
 - a. Pressure Rating: 190 psi.
 - b. Compressive Movement: 1.4"
 - c. Expansion Movement: 0.7"
 - d. Weight: 20.5 lbs
 - e. Expansion Medium: Arched rubber joint.
 - f. Tube and cover: Butyl or other elastomer, suitable for system service, and multiple plies of polyester or nylon cord.
 - g. Connection Type: Full face flanges and retaining rings drilled to 150# ANSI B16.5 standard.

- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system components.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat face, Class 125 cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised face, Class 250, cast-iron and steel flanges.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Materials: AWS A5.8, Copper-phosphorous Brazing Alloys, BCuP Series, unless otherwise indicated.
- F. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.8 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions:
 - 1. Factory-fabricated union assembly, for 250 psi at minimum working pressure at 200 deg F as required to suit system pressures.
- D. Dielectric Flanges:
 - 1. Factory-fabricated companion flange assembly, for 150 psi or 300 psi minimum working pressure as required to suit system pressures.
- E. Dielectric-Flange Kits:
 - 1. Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 - 2. Separate companion flanges and steel bolts and nuts shall have 150 psi or 300 psi minimum working pressure where required to suit system pressures.
- F. Dielectric Couplings:
 - 1. Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300 psi minimum working pressures at 225 deg F.
- G. Dielectric Nipples:
 - 1. Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300 psi minimum working pressure at 225 deg F.

2.9 VALVES

- A. Provide Valves with ANSI/ ASME Class 125 service rating, which for 150 degrees F, the pressure rating is 175 psig.
- B. Plug Valve: Plug valves 2-1/2 inches and larger shall conform to MSS SP-78, have flanged or threaded ends, and have cast iron bodies with bronze trim. Valves 2 inches and smaller shall be bronze with NPT connections for black steel pipe and brazed connections for copper tubing. Valve shall be lubricated, non-lubricated, or tetrafluoroethylene resin coated type. Valve shall be resilient, double seated, trunnion mounted with tapered lift plug capable of 2-way shutoff. Valve shall operate from fully open to fully closed by rotation of the handwheel to lift and turn the plug.
- C. Ball Valve: Full port design. Ball valves 1/2 inch and larger shall conform to MSS SP-72 or MSS SP-110 and shall be bronze with threaded, soldered, or flanged ends. Ball valves may be used in lieu of gate valves.
- D. Butterfly Valve: Conform to MSS SP-67, Type 1 and shall be either the wafer or lug type. Valves smaller than 8 inches shall have throttling handles with a minimum of seven locking positions.
- E. Bronze, Calibrated-Orifice, Balancing Valves:
 - 1. Body: Bronze, ball or plug type with calibrated orifice or venturi.
 - 2. Ball: Brass or stainless steel.
 - 3. Plug: Resin.
 - 4. Seat: Polytetrafluoroethylene (PTFE).
 - 5. End connections: Threaded or socket.
 - 6. Pressure Gage Connections: Integral seals for portable differential pressure meter.
 - 7. Cold Water Pressure Rating: Minimum 125 psi.
 - 8. Maximum Operating Temperature: 250 deg F.
 - 9. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.
- F. Diaphragm-Operated, Pressure Reducing Valves:
 - 1. Body: Bronze or brass.
 - 2. Disc: Glass and carbon-filled polytetrafluoroethylene (PTFE).
 - 3. Seat: Brass.
 - 4. Stem Seals: EDPM O-rings.
 - 5. Diaphragm: Ethylene-Propylene Terpolymer (EPT)
 - 6. Low inlet-pressure check valve.
 - 7. Inlet Strainer: Removable without system shutdown.
 - 8. Valve Seat and Stem: Noncorrosive.
 - 9. Valve Size, Capacity and Operating Pressure: selected based on the following properties:
 - a. Temperature range: 45-100 deg F
 - b. Pressure range: 30-75 psig
- G. Diaphragm-Operated Safety Valves:
 - 1. Body: Bronze or brass.

2. Disc: Glass and carbon-filled polytetrafluoroethylene (PTFE).
3. Seat: Brass.
4. Stem Seals: EDPM O-rings.
5. Diaphragm: EPT.
6. Wetted, Internal Working Parts: Brass and rubber.
7. Inlet Strainer: Removable without system shutdown.
8. Valve Seat and Stem: Noncorrosive.
9. Valve Size, Capacity and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected based on the following properties:
 - a. Temperature range: 45-100 deg F
 - b. Pressure range: 30-75 psig

2.10 AIR CONTROL DEVICES

A. Manual Air Vents:

1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: $\frac{3}{4}$ inch
5. Discharge Connection: $\frac{1}{4}$ inch
6. Cold Water Pressure Rating: 150 psi.
7. Maximum Operating Temperature: 225 deg F.

B. Automatic Air Vents:

1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: $\frac{3}{4}$ inch
5. Discharge Connection: $\frac{1}{4}$ inch
6. Cold Water Pressure Rating: 150 psi.
7. Maximum Operating Temperature: 225 deg F.

C. Diaphragm-Type Expansion Tanks

1. Tank: Welded steel, rated for 125 psi working pressure and 375 deg F maximum operating temperature. Tanks shall be factory tested with taps fabricated and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Diaphragm: Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
3. Air-Charge Fittings: Schrader valve, stainless steel with EDPM seats.

D. Tangential Air Separators:

1. Tank: Welded steel; ASME constructed and labeled for 125 psi minimum working pressure and 375 deg F maximum operating temperature.
2. Air Collector Tube: Perforated stainless steel, construction to direct released air into expansion tank.
3. Tangential Inlet and Outlet Connection: Threaded for 2 inches and smaller; flanged connection for 2-1/2 inches and larger.
4. Blowdown Connection: Threaded.
5. Size: Match system flow capacity

2.11 CHEMICAL TREATMENT

- A. Bypass Chemical Feeder: Welded steel construction; 225 psi working pressure; 5 gallon capacity.
 - 1. Chemicals: Specially formulated, based on analysis of make-up water, to prevent accumulation of scale and corrosion in piping and connected equipment.
 - 2. Provide funnel inlet, inlet & outlet valves, swing check valve, unions, drain valve, & 1/4" bleeder.

2.12 HYDRONIC SPECIALTIES

- A. Y-Pattern Strainers
 - 1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
 - 2. End Connections: Threaded ends for 2 inches and smaller; flanged ends for 2-1/2 inches and larger.
 - 3. Strainer screen: 40 mesh startup strainer and perforated stainless-steel basket with 50 percent free area.
 - 4. Cold Water Pressure Rating: 150 psi.
- B. Basket Strainers
 - 1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
 - 2. End Connections: Threaded ends for 2 inches and smaller; flanged ends for 2-1/2 inches and larger.
 - 3. Strainer screen: 40 mesh startup strainer and perforated stainless-steel basket with 50 percent free area.
 - 4. Cold Water Pressure Rating: 150 psi.
- C. Stainless Steel Bellow, Flexible Connectors:
 - 1. Body: Stainless steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
 - 2. End Connections: Threaded or flanged to match equipment connected.
 - 3. Performance: Capable of 3/4 inch misalignment.
 - 4. Cold Water Pressure Rating: 150 psi.
 - 5. Maximum Operating Temperature: 250 deg F.
- D. Double-Check Backflow-Prevention Assemblies :
 - 1. Standard: ASSE 1015.
 - 2. Operation: Continuous-pressure applications, unless otherwise indicated.
 - 3. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
 - 4. Size to pipe connection.
 - 5. Bronze for NPS 2 and smaller
 - 6. Threaded for NPS 2 and smaller.
 - 7. Accessories:
 - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller.

2.13 BAG-TYPE FILTERS

- A. Description: Simplex single length, floor-mounted housing with single-bag filter for removing suspended particles from water.
 - 1. Housing: Corrosion resistant; designed to separate feedwater from filtrate and to direct feedwater through bag-type water filter(s); with bag support and base, feet, or skirt.
 - a. Material: Carbon steel with NSF 61 lining material, Stainless steel, or Glass-reinforced polypropylene.
 - b. Seals: Viton or EPDM
 - c. Bag Support: Top lock ring and perforated basket.
 - d. Pipe Connections: 2" NPT threaded or 150# ANSI flange. PVDF: 2" flange.
 - e. Pressure Rating: 150 psi
 - 2. Bag: Replaceable, 2 sq. ft., of shape to fit housing.
- B. Capacity and Characteristics: As indicated.

PART 3 EXECUTION

3.1 VALVE APPLICATIONS

- A. Install shutoff duty valves at each branch connection to supply mains and at supply connection to each piece of equipment.
- B. Install throttling duty valves at each branch connection to return main.
- C. Install calibrated-orifice, balancing valves in the return pipe of each heat pump.
- D. Install check valves at each pump discharge and elsewhere as required to control flow direction.
- E. Install pressure-reducing valves at makeup water connection to regulate system fill pressure.

3.2 PIPING INSTALLATIONS

- A. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- B. 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.
- C. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- D. Install piping to permit valve servicing.
- E. Install piping at indicated slopes.

- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Install piping to allow application of insulation.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- K. Install drains, consisting of a tee fitting, $\frac{3}{4}$ inch ball valve, and short $\frac{3}{4}$ inch threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- L. Install piping at a uniform grade of one percent downward in direction of flow.
- M. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- N. Install branch connections to mains using mechanically formed tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-fee risers, connect the branch to the top of the main.
- O. In piping 2 inches and smaller, install unions adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- P. In piping 2-1/2 inches and larger, install flanges at final connections of equipment and elsewhere as indicated.
- Q. Install strainers on inlet side of each pressure reducing valve, in-line pump, and elsewhere as indicated. Install $\frac{3}{4}$ inch nipple and ball valve in lowdown connection of strainers 2 inches and larger. Match size of strainer blow off connection for strainers smaller than 2 inches.
- R. Install expansion loops, expansion joints, anchors, and pipe alignment guides as required.
- S. Condensate drains:
 - 1. Provide on all equipment as indicated.
 - 2. Slope shall be one percent downward.
 - 3. Run from Heat Pump to condensate drain termination shall 100' maximum.
 - 4. Condensate drains sizes:
 - a. $\frac{3}{4}$ inch minimum serving up to 20 tons of cooling
 - b. 1 inch minimum serving over 20 tons of cooling
 - 5. Termination of condensate drains shall not be over a public walkway per CMC 310.1.

3.3 PIPE JOINT CONSTRUCTION

- A. No welding shall be performed inside the building.
 - 1. All welding activities shall be performed outside.
 - 2. Provide adequate welding ventilation and screening per all governing codes.

- B. All pipe connections made inside the building shall be coupling, flange, or thread.
- C. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- D. Remove scale, slag, dirt and debris from inside and outside of pipe and fittings before assembly.
- E. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated to tube end. Construct joints according to ASTM B 828 or Copper Development Association's (CDA) "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B32.
- F. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter using copper-phosphorus brazing filler metal complying with AWS A5.8.
- G. Threaded joints: thread pipe with tapered pie threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings an valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe section that have cracked or open welds.
- H. Welded Joints: Construction joints according to AWS D10.12, using qualified processes and welding operators according to Part 1,"Quality Assurance" Article.
- I. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- J. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - 1. Plain-End Pipe and Fittings: Use butt fusion.
 - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.
- K. Mechanical Grooved Joints:
 - 1. Cut or roll grooved. Grooves shall be in accordance with latest manufacturer's published recommendations.
 - 2. All components of the mechanical grooved piping system shall be in accordance with the manufacturer's latest specifications for temperature, pressure, and suitability.
 - 3. Manufacturer to provide instruction manuals and assist the Contractor in training assembly personnel.
 - 4. Use only grooving tools specifically designed for this system.

3.4 HYDRONIC SPECIALTIES INSTALLATION

- A. Install manual air vents at high points in piping, at heat transfer coils, and elsewhere as required for system air venting.
- B. Install automatic air vents at high points of system piping in mechanical equipment rooms only.

- C. Install tangential air separator in pump suction. Install blowdown piping with gate or full-port ball valve; extend full size to nearest floor drain.
- D. Install bypass chemical feeders in each hydronic system where indicated, in upright position with top of funnel not more than 48 inches above the floor. Install feeder in minimum $\frac{3}{4}$ inch bypass line, from main with full-size, full-port, ball valve in the main between bypass connections. Install $\frac{3}{4}$ inch drain line from chemical feeder drain, to nearest approved equipment drain location, and include a full-size, full-port, ball valve.
- E. Install diaphragm expansion tanks on the floor. Vent and purge air from hydronic system and ensure tank is properly charged with air.
- F. Install backflow prevention devices as indicated.
- G. Water metering devices shall be installed for the following:
 - 1. Mechanical equipment make-up water. Install along $\frac{1}{2}$ " make-up line, between tap to (E) cold water system and (N) expansion tank, ET-1.
 - 2. Contractor's non-potable general water use. Install at "Source of non-potable water" note, as indicated on sheet M1.0.

3.5 HEAT PUMP EQUIPMENT CONNECTIONS

- A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.
- B. Install ports for pressure gages and thermometers at coil inlet and outlet connections.

3.6 CHEMICAL TREATMENT

- A. Perform an analysis of makeup water to determine type and quantities of chemical treatment needed to keep system free of scale, corrosion, and fouling, and to sustain the following water characteristics.
 - 1. pH: 9.0 to 10.5
 - 2. "P" Alkalinity: 100 to 500 ppm.
 - 3. Boron: 100 to 200 ppm.
 - 4. Chemical Oxygen Demand: Maximum 100 ppm.
 - 5. Corrosion Inhibitor:
 - a. Sodium Nitrate: 1000 to 1500 ppm
 - b. Molybdate: 200 to 300 ppm
 - c. Chromate: 200 to 300 ppm
 - d. Sodium Nitrate Plus Molybdate: 100 to 200 ppm each.
 - e. Chromate Plus Molybdate: 50 to 100 ppm each.
 - 6. Soluble Copper: Maximum 0.20 ppm.
 - 7. Tolyriazole Copper and Yellow Metal Corrosion Inhibitor: Minimum 10 ppm.
 - 8. Total Suspended Solids: Maximum 10 ppm.
 - 9. Ammonia: Maximum 20 ppm.
 - 10. Free Caustic Alkalinity: Maximum 20 ppm.
 - 11. Microbiological Limits:
 - a. Total Aerobic Plate Count: Maximum 1000 organisms/ml.
 - b. Total Anaerobic Plate Count: Maximum 100 organisms/ml.

- c. Nitrate Reducers: 100 organisms/ml.
 - d. Sulfate Reducers: Maximum 0 organisms/ml.
 - e. Iron Bacteria: Maximum 0 organisms/ml.
- B. Fill system with fresh water and add liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products from piping. Circulate solution for a minimum of 24 hours, drain, clean strainer screens, and refill with fresh water.
- C. Add initial chemical treatment and maintain quality in ranges noted above the first year of operation.

3.7 BAG-TYPE FILTER INSTALLATION

- A. Equipment Mounting: Install filters on concrete base.
- B. Install bag-type filters level and plumb, as indicated original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
- C. Install filter media bags.

3.8 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
1. Leave joints uninsulated and exposed for examination during test.
 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
 3. Flush hydronic piping system with clean water; then remove and clean or replace strainer screens.
 4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to the valve. Install blinds in flanged joints to isolate equipment.
 5. Install safety valve, set at pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
- B. Perform the following tests on hydronic piping:
1. Use ambient temperature water as a testing medium.
 2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
 3. Isolate expansion tanks and determine that hydronic system is full of water.
 4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed ninety percent of specified yield strength or 1.7 times "SE" value in Appendix A in ASME M31.9, "Building Services Piping."

5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping joints, and connections for leakage. Eliminate by tightening, repairing, or replacing components and repeat hydrostatic test until there are no leaks.
- C. Perform the following system start-up test before operating the system.
1. Open manual valves fully.
 2. Inspect pumps for proper rotation.
 3. Set makeup pressure-reducing valves for required system pressure.
 4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
 5. Set temperature controls so all coils are calling for full flow.
 6. Inspect and set operating temperatures of hydronic equipment, such as heat pumps, to specified values.
 7. Verify lubrication of motors and bearings.
 8. Clean Y-strainers.

END OF SECTION

SECTION 15185
HYDRONIC PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Base-mounted, end-suction centrifugal Primary loop pumps.
2. Close-coupled, in-line centrifugal Secondary loop pumps.

B. Related Sections

1. Section 15050 (Basic Mechanical Materials and Methods)
2. Section 15181 (Hydronic Piping and Specialties)
3. Section 16050 (Basic Electrical Materials and Methods)

1.2 REFERENCES

- A. ANSI/HI 1.1-1.5-1995, Centrifugal Pump Standards.
- B. Underwriters Laboratories Inc., UL 778, Motor Operated Water Pumps

1.3 SUBMITTALS

- A. Product Data: Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves.
- B. Shop Drawings: Show pump layout and connections. Include setting drawings with templates for installing foundation and anchor bolts and other anchorages.
 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Installation, Operation, and Maintenance Manuals:
 1. Primary Loop Base-Mounted Hydronic Pumps.
 2. Secondary Loop In-Line integrated Circulator Pumps.

1.4 QUALITY ASSURANCE

A. Product Options:

- B. Indicate size, profiles, and dimensional requirements of hydronic pumps and are based on the specific system indicated.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Manufacturer's Preparation for Shipping: Clean flanges and exposed machined metal surfaces and treat with anticorrosion compound after assembly and testing. Protect flanges, pipe openings, and nozzles with wooden flange covers or with screwed-in plugs.
- B. Store pumps in dry location.
- C. Retain protective covers for flanges and protective coatings during storage.
- D. Protect bearings and couplings against damage from sand, grit, and other foreign matter.
- E. Comply with pump manufacturer's written rigging instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Base-Mounted, End-Suction Centrifugal Primary Loop Pumps
 - 1. Bell & Gossett; Div. of ITT Industries.
 - 2. Armstrong Pumps, Inc.
 - 3. Or Approved Equal
- B. Secondary Loop In-Line Circulation Secondary Loop Pumps
 - 1. Climatemaster Integrated Pump (To be included with heat pump)
 - 2. Grundfos Pumps Corporation.
 - 3. Taco, Inc.
 - 4. Or Approved Equal

2.2 BASE-MOUNTED, END-SUCTION CENTRIFUGAL PUMPS

- A. Description: as indicated.
- B. Pump Construction:
 - 1. Casing: Class 30 cast iron with integrally-cast pedestal support feet.

2. Impeller: Cast bronze enclosed type, balanced to ANSI/HI 1.1-1.5-1994, section 1.4.6.1.3.1, figure 1.106, balance grade G6.3 and keyed to the shaft by locking capscrew.
3. Liquid Cavity: Sealed by internally-flushed mechanical seal with ceramic seal seat and carbon seal ring suitable for continuous operation at 225°F.
4. Pump shall be rated for minimum of 175 psi working pressure.

2.3 CLOSE-COUPLED, IN-LINE CENTRIFUGAL PUMPS

- A. Close-coupled, in-line centrifugal pumps to be included within the water source heat pump cabinet by manufacturer.
- B. Integrated pump sizes for the following heat pumps:
 1. 2 Ton: 1/12 horsepower, capable of circulating 6 GPM at 13 feet of head.
 2. 3 Ton: 1/12 horsepower, capable of circulating 6.8 GPM at 23 feet of head.
 3. 4 Ton: 1/12 horsepower, capable of circulating 9 GPM at 21 feet of head.
 4. 5 Ton: 1/6 horsepower, capable of circulating 11.3 GPM at 25 feet of head.
- C. Motor:
 1. Rigidly mounted to pump casing
 2. Permanently lubricated ball bearings, unless otherwise indicated.
 3. Premium efficiency and inverter duty compatible.
- D. Design based on Climatemaster Tranquility 27 heat pumps with internally mounted circulation pump. These heat pumps are 460 volt, and include a step-down transformer for the circulation pump. Other approved manufacturers may be used, however, contractor shall provide step-down transformer for secondary pump power connection at no additional cost to the Owner.
- E. Provide 1-1/4" secondary piping connections to primary loop, as indicated.

2.4 PUMP SPECIALTY FITTINGS

- A. Triple-Duty Valve: Angle or straight pattern, iron body, pump-discharge fitting; with drain plug and bronze-fitted shutoff, balancing, and check valve features. Brass gage ports with integral check valve, and orifice for flow measurement. Match to pump manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine equipment foundations and anchor-bolt locations for compliance with requirements for installation tolerances and other conditions affecting performance of work.

- B. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation. Minimize use of elbows where possible.
- C. Examine foundations and inertia bases for suitable conditions where pumps are to be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CONCRETE BASES

- A. Install concrete bases of dimensions indicated for pumps and controllers.
 - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of base.
 - 2. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 3. Install cast anchor bolts to elevations required for proper attachment to supported equipment.

3.3 PUMP INSTALLATION

- A. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.
- B. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping. See Section 15050 (Basic Mechanical Materials and Methods) for pipe and pump support installation.
- C. Set base-mounted pumps on concrete foundation. Disconnect coupling before setting. Do not reconnect couplings until alignment procedure is complete.
 - 1. Support pump baseplate on rectangular metal blocks and shims, or on metal wedges with small taper, at points near foundation bolts to provide gap between pump base and foundation for grouting.
 - 2. Adjust metal supports or wedges until pump and driver shafts are level. Check coupling faces and suction and discharge flanges of pump to verify that they are level and plumb.

3.4 ALIGNMENT

- A. Align pump and motor shafts and piping connections after setting on foundation, grout has been set and foundation bolts have been tightened, and piping connections have been made.
- B. Comply with pump and coupling manufacturers' written instructions.
- C. Adjust pump and motor shafts for angular and offset alignment by methods specified in ANS/HI 1.1-1.5.

- D. After alignment is correct, tighten foundation bolts evenly. Completely fill baseplate with nonshrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

3.5 CONNECTIONS

- A. Piping installation requirements are specified in Section 15181 (Hydronic Piping and Specialties).
- B. Install piping adjacent to machine to allow service and maintenance.
- C. Connect piping to pumps. Install valves that are same size as piping connected to pumps.
- D. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.
- E. Install check valve and throttling or triple-duty valve on discharge side of pumps.
- F. Install Y-type strainer and suction diffuser and shutoff valve on suction side of pumps.
- G. Install flexible connectors on suction and discharge sides of base-mounted pumps between pump casing and valves.
- H. Install pressure gages on pump suction and discharge, at integral pressure-gage tapping, or install single gage with multiple input selector valve.
- I. Install electrical connections for power, controls, and devices per Section 16050 (Basic Materials and Methods).
- J. Install suction diffuser or minimum 5 pipe diameters between elbow and pump. Angle pattern, iron body and end cap, pump-inlet fitting; with bronze startup and bronze or stainless-steel permanent strainers; bronze or stainless-steel straightening vanes; drain plug; and factory-fabricated support.

3.6 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Check piping connections for tightness.
 - 3. Clean strainers on suction piping.
 - 4. Perform the following startup checks for each pump before starting:
 - a. Verify bearing lubrication.
 - b. Verify that pump is free to rotate by hand. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
 - c. Verify that pump is rotating in the correct direction.

5. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
6. Start motor.
7. Open discharge valve slowly.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps for a minimum of two sessions of two hours each, per base-mounted pump.
- B. Additional time will be provided at the Owners discretion if secondary loop pump are not internal to the heat pumps.

END OF SECTION

SECTION 15600

GROUND HEAT EXCHANGER**PART 1 GENERAL****1.1 SUMMARY**

A. Section Includes:

1. The ground-coupled, exterior ground loop system. Provide permits, surveys, underground drilling equipment, grouting, piping, valves, dewatering pumps, purge pumps, supports, test equipment and other related equipment necessary to provide a complete working system as designed.
2. Termination of HDPE pipe at pump enclosure for connection to interior piping system and equipment.

B. Related Sections

1. Section 02324 (Trenching)
2. Section 15181 (Hydronic Piping)
3. Section 15745 (Water Source Heat Pumps)

1.2 REFERENCES

- A. American Society for Testing and Materials, ASTM D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort.
- B. Closed-Loop/Geothermal Heat Pump Systems: Design and Installation Standards. IGSHPA: International Ground Source Heat Pump Association.
- C. Geothermal Heat Exchange Wells: Well Standards. Draft, California Department of Water Resources.

1.3 SUBMITTALS

A. Product Data:

1. HDPE pipe and fittings
2. HDPE valves
3. Enhanced thermal conductivity grout

B. Quality Assurance / Quality Control Submittals:

1. Current Fuse Welding Certificates for all technicians working on the project. Provide photocopies of all certification cards to the Owner for review prior to the commencement of work.
2. Proof of IGSHPA certification for all technicians working on the project.
3. Hydrostatic Pressure Test Results

C. Drilling fluids and spoils management plan. To include containment, management, and disposal plans.

- D. File a Report of Completion with the California Department of Water Resources (DWR) within 60 days from the date of construction completion pursuant to DWR standards.

1.4 WARRANTY

- A. The ground loop shall be warranted against leaks for 25 years by the piping manufacturer, including all parts and labor.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubing with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

1.6 PROJECT CONDITIONS

- A. Existing Conditions
 - 1. The ground loop design for this project is based upon the following properties.
 - a. Soil thermal conductivity = 0.8 Btu/hr-ft-°F
 - b. Soil thermal diffusivity = 0.56 sf/day
 - c. Undisturbed ground temperature = 66 °F
 - d. Borehole depth = 400 ft
 - e. Borehole spacing = 20 ft on center

PART 2 MATERIALS

2.1 MANUFACTURERS

- A. Traffic-rated Vault Doors:
 - 1. Bilco J-3AL
 - 2. Or Approved Equal

2.2 GROUND LOOP PIPING, FITTINGS AND VALVES

- A. All ground loop piping shall be high density polyethylene (HDPE), PE3408.
- B. See Section 15181 (Hydronic Piping) for HDPE piping requirements.
- C. All trenches containing HDPE shall be traced with inductive tape or locator wire and tracer tape.

2.3 BOREHOLE DRILLING AND GROUTING

- A. All drilling fluid additives used shall comply with recognized industry guidelines and practices and local codes. Toxic or dangerous substances shall not be added to the drilling fluid.

2.4 DEMONSTRATION BOREHOLE

- A. Demonstration borehole supply and return piping shall have temperature gauges and fluid directional arrows. These shall be viewable from above.
- B.

PART 3 EXECUTION

3.1 EXCAVATION

- A. All trenching widths shall be as indicated. See Section 02324 (Trenching).
- B. Backfill all trenches in the loop field, including the supply and return header mains into pump enclosure, as indicated.
- C. Trim trench bottom by hand or provide a 6 inch deep minimum bed of sand to provide a uniform grade and firm support throughout entire length of pipe. Pipe bedding materials shall be clean fill with rocks removed. Ensure that all rocks have been removed from the trench, the edge of the trench, and the top of the spoils pile.
- D. Maintain a lithologic log of each boring noting general lithologic characteristics (e.g., silty sand, clayey gravel, clay, etc.) and depth of primary lithologic changes.
- E. Construct and Install one nested piezometer with three discrete well screen intervals according to the attached specifications.

3.2 BACKFILL

- A. Completely backfill boreholes using "Tremie Method" PRMD drilling permit requirements and in accordance with Geothermal Heat Exchange Wells: Well Standards. April 1999, Draft, California Department of Water Resources.
 - 1. During loop installation, the Tremie pipe shall be semi-attached to the U-bend.
 - 2. Immediately following the loop installation, completely backfill boreholes via Tremie pipe with pure high solids bentonite grout with conductivity (k) of 0.85 btu/hr-ft-°F minimum.
 - 3. Grout shall be placed using a grout pump through the tremie line from the bottom to the top of the borehole.
 - 4. Contain, manage, and dispose of drill cuttings in accordance with local regulations.
- B. See Section 02324 (Trenching) for trench backfill materials and methods.
 - 1. Provide dewatering of trenches as required allowing for installation of piping systems on a dry trench bottom.
 - 2. Inductive Tracer Tape:
 - a. Depth of trace tape shall be minimum thirty-six inches below finished grade.
 - b. Tracer wire located no more than twelve (12) inches above the horizontal piping in conjunction with caution tape placed not deeper than twenty-four inches from final grade shall also be acceptable.

3.3 GROUND LOOP TESTING AND PURGING

- A. Particulate contaminates shall be removed from the piping system prior to initial start-up; all y-strainers to be cleaned.

1. Drain water from pipe purging or testing shall be temporarily routed to a sewer manhole or other Owner- approved location.
 2. Drain water shall not be allowed to run into the ground.
- B. Visually inspect all connections.
- C. Start-up pressurization of the circuit to be 20-30 psi when installed in the summer with circulating temperature of 70-90 degrees F and 40-50 psi when installed in the winter with circulating water temperature of 40-50 degrees F is required.
- D. Vertical loops shall be pressure tested to rated working pressure of DR 11 pipe, adjusted for the pipe’s ambient temperature, but not more than 160 psi, with fluid for 45 minutes before and after insertion in the ground. If pressure cannot be verified at the opposite end of the circuit from the intake end, this is an indication of a collapsed, pinched, or otherwise damaged circuit pipe, and must be replaced.

An additional pressure test shall be performed after lateral piping is connected and before backfilling. Vertical loops and laterals shall be pressure tested in accordance with Phillips "Method II Hydrostatic Pressure Test" with fluid for 45 minutes to 1.2 times the 50 year water rated working pressure (WRWP), calculated at the pipe’s ambient temperature. This test shall be performed in the presence of the Owner.

- E. The completed loop field, headers, and supply and return lines to the building are to be flushed and purged at a minimum velocity of 2 ft/sec for a period sufficient to remove all air from the loop field to circulate no less than 3 volumes of water have been re-circulated through the system without requiring the cleaning of strainers.

Flushing Flow Rates Required to Obtain 2 ft/sec.

Pipe Size	Flow Rate (GPM)
25.4 mm(1")	5.7
31.75 mm (1-1/4")	9.1
50.8 mm(2")	18
76.2 mm (3")	40

- F. Flushing shall be performed for each vertical circuit before connection to the lateral header.

3.4 PIPING INSTALLATION

- A. All buried pipe shall be heat-fused by butt, socket, sidewall electrofusion in accordance with the pipe manufacturer’s procedures. All joining to be performed by factory-trained installers with current IGSHPA fusion certification documents. Technicians must carry a current certification card on Site for regular inspection.
- B. Where possible, use large radius bends of HDPE piping in trenches in lieu of angle fittings.

1. Radius of bends shall be according to the following:

SDR	Minimum Allowable Bend Radius
17.0	27 times outside diameter
15.5	27 times outside diameter
13.0	25 times outside diameter
11.0	25 times outside diameter
9.0	20 times outside diameter

- C. Vertical pipes shall be fused to the lateral reverse-return headers 4 ft below finished grade.
- D. Supply and return piping from the ground loop field shall be a minimum of 3 ft below finished grade.
- E. Shut-off valves to be provided in the pump enclosure as indicated. Fused connecting flanges to be provided at the supply and return termination point in the pump enclosure.
- F. Transition fittings between dissimilar materials shall be inside or accessible.
- G. All pipes through walls or floors shall be sleeved and sealed with resilient, non-hardening caulking material as indicated. Mechanical sealing devices are acceptable if they provide a watertight seal and permit expansion and contraction of the HDPE piping.
- H. Provide pressure and temperature-sensing ports within 2 ft of each shut-off valve (loop side) on supply and return piping.
- I. The existing test borehole shall be incorporated into loopfield 9, as indicated.
- J. Demonstration borehole:
 1. Location: As indicated on sheet M1.1.
 2. Construction: As indicated on sheet C0.1.

END OF SECTION

SECTION 15745

WATER-SOURCE HEAT PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Concealed Horizontal Water Source Heat Pumps, 5 tons and smaller.

B. Related Sections

1. Section 15050 (Basic Mechanical Materials and Methods)
2. Section 15185 (Hydronic Pumps)
3. Section 15815 (Ductwork and Accessories)
4. Section 15940 (Mechanical Sequence of Operation)
5. Section 15950 (Testing, Adjusting, and Balancing of HVAC Systems)

1.2 REFERENCES

- A. ARI-ISO-13256-1 Standard for Water Source Heat Pumps.
- B. American Society of Testing and Materials, ASTM B743, Standard Specification for Seamless Copper Tube in Coils.
- C. ASHRAE Compliance:
 1. American Society of Heating, Refrigerating, and Air-Conditioning Engineers, ASHRAE 15, Safety Standard for Refrigeration Systems.
 2. Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- D. ASHRAE/IESNA 90.1-2004 Compliance:
 1. ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- E. California Mechanical Code, CMC 305.0, Equipment Access.
- F. National Fire Protection Association, NFPA 70, National Electrical Code.
- G. Underwriters Laboratories Inc., UL 181, Factory-Made Air Ducts and Air Connectors.

1.3 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties and accessories for each piece of equipment provided in this section.
- B. Acoustical Data: Include Noise Criterion (NC) ratings.
- C. Product Certificates: for extended-range water source heat pump, signed by each product manufacturer.
- D. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Suspended ceiling components.
 - 2. Structural members to which heat pumps will be attached.
 - 3. Method of attaching hangers to building structure.
 - 4. Size and location of initial access modules for acoustical tile.
 - 5. Items penetrating finished ceiling, including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - 6. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 7. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
 - 8. Water Source Heat Pump Startup Report with completed startup sheets.
- E. Installation, Operation, and Maintenance Data:
 - 1. Water-source heat pumps

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Packaged water-source heat pump with temperature controls; factory assembled, tested, and rated according to performance specification ARI-ISO-13256-1.
- C. Field quality-control test reports. Information shall be required for test and balance.

1.5 COORDINATION

- A. Coordinate layout and installation of water-source heat pumps and suspension components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system components, and partition assemblies.
- B. Coordinate installation of equipment supports, ductwork, and connections to condenser water piping and condensate drains.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of water-source heat pumps that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, refrigeration components.
 - 2. Warranty Period: 5 years from date of Substantial Completion.
- B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to 2 visits to Site during other than normal occupancy hours for this purpose.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. 1 filter for each 2 or 3-ton heat pump.
 - 2. 2 filters for each 4 or 5-ton heat pump.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Concealed Water-Source Heat Pumps, 6 Tons And Smaller
 - 1. ClimateMaster, Inc.
 - 2. FHP Manufacturing Inc.
 - 3. WaterFurnace International, Inc.
 - 4. Or Approved Equal

2.2 CONCEALED WATER-SOURCE HEAT PUMPS, 5 TONS AND SMALLER

- A. Cabinet and Chassis: Galvanized-steel casing with the following features:

1. Access panel for access and maintenance of internal components.
 2. Knockouts for electrical and piping connections.
 3. Flanged duct connections.
 4. Cabinet Insulation: Glass-fiber liner, minimum 1/2 inch thick, complying with UL 181.
 5. Condensate Drainage:
 - a. Water Source Heat Pump shall include solid-state electronic condensate overflow protection.
 6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
 - a. Air handling section interior surfaces shall be lined with 1/2 inch foil backed fiber insulation.
 7. Sound Attenuation Package:
 - a. Minimum 1/2 inch thick super-dense insulation for compressor enclosure and front panel.
 - b. Additional sound attenuating material applied to the compressor casings, air handling compartment casings, and fan scroll.
 - c. Maximum Sound Noise Criterion rating of 35.
 - d. Noisy equipment shall include a discharge muffler.
- B. Fan: Direct driven, centrifugal, with variable speed motor resiliently mounted in fan inlet.
1. Motor: ECM Version 2 Variable speed, ball bearing type, soft starting, permanently lubricated.
- C. Water Circuit:
1. Refrigerant-to-Water Heat Exchangers: Coaxial heat exchangers with copper water tube with enhanced heat-transfer surfaces inside a steel shell; both shell and tube leak tested to 625 psig on refrigerant side and 500 psig on water side. Factory mount heat exchanger in unit on resilient rubber vibration isolators.
 2. Water Regulating Valves: Limit water flow through refrigerant-to-water heat exchanger, and control head pressure on compressor during cooling and heating. Valves shall close when heat-pump compressor is not running.
 3. Motorized Water Valve: Stop water flow through the unit when compressor is off.
- D. Refrigerant-to-Air Coils: Copper tubes with aluminum fins, leak tested to 625 psig.
- E. Refrigerant Circuit Components:
1. Sealed Refrigerant Circuit: Charge with R-410A refrigerant.
 2. Filter-Dryer: Factory installed to clean and dehydrate the refrigerant circuit.

3. Charging Connections: Service fittings on suction and liquid for charging and testing.
 4. Reversing Valve: Pilot-operated sliding-type valve designed to be fail-safe in heating position with replaceable magnetic coil.
 - a. Compressor: Hermetic compressor installed on vibration isolators and housed in an acoustically treated enclosure with discharge muffler.
 5. Refrigerant Piping Materials: ASTM B 743 copper tube with wrought-copper fittings and brazed joints.
 6. Refrigerant Metering Device: Thermal expansion valve to allow specified operation with entering-water temperatures from 20 to 120 deg F.
- F. Filters: Disposable, glass-fiber, flat type, 1 inch thick, treated with adhesive, and having a minimum of 80 percent arrestance according to ASHRAE 52.1 and a minimum efficiency reporting value of 5 according to ASHRAE 52.2.
1. Install filter(s) for each Water Source Heat Pump with appropriate transitional fittings between return plenum and heat pump. See Drawings for filter Return Plenum Detail.
 2. Filter Sizes:
 - a. 2 and 3-ton Water Source Heat Pumps: one (1) 25" by 20", installed in the filter return plenum.
 - b. 4 and 5-ton Water Source Heat Pumps: two (2) 20" by 16", installed side-by-side in the filter return plenum.
- G. Control equipment and sequence of operation are specified in Section 15940 (Sequence of Operation).
- H. Controls:
1. Basic Unit Controls:
 - a. Low- and high-voltage protection.
 - b. Overcurrent protection for compressor and fan motor.
 - c. Random time delay, three to ten seconds, start on power up.
 - d. Time delay override for servicing.
 - e. Control voltage transformer.
 - f. High/low pressure fault.
 - g. Freeze protection.
 2. Thermostat:
 - a. Wall-Mounted Thermostat:
 - 1) Heat-cool-off switch.
 - 2) Fan on-auto switch.
 - 3) Manual changeover.
 - 4) Exposed temperature set point.
 - 5) Exposed temperature indication.

- 6) Deg F indication.
 - b. Wall-mounted temperature sensor.
 - c. Unoccupied period override push button.
 - d. Light Emitting Diode (LED) to indicate fault condition at heat pump.
3. Electrical Connections: Controls and safety devices shall be factory wired and mounted within the unit.
- I. Capacities and Characteristics: See mechanical schedules for heat pump fan, hydronic, heating and cooling capacity, and electrical requirements and data.
 1. Heat Pumps are rated in accordance with ARI/ISO 13256-1.
 2. Heating and cooling capacities based on the following criteria.
 - a. Cooling:
 - 1) Entering-Water Temperature: 90 deg F.
 - 2) 80.6 deg F dry bulb, 66.2 deg F wet bulb Entering Air Temperature.
 - b. Heating:
 - 1) Entering-Water Temperature: 45 deg F.
 - 2) 70 deg F dry bulb Entering Air Temperature.

2.3 HOSE KITS

- A. General: All units shall be connected with hoses or prefabricated secondary piping as indicated. The hoses shall be braided stainless steel fire rated hoses complete with adapters. Tag hose kits to equipment designations.
- B. Hose: 2 feet. Minimum diameter, equal to water-source heat-pump connection size.
- C. Isolation Valves: Two-piece bronze-body ball valves with stainless-steel ball and stem and galvanized-steel lever handle. Provide valve for supply and return. If balancing device is combination shutoff type with memory stop, the isolation valve may be omitted on the return.
- D. Strainer: Y-type with blowdown valve in supply connection.
- E. Balancing Device: Mount in return connection. Include meter ports to allow flow measurement with differential pressure gage.
 1. Automatic balancing valve, factory set to operate within 10 percent of design flow rate over a 40:1 differential pressure range of 2 to 80 psig.
 2. Manual, calibrated-orifice balancing valve.
 3. Manual, venturi-type balancing valve.

2.4 PUMP MODULE

- A. Heat Pump cabinet to include integrated secondary loop pump module.
 - 1. General requirements for motors are specified in Section 15185 (Hydronic Pumps).
 - 2. Water Source Heat Pump electrical data includes integrated circulator pump load (Secondary Loop Pump), as indicated.
- B. Include pump module hose kit with thread to barb fittings, hose, and hose clamps.
- C. Include controls to operate pump as required to maintain room temperature and ventilation set points.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of water-source heat pumps.
- B. Examine roughing-in for piping and electric installations for water-source heat pumps to verify actual locations of piping connections and electrical conduit before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Suspend water-source heat pumps from structure with threaded steel rods and vibration isolators as described in Section 15050 (Basic Mechanical Materials and Methods).
- B. Water Source Heat Pumps shall be accessible for inspection, service, repair and replacement without removing permanent construction per CMC 305.0.
- C. Install wall-mounting thermostats, temperature sensors, and switch controls in electrical outlet boxes at 4'-0" above finished floor.

3.3 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:
 - 1. Connect supply and return steel hydronic piping to heat pump with unions, proper valves, and hose kits.
 - 2. Connect heat-pump condensate drain pan to indirect waste connection with condensate trap of adequate depth to seal against the pressure of fan.

- B. Duct installation requirements are specified in other Section 15815 (Ductwork and Accessories). Drawings indicate general arrangement of ducts. Specific connection requirements are as follows:
- C. Install electrical devices furnished by manufacturer but not specified to be factory mounted.
- D. Install piping adjacent to machine to allow service and maintenance.
- E. Ground equipment according to electrical plans and specifications
- F. Connect wiring according to electrical plans and specifications.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect and be present during testing and adjusting field-assembled components. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. After installing water-source heat pumps and after electrical circuitry has been energized, test units for compliance with requirements.
 - 2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace malfunctioning units and retest as specified above.

3.5 MECHANICAL STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. See Section 15950 (Testing, Adjusting, and Balancing of HVAC Systems).
- C. Complete installation and startup checks according to manufacturer's written instructions and do the following:
 - 1. Inspect for visible damage to unit casing.
 - 2. Inspect for visible damage to compressor, coils, and fans.
 - 3. Inspect internal insulation.
 - 4. Verify that labels are clearly visible.
 - 5. Verify that clearances have been provided for servicing.
 - 6. Verify that controls are connected and operable.
 - 7. Verify that filters are installed.
 - 8. Adjust vibration isolators.
 - 9. Verify bearing lubrication on fan.

10. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
11. Adjust fan belts to proper alignment and tension.
12. Start unit according to manufacturer's written instructions.
13. Complete startup sheets.
14. Inspect and record performance of interlocks and protective devices; verify sequences.
15. Operate unit for an initial period as recommended or required by manufacturer.
16. Verify thermostat and humidistat calibration.
17. Inspect outdoor-air dampers for proper outdoor air setting.

18. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
 - a. Supply-air volume.
 - b. Return-air volume.
 - c. Relief-air volume.
 - d. Outdoor-air intake volume.

3.6 ADJUSTING

- A. Adjust initial temperature and humidity set points.
- B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

3.7 CLEANING

- A. Replace filters used during construction prior to air balance.
- B. After completing installation of exposed, factory-finished water-source heat pumps, inspect exposed finishes and repair damaged finishes.
- C. Repair all T-Bar and ceiling tiles to original condition as shown on Detail 1 through 8, Sheet A3.0.

3.8 DEMONSTRATION AND TRAINING

- A. Provide two 4-hour training periods to educate the maintenance staff on the operation of all Water Source Heat Pumps.

END OF SECTION

SECTION 15815

DUCTWORK AND ACCESSORIES**PART 1 GENERAL****1.1 SUMMARY:**

- A. Section Includes:
 - 1. Round Ductwork
 - 2. Rectangular Ductwork
 - 3. Metal ductwork
 - 4. Duct test holes
 - 5. Flexible duct connections
 - 6. Dampers
 - 7. Duct Smoke Detectors
 - 8. Diffusers and grilles
 - 9. Duct Hangers and Supports

1.2 REFERENCES

- A. American Society for Testing and Materials, ASTM A36, Standard Specification for Carbon Structural Steel.
- B. American Society for Testing and Materials, ASTM A90, Standard Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
- C. American Society for Testing and Materials, ASTM A492, Standard Specification for Stainless Steel Rope Wire.
- D. American Society for Testing and Materials, ASTM A525, General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- E. American Society for Testing and Materials, ASTM A575, Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades.
- F. American Society for Testing and Materials, ASTM A603, Standard Specification for Zinc-Coated Steel Structural Wire Rope
- G. California Mechanical Code, CMC 605, Insulation of Ducts.
- H. California Mechanical Code, CMC 609, Automatic Shutoffs.
- I. California Mechanical Code, CMC Chapter 5, Exhaust Systems.
- J. National Fire Protection Association, NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
- K. SMACNA 1966, HVAC Duct Construction Standards - Metal and Flexible.

- L. Underwriters Laboratories Inc., UL 555, Fire Dampers.
- M. Underwriters Laboratories Inc., UL 555S, Standard for Smoke Dampers.

1.4 SUBMITTALS

- A. Product Data:
 - 1. Duct materials and duct connectors.
 - 2. Diffusers and grilles: performance, size, finish, and type of mounting.

PART 2 MATERIALS

2.1 MANUFACTURERS

- A. Round Duct
 - 1. McGill AirFlow LLC.
 - 2. SEMCO Incorporated.
 - 3. Spiral Manufacturing Co., Inc.
 - 4. Or Approved Equal
- B. Rectangular Duct Lining
 - 1. Aeroflex by Owens-Corning Fiberglass Corp.
 - 2. Linacoustic by Schuller Corp.
 - 3. Ultralite by CertainTeed Corporation.
 - 4. Or Approved Equal
- C. Fire/Smoke Dampers
 - 1. Pottorff
 - 2. Ruskin Company
 - 3. Greenheck Fan Corporation
 - 4. Or Approved Equal
- D. Duct Smoke Detectors
 - 1. Pottorff
 - 2. Ruskin Company
 - 3. Air Products and Controls, Inc.
 - 4. Or Approved Equal
- E. Diffusers, Grilles, and Registers
 - 1. Titus
 - 2. J and J Register

3. Metalaire
4. Or Approved Equal

2.2 ROUND DUCTS AND FITTINGS

- A. Duct Sizes are as indicated. For lined ducts, maintain sizes inside lining.
- B. General Insulation Requirements: Comply with Building Energy Efficiency Standards Section 124 and the CMC Chapter 6, Section 605.0.
- C. Environmental Air Ducts shall be per CMC Chapter 5, Universal Building Code 1202 and Energy Efficiency Standards Section 121.
- D. General Fabrication Requirements: Comply with SMACNA 1966, Chapter 3, Round, Oval, and Flexible Duct, based on indicated static-pressure class unless otherwise indicated.
- E. Transverse Joints: Select joint types and fabricate according to SMACNA 1966, Figure 3-2, Transverse Joints - Round Duct, for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA 1966.
- F. Longitudinal Seams: Select seam types and fabricate according to SMACNA 1966, Figure 3-1, Seams - Round Duct and Fittings, for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA 1966.
- G. Tees and Laterals: Select types and fabricate according to SMACNA 1966 Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA 1966.

2.3 METAL DUCTWORK

- A. Galvanized Steel Ducts: ASTM A525 and ASTM A527 galvanized sheet, lock-forming quality, having G90 zinc coating in conformance with ASTM A90.
- B. Fasteners: Rivets, bolts or sheet metal screws.
- C. Sealant: All rigid ductwork shall be sealed airtight with mastic or other approved materials.
- D. Hanger Rod: ASTM A36; continuously threaded.
- E. No duct tape is approved for rigid duct use.

2.4 DUCTWORK FABRICATION

- A. Fabricate and support in accordance with SMACNA 1966 for 2" w.g. pressure class. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

- B. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows are used, provide air foil turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.
- C. Duct transitions shall not exceed 15 degrees; maximum of 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- D. Fabricate continuously welded round duct fittings two gages heavier than duct gages indicated in SMACNA 1966. Joints shall be minimum 4 inch cemented slip joint or brazed. Prime coat welded joints.
- E. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connection may be used.
- F. Round supply ductwork shall be of the same material, gauges, and construction as that indicated for 4 inch pressure class ductwork.
 - 1. Provide 20 gauge minimum for ductwork exposed within occupied spaces.
- G. Supply and return ducts shall be insulated to achieve the minimum thermal (R) value as set forth in CMC Table 6-6.

2.5 RECTANGULAR DUCTWORK MATERIALS

- A. Duct Sizes are as indicated. For lined ducts, maintain sizes inside lining.
- B. Internal duct lining:
 - 1. Provide internal duct lining in all supply and return air plenums and rigid duct connected to all Heat Pumps.
 - a. Where not exposed to weather, lining may be 1 inch thick, 3 pound density, with R value of 4.2 minimum.
 - 2. Duct liner and adhesive shall not exceed flame spread rating of 25 and smoke development rating of 50, all in conformance with CMC requirements.
- C. Ductwork Support Materials: Except as otherwise indicated, Provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.

2.6 DUCT TEST HOLES

- A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist on metal caps.
- B. Permanent Test Holes: Factory fabricated airtight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.7 FLEXIBLE DUCT CONNECTIONS

- A. Fabricate in accordance with SMACNA 1966.
- B. Connector: Fabric crimped into metal edging strip.
 - 1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A.
 - 2. Net Fabric Width: Approximately 2 inches wide.
 - 3. Metal: 3 inches wide, galvanized steel.
- C. Leaded Vinyl Sheet: Minimum 0.55 inch thick, 0.87 lb per sq ft, 10 dB attenuation in 10 to 10,000 Hz range.
- D. Duct connections and fittings shall be insulated the same as the round duct it connects.

2.8 DAMPERS

- A. Construct dampers with galvanized sheet metal two gauges heavier than duct in which installed.
- B. Except as modified herein, the construction shall be of aluminum or galvanized steel with interlocking edges and maximum 10 inch blade width.
- C. Blades:
 - 1. Opposed-blade type.
 - 2. Connect to the damper frame with the non-metallic anti-friction bushing.
 - 3. Connect to the frame with a galvanized zinc coated steel anti-friction bearing pin.
 - a. The pin shall consist of a ball bearing, lubricated for life with a full stroke test of 200,000 or more strokes in accordance with UL 555S. The bearing shall be pressed onto a steel shaft via a knurled stud.
- D. Manual Volume Dampers
 - 1. Balancing, factory-fabricated type. Equip dampers with accessible mechanism such as quadrant operators or 3/16 inch rods brought through the side of ducts with locking setscrew and bushing. Where quadrant operators are furnished, Provide chrome plated or enamel painted type with exposed edges rounded.
- E. Backdraft Dampers
 - 1. Factory-fabricated with statically balanced blades that open automatically when the fan starts and close by gravity or spring when the fan stops.
- F. Fire/Smoke Dampers

1. Factory-fabricated with triple-V blades which are operable by actuator for point-of-origin control of fire and smoke.
2. Damper shall be UL 555 Fire Resistance Rated for 1.5 hours and UL 555S Leakage Class 1 Rated.
3. Frame shall have round duct transitions on either side and shall be ordered to fit the connecting ductwork.

2.9 DUCT SMOKE DETECTORS

- A. Factory-fabricated with either Ionization or Photoelectric detection head. Detector shall operate between 100 & 4000 feet per minute and at a maximum temperatures of no less than 140 deg F.

2.10 DIFFUSERS AND GRILLES

- A. All new and existing 24"x24" diffusers and grilles shall fit properly within the T-Bar structure.
- B. Provide proper frame for diffusers and grilles to be installed in the T-bar structure.
- C. Diffuser to come with opposed blade damper.

2.11 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA 1966, Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- F. 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.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.

3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install and seal ducts in accordance with SMACNA 1966.
- C. All returns shall be ducted to new heat pumps.
- D. Provide openings in ductwork where required to accommodate thermometers and controllers for testing. Provide Pitot tube openings where required for testing of systems, complete with metal cap with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
- E. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- F. Use double nuts and lock washers on threaded rod supports. Connect flexible duct to metal ducts with nylon strap, adhesive and tape.
- G. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- H. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA 1966.
- I. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment.
- J. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum of 2 duct widths from duct take-off.
- K. Provide balancing dampers on duct take-off to diffusers, grilles, and registers.
- L. Install diffusers in accordance with manufacturer's instructions.
- M. Check location of outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry and lighting arrangement.
- N. Install diffusers to ductwork with airtight connection.
- O. All exterior wall penetrations shall be flashed and counterflashed as required to seal weathertight.
- P. Smoke Detectors:

1. Install in the supply plenum of all Heat Pumps per CMC 609.
2. Install within 5 feet of any Fire/Smoke Damper indicated, per local code, and per Fire Marshal.
3. Wire to the Heat Pump and the Fire Control System in a way that disengages the Heat Pump and alerts the Fire Control System if smoke is detected.

Q. Fire/Smoke Dampers:

1. Install as indicated, per local code, and per Fire Marshal.
2. Construct of approved materials with permanent identification labels.
3. Maintain access for inspection.
4. Insert slotted dowel pin through the hole connecting the two pins for blade to frame connection.

R. Penetrations through fire rated assemblies:

1. Fire stop and seal with a materials that meets or exceeds the "T" rating of the assembly penetrated.
2. Cement duct liner in place with nonflammable, non-hardening duct adhesive. Seal all raw edges of insulation inside ductwork with adhesive.

T. Provide sheet metal weld pins and washers for clinch pins and washers on all ductwork on 12 inch intervals with the first row within 3 inches of the leading edge of each piece of insulation and within 4 inches of corners. No use of adhesive mounted pins will be considered.

U. Install clinched pin fasteners with properly adjusted automatic fastening equipment. Manual installation will not be considered.

V. Install weld pins with properly adjusted automatic fastening equipment. Installation shall not damage the galvanized coating on the outside of the duct.

W. Duct Insulation:

1. Shall be installed on the following:
 - a. Round supply and return ductwork.
 - b. Rectangular supply and return plenums at heat pumps.
 - c. Cold outside air ductwork, where condensation could form on the outside of the duct.
2. Install per manufacturer's recommendations and relevant codes and standards.
3. Ensure unfaced fiberglass and mineral fiber insulation are not in contact with the airstream.

3.2 CLEANING

- A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment, which may be harmed by excessive dirt with temporary filters, or bypass during cleaning.
- B. Repair all T-Bar and ceiling tiles to original condition as shown on Detail 1 through 8, Sheet A3.0.

END OF SECTION

SECTION 15856

INTAKE VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Louvered-penthouse gravity ventilators.

B. Related Documents

1. Section 15815 (Ductwork and Accessories)

1.2 REFERENCES

- A. American Society of Heating, Refrigerating and Air-Conditioning Engineers, ASHRAE 62.1, Ventilation for Acceptable Indoor Air Quality.
- B. American Society for Testing and Materials, ASTM B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- C. American Society for Testing and Materials, ASTM B221, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- D. American Society for Testing and Materials, ASTM D1187, Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.
- E. American Society for Testing and Materials, ASTM E488, Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements.

1.3 SUBMITTALS

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

B. Coordination Drawings: Roof framing plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members to which roof curbs and ventilators shall be attached.
2. Sizes and locations of roof openings.

C. Welding certificates.

1.4 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.5 PERFORMANCE REQUIREMENTS

- A. Ventilators shall withstand the effects of gravity and wind loads and stresses within limits and under conditions indicated without permanent deformation of ventilator components, noise or metal fatigue caused by ventilator blade rattle or flutter, or permanent damage to fasteners and anchors. Ventilator shall feature storm resistant weather blades.
- B. Water Entrainment: Limit water penetration through unit to comply with ASHRAE 62.1.

PART 2 - PRODUCTS

2.1 MANUFACTURERES

- A. Louvered-Penthouse Gravity Ventilators
 - 1. Greenheck Fan Corporation
 - 2. Loren Cook Company
 - 3. PennBarry
 - 4. Or Approved Equal

2.2 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5 or T-52.
- B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming or as otherwise recommended by metal producer for required finish.
- C. Fasteners: Same basic metal and alloy as fastened metal or 300 Series stainless steel unless otherwise indicated. Do not use metals that are incompatible with joined materials.
 - 1. Use types and sizes to suit unit installation conditions.
- D. Post-Installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors made from stainless-steel components, with capability to sustain without failure a load equal to 4 times the loads imposed for concrete, or 6 times the load imposed for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.3 FABRICATION, GENERAL

- A. Factory or shop fabricate gravity ventilators to minimize field splicing and assembly. Disassemble units to the minimum extent as necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.
- B. Fabricate frames, including integral bases, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
- C. Fabricate units with closely fitted joints and exposed connections accurately located and secured.
- D. Fabricate supports, anchorages, and accessories required for complete assembly.
- E. Perform shop welding by approved procedures and personnel.

2.4 LOUVERED-PENTHOUSE VENTILATORS

- A. Construction: All-welded assembly with 4-inch-deep louvers, mitered corners, and aluminum sheet roof.
- B. Frame and Blade Material and Nominal Thickness: Extruded aluminum, of thickness required to comply with structural performance requirements, but not less than 0.080 inch for frames and 0.080 inch for blades with wind deflectors.
- C. Roof Curbs: Provide new unit roof curb to fit new ventilator. Roof curb shall be galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch-thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to fit roof opening and ventilator base.
- D. Bird Screening: Aluminum, 1/2-inch-square mesh.
- E. Accessories:
 - 1. Dampers:
 - a. Location: Penthouse neck.
- F. Capacities and Characteristics: as indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install gravity ventilators level, plumb, and at indicated alignment with adjacent work.
- B. Install gravity ventilators with clearances for service and maintenance.

- C. Air inlets shall be mounted a minimum of 10 feet horizontally from all powered exhaust air outlets or relief air ventilators.
- D. Install perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Install concealed gaskets, flashings, joint fillers, and insulation as installation progresses.
- F. Label gravity ventilators according to the HVAC systems served as indicated.
- G. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
- H. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

3.2 CONNECTIONS

- A. Duct installation and connection requirements are specified in other Section 15815 (Ductwork and Accessories). General arrangements of ducts and duct accessories are as indicated.

3.3 ADJUSTING

- A. Adjust damper linkages for proper damper operation.

END OF SECTION

SECTION 15900

BUILDING MANAGEMENT SYSTEM (BMS)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. System Architecture
2. Operator Workstation
3. Operator Interface
4. Application Nodes
5. Application Software
6. Field Devices
7. Specialty Items
8. Installation Practices
9. Training
10. Commissioning Requirements
11. Point Lists

B. Related Sections

1. Section 15815 (Ductwork and Accessories)

1.2 REFERENCES

- A. Underwriters Laboratories, UL 268, Smoke Detectors for Fire Alarm Signaling Systems.
- B. Underwriters Laboratories, UL 864, Control Units and Accessories for Fire Alarm Systems.
- C. Underwriters Laboratories, UL 916, Energy Management Equipment.
- D. National Fire Protection Association, NFPA 70, National Electrical Code.
- E. National Fire Protection Association, NFPA 92A and 92B, Smoke Purge/Control Equipment.
- F. Federal Communications Commission, FCC, including Part 15, Radio Frequency Devices.
- G. American National Standards Institute, ANSI/EIA 909.1-A (LonWorks)
- H. ANSI/ASHRAE 195, Data Communication Protocol for Building Automation and Control Networks (BACnet)
- I. American Society of Heating, Refrigeration, and Air-Conditioning Engineers, ASHRAE SSPC-135, Data Communication Protocol for Building Automation and Control Networks (BACnet)

J. Electronic Industry Alliance (EIA) RS-485

1.3 DEFINITIONS

- A. ADC - Analog to Digital Converter
- B. AI - Analog Input
- C. AN - Application Node
- D. Analog: A continuously variable system or value not having discrete levels. Typically exists within a defined range of limiting values.
- E. AO - Analog Output
- F. BMS Network: The total digital on-line real-time interconnected configuration of BMS digital processing units, workstations, panels, sub-panels, controllers, devices and associated elements individually known as network nodes. May exist as one or more fully interfaced and integrated sub-networks, LAN, WAN or the like.
- G. BMS Integration: The complete functional and operational interconnection and interfacing of all BMS work elements and nodes in compliance with all applicable codes, standards and ordinances so as to provide a single coherent BMS as required by this Division.
- H. Binary: A two-state system where an "ON" condition is represented by one discrete signal level and an "OFF" condition is represented by a second discrete signal level.
- I. Building Management System (BMS): Also known as the "Controls" or "Control System." The total integrated BMS of fully operational and functional elements, including equipment, software, programming, and associated materials, to be provided by this Division BMS Contractor and to be interfaced to the associated work of other related trades.
- J. CPU - Central Processing Unit
- K. CRT - Cathode Ray Tube
- L. Control Sequence: An BMS pre-programmed arrangement of software algorithms, logical computation, target values and limits as required to attain the defined operational control objectives.
- M. DAC - Digital to Analog Converter
- N. DDC - Direct Digital Control
- O. DI - Digital Input
- P. DO - Digital Output
- Q. Direct Digital Control: The digital algorithms and pre-defined arrangements included in the BMS software to provide direct closed-loop control for the designated equipment and controlled variables. Inclusive of Proportional, Derivative and Integral control algorithms together with target values, limits, logical functions, arithmetic functions, constant values, timing considerations and the like.
- R. EEPROM - Electronically Erasable Programmable Read Only
- S. EMI - Electromagnetic Interference
- T. FAS - Fire Alarm Detection and Annunciation System
- U. GUI - Graphical User Interface
- V. HOA - Hand-Off-Auto
- W. I/O - Input/Output

- X. LAN - Local Area Network
- Y. LCD - Liquid Crystal Display
- Z. LED - Light Emitting Diode
- AA. MCC - Motor Control Center
- BB. NC - Normally Closed
- CC. NO - Normally Open
- DD. Node: A digitally programmable entity existing on the BMS network.
- EE. OWS - Operator Workstation
- FF. OAT - Outdoor Air Temperature
- GG. PC - Personal Computer
- HH. PC: IBM-compatible Personal Computer from a recognized major manufacturer
- II. RAM - Random Access Memory
- JJ. RF - Radio Frequency
- KK. RFI - Radio Frequency Interference
- LL. RH - Relative Humidity
- MM. ROM - Read Only Memory
- NN. RTD - Resistance Temperature Device
- OO. SPDT - Single Pole Double Throw
- PP. SPST - Single Pole Single Throw
- QQ. Software: The term “software” and its derivatives when used in this Division shall mean all of programmed digital processor software, preprogrammed firmware and project specific digital process programming and database entries and definitions as generally understood in the BMS industry for real-time, on-line, integrated BMS configurations.
- RR. TBA - To Be Advised
- SS. TCP/IP - Transmission Control Protocol/Internet
- TT. TTD - Thermistor Temperature Device
- UU. UPS - Uninterruptible Power Supply
- VV. VAC - Volts, Alternating Current
- WW. VAV - Variable Air Volume
- XX. VDC - Volts, Direct Current
- YY. WAN - Wide Area Network
- ZZ. WRS - Wireless Room Sensor
- AAA. Wiring: The term “Wiring” and its derivatives when used in this Division shall mean provide the BMS wiring and terminations.
- BBB. XVGA - Extended Video Graphics Adapter

1.4 SUBMITTALS

A. Shop Drawings, Product Data, and Samples for the following:

1. At a minimum, submit the following:
 - a. BMS network architecture diagrams including all nodes and interconnections.
 - b. BMS schematics, sequences and flow diagrams.
 - c. Points schedule for each point in the BMS, including: Point Type, Object Name, Expanded ID, Display Units, Controller type, and Address.
 - d. Samples of Graphic Display screen types and associated menus.

- e. Detailed Bill of Material list for each system or application, identifying quantities, part numbers, descriptions, and optional features.
- f. Control Damper Schedule including a separate line for each damper provided under this section and a column for each of the damper attributes, including: Code Number, Fail Position, Damper Type, Damper Operator, Duct Size, Damper Size, Mounting, and Actuator Type.
- g. Details of all BMS interfaces and connections to the work of other trades.
- h. Product data sheets or marked catalog pages including part number, photo and description for all products including software.

1.5 QUALITY ASSURANCE

- A. The BMS shall be a complete system designed for use with the enterprise IT systems. This functionality shall extend into the equipment rooms.
- B. Devices residing on the automation network located in equipment rooms and similar shall be fully IT compatible devices that mount and communicate directly on the IT infrastructure in the facility.
- C. Contractor shall be responsible for coordination with the Owner's IT staff to ensure that the BMS will perform in the Owner's environment without disruption to any of the other activities taking place on that LAN.
- D. The Building Management System architecture shall consist of the products of a manufacturer regularly engaged in the production of Building Management Systems, and shall be the manufacturer's latest standard of design at the time of bid.
- E. The BMS Contractor shall have a branch facility within a 100-mile radius of the Site supplying complete maintenance and support services on a 24 hour, 7 day-a-week basis.

1.6 WARRANTY

- A. The Building Automation Control System contractor shall respond to the Site within a four (4) hour period for any emergency relating to the Control System and associated components installed by the Building Automation Control System contractor.
- B. Warranty period shall commence after all operator instruction is completed and the entire BMS is commissioned and operational.
- C. Standard Material and Labor Warranty:
 1. Maintain an adequate supply of materials within 100 miles of the Site such that replacement of key parts and labor support, including programming.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with ZigBee Technology, Wireless Mesh, Open-Protocol Networks outlined in these specifications, the following manufacturers may be considered:
 1. Johnson Controls, Metasys

2. Honeywell, Enterprise Building Integrator (EBI)
 3. Siemens Building Systems, APOGEE
 4. Or Approved Equal
- B. 3rd party distributors or franchise dealers of the product manufacturer listed above are NOT acceptable.

2.2 GENERAL DESCRIPTION

- A. The Building Management System (BMS) shall use an open architecture and fully support a multi-vendor environment.
- B. The BMS shall be capable of fully controlling and programming each heat pump or packaged air conditioning unit.
- C. The BMS shall support open communication protocol standards and integrate a wide variety of third-party devices and applications.
- D. The BMS shall be designed for use on the Internet, or intranets using off the shelf, industry standard technology compatible with other owner provided networks.
- E. The BMS shall consist of the following:
1. Standalone Network Automation Engine(s)
 2. Field Equipment Controller(s)
 3. Input/Output Module(s)
 4. Local Display Device(s)
 5. Portable Operator's Terminal(s)
 6. Distributed User Interface(s)
 7. Network processing, data storage and communications equipment
 8. Other components required for a complete and working BMS
- F. The BMS shall be modular in nature, and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, controllers and operator devices, while re-using existing controls equipment.
- G. BMS architectural design shall eliminate dependence upon any single device for alarm reporting and control execution.
1. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.
 2. The BMS shall maintain all settings and overrides through a system reboot.
- H. BMS architectural design shall eliminate dependence upon any single device for alarm reporting and control execution.
- I. All points of user interface shall be on standard PCs that do not require the purchase of any special software from the BMS manufacturer for use as a building operations terminal. The primary point of interface on these PCs will be a standard Web Browser.
- J. The BMS as provided shall incorporate, at minimum, the following integrated features, functions and services:

1. Operator information, alarm management and control functions.
2. Enterprise-level information and control access.
3. Information management including monitoring, transmission, archiving, retrieval, and reporting functions.
4. Diagnostic monitoring and reporting of BMS functions.
5. Offsite monitoring and management access.
6. Energy management
7. Standard applications for terminal HVAC systems.
8. BMS shall be fully compatible with BACnet, per standards ANSI/ASHRAE 195 and ASHRAE SSPC-135 (BACnet).

2.3 BMS ARCHITECTURE

A. Automation Network

1. The automation network shall be based on a PC industry standard of Ethernet TCP/IP. Where used, LAN controller cards shall be standard "off the shelf" products available through normal PC vendor channels.
2. The BMS shall network multiple user interface clients, automation engines, system controllers and application-specific controllers. Provide application and data server(s) as required for BMS operation.
3. The automation network shall be capable of operating at a communication speed of 100 Mbps, with full peer-to-peer network communication.
4. Network Automation Engines (NAE) shall reside on the automation network.
5. The automation network will be compatible with other enterprise-wide networks. Where indicated, the automation network shall be connected to the enterprise network and share resources with it by way of standard networking devices and practices.

B. Control Network

1. Network Control Engine (NCE) shall provide supervisory control over the control network and shall support all three (3) of the following communication protocols:
 - a. BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9
 - 1) The NAE shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
 - 2) The NAE shall be tested and certified as a BACnet Building Controller (B-BC).
 - b. LonWorks enabled devices using the Free Topology Transceiver (FTT-10a).
 - c. The Johnson Controls N2 Field Bus.
2. Control networks shall provide either "Peer-to-Peer," Master-Slave, or Supervised Token Passing communications, and shall operate at a minimum communication speed of 9600 baud.
3. DDC Controllers shall reside on the control network.

4. Control network communication protocol shall be BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135.
5. A BACnet Protocol Implementation Conformance Statement (PICS) shall be provided for each controller device (master or slave) that will communicate on the BACnet MS/TP Bus.

2.4 USER INTERFACE

A. Distributed Web Based User Interface

1. All features and functions of the dedicated user interface previously defined in this document shall be available on any computer connected directly or via a wide area or virtual private network (WAN/VPN) to the automation network and conforming to the following specifications.
2. The software shall run on the Microsoft Internet Explorer (6.0 or higher) browser supporting the following functions:
 - 1) Configuration
 - 2) Commissioning
 - 3) Data Archiving
 - 4) Monitoring
 - 5) Commanding
 - 6) System Diagnostics
3. Minimum PC hardware requirements:
 - a. 512 MB RAM
 - b. 2.0 GHz Clock Speed Pentium 4 Microprocessor
 - c. 100.0 GB Hard Drive.
 - d. 1 Keyboard with 83 keys (minimum).
 - e. Super Video Graphics Array (SVGA) 1024x768 resolution display with 64K colors and 16 bit color depth
 - f. Mouse or other pointing device

B. User Interface Application Components

1. Operator Interface
 - a. An integrated browser based client application shall be used as the user operator interface program.
 - b. The BMS shall employ an event-driven rather than a device polling methodology to dynamically capture and present new data to the user.
 - c. All Inputs, Outputs, Setpoints, and all other parameters as defined within Part 3, as indicated, or required as part of the system software, shall be displayed for operator viewing and modification from the operator interface software.
 - d. The user interface software shall provide help menus and instructions for each operation and/or application.
 - e. The BMS shall support customization of the UI configuration and a home page display for each operator.
 - f. The BMS shall support user preferences in the following screen presentations:
 - 1) Alarm
 - 2) Trend

- 3) Display
 - 4) Applications
 - g. All controller software operating parameters shall be displayed for the operator to view/modify from the user interface. These include: setpoints, alarm limits, time delays, proportional-integral-derivative (PID) tuning constants, run-times, point statistics, schedules, and so forth.
 - h. The Operator Interface shall incorporate comprehensive support for functions including, but not necessarily limited to, the following:
 - 1) User access for selective information retrieval and control command execution
 - 2) Monitoring and reporting
 - 3) Alarm, non-normal, and return to normal condition annunciation
 - 4) Selective operator override and other control actions
 - 5) Information archiving, manipulation, formatting, display and reporting
 - 6) BMS internal performance supervision and diagnostics
 - 7) On-line access to user HELP menus
 - 8) On-line access to current BMS as-built records and documentation
 - 9) Means for the controlled re-programming, re-configuration of BMS operation and for the manipulation of BMS database information in compliance with the prevailing codes, approvals and regulations for individual BMS applications
 - i. The BMS shall support a list of application programs configured by the users that are called up by the following means:
 - 1) The Tools Menu
 - 2) Hyperlinks within the graphics displays
 - 3) Key sequences
 - j. The operation of the BMS shall be independent of the user interface, which shall be used for operator communications only. Systems that rely on an operator workstation to provide supervisory control over controller execution of the sequences of operations or system communications shall not be acceptable.
2. Navigation Trees
 - a. The BMS will have the capability to display multiple navigation trees that will aid the operator in navigating throughout all systems and points connected. At minimum provide a tree that identifies all systems on the networks.
 - b. Provide the ability for the operator to add custom trees. The operator will be able to define any logical grouping of systems or points and arrange them on the tree in any order. It shall be possible to nest groups within other groups. Provide at minimum 5 levels of nesting.
 - c. The navigation trees shall be "dockable" to other displays in the user interface such as graphics. This means that the trees will appear as part of the display, but can be detached and then minimized to the Windows task bar or closed altogether. A simple keystroke will reattach the navigation to the primary display of the user interface.
 3. Alarms
 - a. Alarms shall be routed directly from Network Automation Engines to PCs and servers. It shall be possible for specific alarms from specific points to be routed to specific PCs and servers. The alarm management portion of the user interface shall, at the minimum, provide the following functions:
 - 1) Log date and time of alarm occurrence.

- 2) Generate a "Pop-Up" window, with audible alarm, informing a user that an alarm has been received.
 - 3) Allow a user, with the appropriate security level, to acknowledge, temporarily silence, or discard an alarm.
 - 4) Provide an audit trail on hard drive for alarms by recording user acknowledgment, deletion, or disabling of an alarm. The audit trail shall include the name of the user, the alarm, the action taken on the alarm, and a time/date stamp.
 - 5) Provide the ability to direct alarms to an e-mail address or alphanumeric pager. This must be provided in addition to the pop up window described above. Systems that use e-mail and pagers as the exclusive means of annunciating alarms are not acceptable.
 - 6) Any attribute of any object in the BMS may be designated to report an alarm.
 - b. The BMS shall annunciate diagnostic alarms indicating system failures and non-normal operating conditions.
 - c. The BMS shall allow a minimum of 4 categories of alarm sounds customizable through user defined wav.files.
 - d. The BMS shall annunciate application alarms at minimum.
4. Reports and Summaries
- a. Reports and Summaries shall be generated and directed to the user interface displays, with subsequent assignment to printers, or disk. As a minimum, the system shall provide the following reports:
 - 1) All points in the BMS
 - 2) All points in each BMS application
 - 3) All points in a specific controller
 - 4) All points in a user-defined group of points
 - 5) All points currently in alarm
 - 6) All points locked out
 - 7) All BMS schedules
 - 8) All user defined and adjustable variables, schedules, interlocks.
 - b. Summaries and Reports shall be accessible via standard UI functions and not dependent upon custom programming or user defined Hypertext Markup Language (HTML) pages.
 - c. Selection of a single menu item, tool bar item, or tool bar button shall print any displayed report or summary on the system printer for use as a building management and diagnostics tool.
 - d. The BMS shall allow for the creation of custom reports and queries via a standard web services Extendable Markup Language (XML) interface and commercial off-the-shelf software such as Microsoft Access, Microsoft Excel, or Crystal Reports.
5. Schedules
- a. A graphical display for time-of-day scheduling and override scheduling of building operations shall be provided. At a minimum, the following functions shall be provided:
 - 1) Weekly schedules
 - 2) Exception Schedules
 - 3) Monthly calendars

- b. Weekly schedules shall be provided for each group of equipment with a specific time use schedule.
 - c. It shall be possible to define one or more exception schedules for each schedule including references to calendars
 - d. Monthly calendars shall be provided that allow for simplified scheduling of holidays and special days for a minimum of five years in advance. Holidays and special days shall be user-selected with the pointing device or keyboard, and shall automatically reschedule equipment operation as previously defined on the exception schedules.
 - e. Changes to schedules made from the User Interface shall directly modify the Network Automation Engine schedule database.
 - f. Schedules and Calendars shall comply with ASHRAE SP135/2003 BACnet Standard.
 - g. Selection of a single menu item or tool bar button shall print any displayed schedule on the system printer for use as a building management and diagnostics tool.
6. Password
- a. Multiple-level password access protection shall be provided to allow the user/manager to user interface control, display, and database manipulation capabilities deemed appropriate for each user, based on an assigned password.
 - b. Each user shall have the following: a user name (accept 24 characters minimum), a password (accept 12 characters minimum), and access levels.
 - c. The BMS shall allow each user to change his or her password at will.
 - d. When entering or editing passwords, the BMS shall not echo the actual characters for display on the monitor.
 - e. A minimum of five levels of access shall be supported individually or in any combination as follows:
 - 1) Level 1 = View Data
 - 2) Level 2 = Command
 - 3) Level 3 = Operator Overrides
 - 4) Level 4 = Database Modification
 - 5) Level 5 = Database Configuration
 - 6) Level 6 = All privileges, including Password Add/Modify
 - f. A minimum of 100 unique passwords shall be supported.
 - g. Operators shall be able to perform only those commands available for their respective passwords. Display of menu selections shall be limited to only those items defined for the access level of the password used to log-on.
 - h. The BMS shall automatically generate a report of log-on/log-off and system activity for each user. Any action that results in a change in the operation or configuration of the control system shall be recorded, including: modification of point values, schedules or history collection parameters, and all changes to the alarm management system, including the acknowledgment and deletion of alarms.
7. Screen Manager
- a. The User Interface shall be provided with screen management capabilities that allow the user to activate, close, and simultaneously manipulate a minimum of 4 active display windows plus a network or user defined navigation tree.
9. Dynamic Color Graphics

- a. The graphics application program shall be supplied as an integral part of the User Interface. Browser or Workstation applications that rely only upon HTML pages shall not be acceptable.
 - b. The graphics applications shall include a create/edit function and a runtime function. The BMS architecture shall support an unlimited number of graphics documents (graphic definition files) to be generated and executed.
 - 1) The graphics shall be able to display and provide animation based on real-time data that is acquired, derived, or entered.
 - c. Graphics runtime functions – A maximum of 16 graphic applications shall be able to execute at any one time on a user interface or workstation with 4 visible to the user. Each graphic application shall be capable of the following functions:
 - 1) All graphics shall be fully scalable
 - 2) The graphics shall support a maintained aspect ratio.
 - 3) Multiple fonts shall be supported.
 - 4) Unique background shall be assignable on a per graphic basis.
 - 5) The color of all animations and values on displays shall indicate if the status of the object attribute.
 - d. Operation from graphics – It shall be possible to change values (setpoints) and states in system controlled equipment by using drop-down windows accessible via the pointing device
 - e. Graphic editing tool – A graphic editing tool shall be provided that allows for the creation and editing of graphic files. The graphic editor shall be capable of performing/defining all animations, and defining all runtime binding.
 - 1) The graphic editing tool shall in general provide for the creation and positioning of point objects by dragging from tool bars or drop-downs and positioning where required.
 - 2) In addition, the graphic editing tool shall be able to add additional content to any graphic by importing backgrounds in the (Scalable Vector Graphics) SVG, Bitmap (BMP) or Joint Photographic Experts Group (JPEG or JPG) file formats.
 - f. Aliasing – Many graphic displays representing part of a building and various building components are exact duplicates, with the exception that the various variables are bound to different field values. Consequently, it shall be possible to bind the value of a graphic display to aliases, as opposed to the physical field tags.
10. Historical trending and data collection
- a. Each Automation Engine shall store trend and point history data for all analog and digital inputs and outputs, as follows:
 - 1) Any point, physical or calculated, may be designated for trending. Three methods of collection shall be allowed:
 - 2) Defined time interval
 - 3) Upon a change of value
 - 4) Each Automation Engine shall have the capability to store multiple samples for each physical point and software variable based upon available memory, including an individual sample time/date stamp. Points may be assigned to multiple history trends with different collection parameters.
 - b. Trend and change of value data shall be stored within the engine and uploaded to a dedicated trend database or exported in a selectable data format via a provided data export utility. Uploads to a dedicated database shall occur based upon one of the

following: user-defined interval, manual command, or when the trend buffers are full. Exports shall be as requested by the user or on a time scheduled basis.

- c. The BMS shall provide a configurable data storage subsystem for the collection of historical data. Data shall have the ability to be stored in Microsoft Access format.

11. Trend data viewing and analysis

- a. Provide a trend viewing utility that shall have access to all database points.
- b. It shall be possible to retrieve any historical database point for use in displays and reports by specifying the point name and associated trend name.
- c. The trend viewing utility shall have the capability to define trend study displays to include multiple trends
- d. Displays shall be able to be single or stacked graphs with on-line selectable display characteristics, such as ranging, color, and plot style.
- e. Display magnitude and units shall both be selectable by the operator at any time without reconfiguring the processing or collection of data. This is a zoom capability.
- f. Display magnitude shall automatically be scaled to show full graphic resolution of the data being displayed.
- g. Trend studies shall be capable of calculating and displaying calculated variables including highest value, lowest value and time based accumulation.
- h. The Display shall support the user's ability to change colors, sample sizes, and types of markers.

12. Database Management

- a. Where a separate Secured Query Language (SQL) database is utilized for information storage the BMS shall provide a Database Manager that separates the database monitoring and managing functions by supporting two separate windows.
- b. Database secure access shall be accomplished using standard SQL authentication including the ability to access data for use outside of the Building Automation application.
- c. The database managing function shall include summarized information on trend, alarm, event, and audit for the following database management actions:
 - 1) Backup
 - 2) Purge
 - 3) Restore
- d. The Database Manager shall support four tabs:
 - 1) Statistics - shall display Database Server information and Trend, Alarm (Event), and Audit information on the Databases.
 - 2) Maintenance - shall provide an easy method of purging records from the Server trend, alarm (event), and audit databases by supporting separate screens for creating a backup prior to purging, selecting the database, and allowing for the retention of a selected number of day's data.
 - 3) Backup - Shall provide the means to create a database backup file and select a storage location.
 - 4) Restore - shall provide a restricted means of restoring a database by requiring the user to log into an Expert Mode in order to view the Restore screen.
- e. The Status Bar shall appear at the bottom of all Database Manager Tabs and shall provide information on the current database activity. The following icons shall be provided:

- 1) Ready
 - 2) Purging Record from a database
 - 3) Action Failed
 - 4) Refreshing Statistics
 - 5) Restoring database
 - 6) Shrinking a database
 - 7) Backing up a database
 - 8) Resetting internet information Services
 - 9) Starting the Device Manager
 - 10) Shutting down the Device Manager
 - 11) Action successful
- f. The Database Manager monitoring functions shall be accessed through the Monitoring Settings window and shall continuously read database information once the user has logged in.
 - g. The BMS shall provide user notification via taskbar icons and e-mail messages when a database value has exceeded a warning or alarm limit.
 - h. The Monitoring Settings window shall have the following sections:
 - 1) General – Shall allow the user to set and review scan intervals and start times.
 - 2) Email – Shall allow the user to create and review e-mail and phone text messages to be delivered when a Warning or Alarm is generated.
 - 3) Warning – shall allow the user to define the Warning limit parameters, set the Reminder Frequency, and link the e-mail message.
 - 4) Alarm – shall allow the user to define the Alarm limit parameters, set the Reminder Frequency, and link the e-mail message.
 - 5) Database login – Shall protect the BMS from unauthorized database manipulation by creating a Read Access and a Write Access for each of the Trend, Alarm (Event) and Audit databases as well as an Expert Mode required to restore a database.
 - i. The Monitoring Settings Taskbar shall provide the following informational icons:
 - 1) Normal – Indicates by color and size that all databases are within their limits.
 - 2) Warning - Indicates by color and size that one or more databases have exceeded their Warning limit.
 - 3) Alarm - Indicates by color and size that one or more databases have exceeded their Alarm limit.
 - j. The BMS shall provide user notification via Taskbar icons and e-mail messages when a database value has exceeded a warning or alarm limit.
13. Demand Limiting and Load Rolling
- a. The BMS shall provide a Demand Limiting and Load Rolling program for the purpose of limiting peak energy usage and reducing overall energy consumption.
 - b. The BMS shall support both Sliding Window and Fixed Window methods of predicting demand.
 - c. The BMS shall support three levels of sensitivity in the Sliding Window demand calculations for fine tuning the system.
 - 1) Low Setting – Sheds loads later and over the shortest amount of time. Maximizes the time the equipment is on.

- 2) Medium Setting - Sheds loads earlier over a longer amount of time than the Low Setting. Increases the time the equipment is on and decreases the probability of exceeding the Tariff Target over the Low Setting.
- 3) High Setting - Sheds loads earlier over a longer amount of time than the Medium Setting. Minimizes the probability of exceeding the Tariff Target.
- d. The BMS shall have both a Shed Mode and a Monitor Only Mode of operation.
 - 1) When the Shed Mode is engaged, the BMS shall actively control the Demand.
 - 2) When the Monitor Mode is engaged, the BMS will simulate the shedding action but will not take any action.
- e. The Demand Limiting program shall monitor the energy consumption rate and compare it to a user defined Tariff Target. The system shall maintain consumption below the target by selectively shedding loads based upon a user defined strategy.
- f. The Demand Limiting program shall be capable of supporting a minimum of 10 separate Load Priorities. Each load shall be user assigned to a Load Priority.
- g. The Demand Limiting program shall be capable of supporting a minimum of 12 separate Tariff Targets defining the maximum allowed average power during the current interval.
- h. The BMS shall support a Maximum Shed Time for each load as determined by the user. The BMS shall restore the load before the Maximum Shed time has expired.
- i. The BMS shall support a Minimum Shed Time for each load as determined by the user. The BMS shall not restore the load sooner than the Minimum Shed Time has expired.
- j. The BMS shall support a Minimum Release Time for each load as determined by the user. The BMS shall not shed the load until it has been off for the Minimum Release time.
- k. The BMS shall support three user defined options if the meter goes unreliable.
 - 1) Shedding - The currently shed loads will be released as their Maximum shed Times expire.
 - 2) Maintain the Current Shed Rate - The BMS will use the Demand Limiting shed rate that was present when the meter went unreliable.
 - 3) Use Unreliable Meter Shed Rate - the BMS will control to a user defined Unreliable Shed Rate target.
- l. The Load Rolling program shall sum the loads currently shed and compare it to a user defined Load Rolling Target. The BMS shall maintain consumption below the target by selectively shedding loads based upon a user defined Load Priority.
- m. The Load Rolling program shall be capable of supporting a minimum of 10 separate Load Priorities. Each load shall be user assigned to a Load Priority.
- n. The Load Rolling program shall be capable of supporting a minimum of 12 separate Tariff Targets defining the amount of power by which the demand must be reduced.
- o. The BMS shall provide the user with a Load Tab that displays all of the Demand Limiting and Load Rolling parameters for any selected load.
- p. The BMS shall provide the user with a Load Summary that displays all of the loads associated with the Demand Limiting and Load Rolling programs. Status Icons for each load shall indicate:
 - 1) Load is Offline
 - 2) Load is Disabled
 - 3) Load is Shed

- 4) Load is Locked
- 5) Load is in Comfort Override
- q. The Load Summary shall include a Load Summary Runtime view listing the following load conditions:
 - 1) Load Priority
 - 2) Shed Strategy
 - 3) Load Rating
 - 4) Present Value
 - 5) Ineligibility Status
 - 6) Active Timer
 - 7) Time Remaining
 - 8) Last Shed Time

C. Ready Access Portal User Interface

1. Provide all computer hardware and software required for the purpose of configuration and consolidation of information and programs required for the delivery of a Task Focused, Web Based Portal to the BMS.
2. Ready Access Portal Architecture - The architecture of the BMS shall be implemented to conform to industry standards, so that it can accommodate applications required by the BMS as well as communicate information to and from the System Site Director.
 - a. Ready Access Portal shall provide a natural, complementary extension to the Site management user interface previously described.
3. User Interface Application Components
 - a. The ready access portal shall provide an intuitive user interface to key functions and tasks via web browser.
 - b. Plug-ins or special software shall not be required for access to alarm, summary, schedule and trend data.
 - c. The information shall be accessible on both personal computer and handheld device platforms as follows:
 - 1) Personal computers - Internet Explorer Version 7.0 recommended
 - 2) Handheld devices - Internet Explorer for Window Mobile Version 5.0 or 6.0 recommended. UI is optimized for devices with a 240 x 320 pixel screen size Quarter Video Graphics Array (QVGA).
 - 3) Other devices may display the UI but full functionality is not guaranteed.
4. Operator Interface
 - a. Password access shall be as described in paragraph 2.4.B.6 or this Section 15900 for management portal UI
 - b. Once logged in, the BMS shall display a pre-selected screen tailored to the task requirements of the individual user.
 - c. The User Interface shall utilize an intuitive navigation and display method designed for operators who access the BMS for casual information and control or on an infrequent basis. It shall feature three basic components.
 - 1) Radio buttons for selection of the type of information to be displayed including Alerts, Summary, Schedules and Diagnostics

- 2) Navigation tree for selection of the specific data to be displayed on screen for the selected type. The navigation tree may be hidden and expanded by the operator to optimize the display of information
- 3) A display window that provides the selected information by type in a pre-configured tabular format
- d. The user interface software shall provide help menus and instructions for each operation and/or application.
- e. The BMS shall provide support for up to 100 concurrent users from an unlimited universe of individuals with defined password access to the BMS
- f. The BMS shall provide Secure Sockets Level (SSL) support. This allows the ready access portal to communicate across a network in a way designed to prevent eavesdropping, tampering, and message forgery. It provides endpoint authentication and communications privacy over the network using cryptography
- g. The BMS shall have the capability to display multiple navigation trees that correspond to the user views configured in the management portal UI.
- h. The alert summary of the remote access portal shall, at the minimum, provide the following information
 - 1) Alert (Alarm) type
 - 2) Date and time of alert occurrence
 - 3) Priority (color coded to level)
 - 4) Item name.
 - 5) Item value (if applicable)
 - 6) Message
 - 7) Any attribute of any object in the BMS may be designated to report an alarm
- i. A standard summary on the remote access portal shall, at the minimum, provide the following information
 - 1) Point type graphic icon
 - 2) Item name
 - 3) Item value
 - 4) Item status
 - 5) Access to the Change Value window (if applicable) for the purpose of setting, holding or releasing an item value
- j. The schedule detail summary of the remote access portal shall, at the minimum, provide the following information
 - 1) Scheduled occurrences including time and value
 - 2) Scheduled overrides including start time, end time and value
 - 3) A list of all scheduled items including name and attribute, value, status and priority
 - 4) Access to the Add Temporary Override window for the purpose of adding a temporary override to the schedule
- k. The diagnostic (trend) summary of the remote access portal as viewed on a personal computing device shall provide the following information.
 - 1) Item name
 - 2) Item status
 - 3) Trend name
 - 4) Trend status
 - 5) Full path name

- 6) Access to trend detail summary including trended value, time and date arranged in a user selectable format of 1 hour, 12 hours, 24 hours, 48 hours or 72 hours

2.5 NETWORK CONTROL ENGINE (NCE)

- A. The Network Control Engine (NCE) shall be a fully user-programmable, supervisory controller. The NCE shall monitor the network of distributed application-specific controllers, provide global strategy and direction, and communicate on a peer-to-peer basis with other Network Automation Engines.
- B. The Network Control Engine (NCE) shall be a fully user-programmable, digital controller that includes a minimum of 33 I/O points.
- C. Automation Network - The NCE shall reside on the automation network and shall support a subnet of 32 Field controllers.
- D. User Interface - Each NCE shall have the ability to deliver a web based User Interface (UI) as previously described. All computers connected physically or virtually to the automation network shall have access to the web based UI.
 1. The web based UI software shall be imbedded in the NCE. Systems that require a local copy of the system database on the user's personal computer are not acceptable.
 2. The NCE shall support a minimum of two (2) concurrent users.
 3. The NCE shall have the capability of generating web based UI graphics. The graphics capability shall be imbedded in the NCE.
 4. Systems that support UI Graphics from a central database or require the graphics to reside on the user's personal computer are not acceptable.
 5. The web based UI shall support the following functions using a standard version of Microsoft Internet Explorer:
 - a. Configuration
 - b. Commissioning
 - c. Data Archiving
 - d. Monitoring
 - e. Commanding
 - f. System Diagnostics
 6. Systems that require workstation software or modified web browsers are not acceptable.
 7. The NCE shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems.
- E. The NCE shall employ a finite state control engine to eliminate unnecessary conflicts between control functions at crossover points in their operational sequences. Suppliers using non-state based DDC shall provide separate control strategy diagrams for all controlled functions in their submittals.
- F. The NCE shall be factory programmed with a continuous adaptive tuning algorithm that senses changes in the physical environment and continually adjusts loop tuning parameters appropriately. Controllers that require manual tuning of loops or perform automatic tuning on command only, shall not be acceptable.
- G. The NCE shall be assembled in a plenum-rated plastic housing with flammability rated to UL94-5VB.
- H. The NCE shall support the following number and types of inputs and outputs:

1. Ten Universal Inputs - shall be configured to monitor any of the following:
 - a. Analog Input, Voltage Mode
 - b. Analog Input, Current Mode
 - c. Analog Input, Resistive Mode
 - d. Binary Input, Dry Contact Maintained Mode
 - e. Binary Input, Pulse Counter Mode
2. Eight Binary Inputs - shall be configured to monitor either of the following:
 - a. Dry Contact Maintained Mode
 - b. Pulse Counter Mode
3. Four Analog Outputs - shall be configured to output either of the following:
 - a. Analog Output, Voltage Mode
 - b. Analog Output, Current Mode
4. Seven Binary Outputs - shall output the following:
 - a. 24 VAC Triac
5. Four Configurable Outputs - shall be configured to output either of the following:
 - a. Analog Output, Voltage Mode
 - b. Binary Output, 24 VAC Triac Mode
- I. The NCE shall have the ability to monitor and control a network of sensors and actuators over a Sensor-Actuator Bus (SA Bus).
 1. The SA Bus shall be a Master-Slave/Token-Passing (MS/TP) Bus supporting BACnet Standard protocol SSPC-135, Clause 9.
 2. The SA Bus shall support a minimum of 10 devices.
 3. The SA Bus shall operate at a maximum distance of 1,200 Ft. between the NCE and the furthest connected device.
- J. The NCE shall have the capability to execute complex control sequences involving direct wired I/O points as well as input and output devices communicating over the Field Trunk or the SA Bus.
- K. The NCE shall support, but not be limited to, the following applications:
 1. Central Equipment including chillers and boilers
 2. Lighting and electrical distribution, compliant with NFPA 70.
 3. Built-up air handling units for special applications
 4. Power generation and energy monitoring equipment
 5. Interfaces to security and fire detection systems.
 - a. See Section 15815 (Ductwork and Accessories).
 - b. Interface with fire smoke dampers, Fire Alarm System, and the BMS shall comply with UL 268, UL 864, NFPA 92A, and NFPA 92B.
- L. The NCE shall support a Local Controller Display (DIS1710) either as an integral part of the NCE or as a remote device communicating over the SA Bus.
 1. The Display shall use a BACnet Standard SSPC-135, clause 9 Master-Slave/Token-Passing protocol.
 2. The Display shall allow the user to view monitored points without logging into the BMS.
 3. The Display shall allow the user to view and change setpoints, modes of operation, and parameters.
 4. The Display shall provide password protection with user adjustable password timeout.
 5. The Display shall be menu driven with separate paths for:

- 1) Input/Output
 - 2) Parameter/Setpoint
 - 3) Overrides
 6. The Display shall use easy-to-read English text messages.
 7. The Display shall allow the user to select the points to be shown and in what order.
 8. The Display shall support a back lit Liquid Crystal Display (LCD) with adjustable contrast and brightens and automatic backlight brightening during user interaction.
 9. The display shall be a minimum of 4 lines and a minimum of 20 characters per line
 10. The Display shall have a keypad with no more than 6 keys.
 11. The Display shall be panel mountable.
- M. The NCE shall be microprocessor-based with a minimum word size of 32 bits.
- N. The NAE shall be a multi-tasking, multi-user, and real-time digital control processor. Standard operating systems shall be employed.
- O. NCE size and capability shall be sufficient to fully meet the requirements of this Specification.
- P. The NCE shall employ an industrial single board computer.
- Q. Each NCE shall have sufficient memory to support its own operating system, databases, and control programs, and to provide supervisory control for all control level devices.
- R. The NCE shall include an integrated, hardware-based, real-time clock.
- S. The NCE shall employ nonvolatile Flash memory to store all programs and data. The NCE shall employ a data protection battery to save data and power the real time clock when primary power is interrupted.
- T. The NCE shall provide removable, color coded, screw terminal blocks for 24 VAC power, communication bus and I/O point field wiring.
- U. The NCE shall include troubleshooting LED indicators to identify the following conditions:
1. Power
 2. Fault
 3. SA Bus
 4. FC Bus
 5. Modem TX
 6. Modem RX
 7. Battery Fault
 8. Ethernet
 9. 10 LNK
 10. 100 LNK
 11. Run
 12. Peer Com
- V. Communications Ports - The NCE shall provide the following ports for operation of operator Input/Output (I/O) devices, such as industry-standard computers, modems, and portable operator's terminals.
1. USB port
 2. RS-232 serial data communication port
 3. RS-485 port

4. RJ-45 Ethernet port
 5. RJ-12 jack
- W. Diagnostics – The NCE shall continuously perform self-diagnostics, communication diagnosis, and diagnosis of all panel components.
1. The Network Control Engine shall provide both local and remote annunciation of any detected component failures, low battery conditions, or repeated failures to establish communication.
- X. Power Failure – In the event of the loss of normal power, The NCE shall continue to operate for a user adjustable period of up to 10 minutes after which there shall be an orderly shutdown of all programs to prevent the loss of database or operating system software.
1. During a loss of normal power, the control sequences shall go to the normal system shutdown conditions. All critical configuration data shall be saved into Flash memory.
 2. Upon restoration of normal power and after a minimum off-time delay, the controller shall automatically resume full operation without manual intervention through a normal soft-start sequence.
- Y. Certification – The NCE shall be listed by Underwriters Laboratories (UL). File E107041, CCN PAZX, UL 916, Energy Management Equipment. FCC Compliant to CFR47, Part 15, Subpart B, Class A
- Z. Field Controller Bus – The NCE shall support the following communication protocols on the Field Controller Bus:
1. The NCE shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9 on the controller network.
 - a. The NCE shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
 - b. The NCE shall be tested and certified as a BACnet Building Controller (B-BC).
 - c. A BACnet Protocol Implementation Conformance Statement shall be provided for the NCE.
 - d. The NCE shall support a minimum of 32 control devices.
 2. The NCE shall support LonWorks enabled devices using the Free Topology Transceiver FTT10 on the Field Controller Bus, per ANSI/EIA 909.1-A.
 - a. All LonWorks controls devices shall be LonMark certified.
 - b. The NCE shall support a minimum of 32 LonWorks enabled control devices.
 3. The NCE shall support the N2 devices on the Field Controller Bus.
 - a. The NCE shall support a minimum of 32 N2 control devices.
 - b. The Bus shall conform to Electronic Industry Alliance (EIA) Standard RS-485.
 - c. The Bus shall employ a master/slave protocol where the NCE is the master.
 - d. The Bus shall employ a four (4) level priority system for polling frequency.
 - e. The Bus shall be optically isolated from the NCE.
 4. Enclosure:
 - a. Provide a NEMA 3 outdoor rated enclosure, protecting the unit from the weather and reducing extreme outdoor conditions.
 - b. Enclosure shall not block access to controls or connections.

2.6 DDC SYSTEM CONTROLLERS

A. Field Equipment Controller (FEC)

1. The Field Equipment Controller (FEC) shall be a fully user-programmable, digital controller that communicates via BACnet MS/TP protocol.
 - a. The FEC shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9 on the controller network.
 - 1) The FEC shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
 - 2) The FEC shall be tested and certified as a BACnet Application Specific Controller (B-ASC).
 - 3) A BACnet Protocol Implementation Conformance Statement shall be provided for the FEC.
2. The FEC shall employ a finite state control engine to eliminate unnecessary conflicts between control functions at crossover points in their operational sequences.
 - a. Suppliers using non-state based DDC shall provide separate control strategy diagrams for all controlled functions in their submittals.
3. Controllers shall be factory programmed with a continuous adaptive tuning algorithm that senses changes in the physical environment and continually adjusts loop tuning parameters appropriately.
 - a. Controllers that require manual tuning of loops or perform automatic tuning on command only shall not be acceptable.
4. The FEC shall be assembled in a plenum-rated plastic housing with flammability rated to UL94-5VB.
5. The FEC shall include a removable base to allow pre-wiring without the controller.
6. The FEC shall include troubleshooting LED indicators to identify the following conditions:
 - a. Power On
 - b. Power Off
 - c. Download or Startup in progress, not ready for normal operation
 - d. No Faults
 - e. Device Fault
 - f. Field Controller Bus - Normal Data Transmission
 - g. Field Controller Bus - No Data Transmission
 - h. Field Controller Bus - No Communication
 - i. Sensor-Actuator Bus - Normal Data Transmission
 - j. Sensor-Actuator Bus - No Data Transmission
 - k. Sensor-Actuator Bus - No Communication
7. The FEC shall accommodate the direct wiring of analog and binary I/O field points.
8. The FEC shall support the following types of inputs and outputs:
 - a. Universal Inputs - shall be configured to monitor any of the following:
 - 1) Analog Input, Voltage Mode
 - 2) Analog Input, Current Mode
 - 3) Analog Input, Resistive Mode
 - 4) Binary Input, Dry Contact Maintained Mode
 - 5) Binary Input, Pulse Counter Mode
 - b. Binary Inputs - shall be configured to monitor either of the following:
 - 1) Dry Contact Maintained Mode

- 2) Pulse Counter Mode
 - c. Analog Outputs - shall be configured to output either of the following
 - 1) Analog Output, Voltage Mode
 - 2) Analog Output, current Mode
 - d. Binary Outputs - shall output the following:
 - 1) 24 VAC Triac
 - e. Configurable Outputs - shall be capable of the following:
 - 1) Analog Output, Voltage Mode
 - 2) Binary Output Mode
9. The FEC shall have the ability to reside on a Field Controller Bus (FC Bus).
 - a. The FC Bus shall be a Master-Slave/Token-Passing (MS/TP) Bus supporting BACnet Standard protocol SSPC-135, Clause 9.
 - b. The FC Bus shall support communications between the FECs and the NAE.
 - c. The FC Bus shall also support Input/Output Module (IOM) communications with the FEC and with the NAE.
 - d. The FC Bus shall support a minimum of 100 IOMs and FECs in any combination.
 - e. The FC Bus shall operate at a maximum distance of 15,000 Ft. between the FEC and the furthest connected device.
 10. The FEC shall have the ability to monitor and control a network of sensors and actuators over a Sensor-Actuator Bus (SA Bus).
 - a. The SA Bus shall be a Master-Slave/Token-Passing (MS/TP) Bus supporting BACnet Standard Protocol SSPC-135, Clause 9.
 - b. The SA Bus shall support a minimum of 10 devices per trunk.
 - c. The SA Bus shall operate at a maximum distance of 1,200 Ft. between the FEC and the furthest connected device.
 11. The FEC shall have the capability to execute complex control sequences involving direct wired I/O points as well as input and output devices communicating over the FC Bus or the SA Bus.
 12. The FEC shall support, but not be limited to, the following:
 - a. Hot water, chilled water/central plant applications
 - b. Built-up air handling units for special applications
- B. Terminal units
- a. Special programs as required for systems control

2.7 FIELD DEVICES

- A. Networked Thermostats (TEC)
1. The networked thermostat shall be capable of controlling water source heat pumps.
 2. The TEC shall communicate over the Field Controller Bus using BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9.
 3. The TEC shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
 - a. The TEC shall be tested and certified as a BACnet Application Specific Controller (B-ASC).

- b. A BACnet Protocol Implementation Conformance Statement shall be provided for the TEC.
 4. The Networked Thermostat shall support remote read/write and parameter adjustment from the web based User Interface through a Network Automation Engine.
 5. The Networked Thermostat shall include an intuitive User Interface providing plain text messages.
 - a. Two line, 8 character backlit display
 - b. LED indicators for Fan, Heat, and Cool status
 - c. Five (5) User Interface Keys
 - 1) Mode
 - 2) Fan
 - 3) Override
 - 4) Degrees C/F
 - 5) Up/Down
 - d. The display shall continuously scroll through the following parameters:
 - 1) Room Temperature
 - 2) System Mode
 - 3) Schedule Status - Occupied/Unoccupied/Override
 - 4) Applicable Alarms
 6. The Networked Thermostat shall provide the flexibility to support any one of the following inputs:
 - a. Integral Indoor Air Temperature Sensor
 - b. Duct Mount Air Temperature Sensor
 - c. Remote Indoor Air Temperature Sensor with Occupancy Override and LED Indicator
 - d. Two configurable binary inputs
 7. The Networked Thermostat shall provide the flexibility to support any one of the following outputs:
 - a. Three Speed Fan Control
 - b. Two On/Off
 - c. Two Floating
 - d. Two Proportional (0 to 10V)
 8. The Networked Thermostat shall provide a minimum of six (6) levels of keypad lockout.
 9. The Networked Thermostat shall provide the flexibility to adjust the following parameters:
 - a. Adjustable Temporary Occupancy from 0 to 24 hours
 - b. Adjustable heating/cooling deadband from 2° F to 5° F
 - c. Adjustable heating/cooling cycles per hour from 4 to 8
 10. The Networked Thermostat shall employ nonvolatile electrically erasable programmable read-only memory (EEPROM) for all adjustable parameters.
- B. Many-To-One Wireless Room Temperature Sensor System
1. Shall comply with FCC Part 15.

2. The Many-To-One System Receiver (WRS Receiver) shall receive wireless Radio Frequency (RF) signals containing temperature data from multiple Wireless Room Temperature Sensors (WRS Sensors).
 - a. The WRS Receiver shall use direct sequence spread spectrum RF technology.
 - b. The WRS Receiver shall operate on the 2.4 GHZ ISM Band.
 - c. The WRS Receiver shall meet the IEEE 802.15.4 standard for low-power, low duty-cycle RF transmitting systems.
 - d. The WRS Receiver shall be FCC compliant to CFR Part 15 subpart B Class A.
 - e. The WRS Receiver shall operate as a bidirectional transceiver with the sensors to confirm and synchronize data transmission.
 - f. The WRS Receiver shall be capable of communication with WRS Sensors up to a distance of 200 Feet.
 - g. The WRS Receiver shall be assembled in a plenum rated plastic housing with flammability rated to UL94-5VB.
 - h. The WRS Receiver shall have LED indicators to provide information regarding the following conditions:
 - 1) Power On/Off
 - 2) Ethernet - Receiver Activity/No Activity
 - 3) Wireless Normal Mode - Transmission from sensors/No Transmission
 - 4) Wireless Rapid Transmit Mode - No transmission/ weak signal/Adequate signal/Excellent signal
 - 5) Ethernet Connection - No connection/10Mbps connection/100Mbps connection
 - 6) Network Activity - No Network Activity/Half-Duplex Communication/Full-Duplex Communication
 2. The WRS Sensors shall sense and report room temperatures to the WRS Receiver.
 - a. The WRS Sensors shall use direct sequence spread spectrum RF technology.
 - b. The WRS Sensors shall operate on the 2.4 GHZ ISM Band.
 - c. The WRS Sensors shall meet the IEEE 802.15.4 standard for low-power, low duty-cycle RF transmitting systems.
 - d. The WRS sensors shall be FCC compliant to CFR Part 15 subpart B Class A.
 - e. The WRS sensors shall be available with
 - 8) Warmer/Cooler Set Point Adjustment
 - 9) No Set Point Adjustment
 - 10) Set Point Adjustment Scale - 55 to 85° F.
 - f. The WRS sensors shall be assembled in NEMA 1 plastic housings.
- C. Wireless Field Bus System
1. Shall comply with FCC Part 15.
 2. The Wireless Field Bus System shall employ ZigBee technology to create a wireless mesh network to provide wireless connectivity for BACnet devices at multiple system levels.
 - a. Wireless Systems that do not comply with ZigBee Open-Standard protocol are not acceptable.
 - b. Include communications from FEC and VMA field controllers to sensors and from engines to these field controllers.
 - c. Wireless devices shall co-exist on the same network with hardwired devices.

- d. Hardwired controllers shall be capable of retrofit to wireless devices with no special software.
3. The Wireless Field Bus Coordinator shall provide a wireless interface between supported field controllers and an NCE25 supervisory controller via the BACnet MS/TP field bus.
 - a. Each wireless mesh network shall be provided with a TEC Coordinator for initiation and formation of the network
 - b. The TEC Coordinator shall use direct sequence spread spectrum RF technology.
 - c. The TEC Coordinator shall operate on the 2.4 GHZ ISM Band.
 - d. The TEC Coordinator shall meet the IEEE 802.15.4 standard for low-power, low duty-cycle RF transmitting systems.
 - e. The TEC Coordinator shall be FCC compliant to CFR Part 15 subpart B Class A.
 - f. The TEC Coordinator shall operate as a bidirectional transceiver with the sensors and routers to confirm and synchronize data transmission.
 - g. The TEC Coordinator shall be capable of communication with sensors and routers up to a maximum distance of 250 Feet (line of sight).
 - h. The TEC Coordinator shall be assembled in a plenum rated plastic housing with flammability rated to UL94-5VB.
 - i. The TEC Coordinator shall have LED indicators to provide diagnostic information required for efficient operation and commissioning.
4. The Wireless Field Bus Router shall be used with any model Field Equipment Controller (FEC) to provide a wireless interface to supervisory engines, via the TEC Coordinator, and associated TEC Wireless Mesh Room Temperature Sensors. .
 - a. The Router shall use direct sequence spread spectrum RF technology.
 - b. The Router shall operate on the 2.4 GHZ ISM Band.
 - c. The Router shall meet the IEEE 802.15.4 standard for low-power, low duty-cycle RF transmitting systems.
 - d. The Router shall be FCC compliant to CFR Part 15 subpart B Class A.
 - e. The Router shall operate as a bidirectional transceiver with other mesh network devices to ensure network integrity.
 - f. The Router shall be capable of communication with other mesh network devices at a maximum distance of 250 feet (line of sight).
 - g. The Router shall be assembled in a plenum rated plastic housing with flammability rated to UL94-5VB.
 - h. The Router shall provide LED indication for use in commissioning and troubleshooting.
5. The Wireless Room Temperature Sensors shall sense and transmit room temperatures, room set point, room occupancy notification low battery condition to an associated Router.
 - a. The Sensors shall use direct sequence spread spectrum RF technology.
 - b. The Sensors shall operate on the 2.4 GHZ ISM Band.
 - c. The Sensors shall meet the IEEE 802.15.4 standard for low-power, low duty-cycle RF transmitting systems.
 - d. The Sensors shall be FCC compliant to CFR Part 15 subpart B Class A.

- e. The sensors shall be available with
 - 1) Warmer/Cooler Set Point Adjustment
 - 2) No Set Point Adjustment
 - 3) Set Point Adjustment Scale - 55 to 85° F.
 - f. The sensors shall be assembled in NEMA 1 plastic housings.
- D. One-to-One Wireless Room Temperature Sensor System
- 1. Shall comply with FCC Part 15.
 - 2. The One-To-One Wireless Receiver (WRS Receiver) shall receive wireless Radio Frequency (RF) signals containing temperature data from multiple Wireless Room Temperature Sensors (WRZ Sensors) and communicate this information to either FEC via the Sensor/Actuator (SA) Bus.
 - a. The Receiver shall use direct sequence spread spectrum RF technology.
 - b. The Receiver shall operate on the 2.4 GHZ ISM Band.
 - c. The Receiver shall meet the IEEE 802.15.4 standard for low-power, low duty-cycle RF transmitting systems.
 - d. The Receiver shall be FCC compliant to CFR Part 15 subpart B Class A.
 - e. The Receiver shall operate as a bidirectional transceiver with the sensors to confirm and synchronize data transmission.
 - f. The Receiver shall be capable of communication with from one to five Sensors up to a distance of 200 Feet.
 - g. The Receiver shall be assembled in a plenum rated plastic housing with flammability rated to UL94-5VB.
 - h. The Receiver shall have LED indicators to provide information regarding the following conditions:
 - 1) Power
 - 2) SA Bus - Receiver Activity/No Activity
 - 3) Wireless RF - Transmission from sensors/No Transmission
 - 4) Wireless Rapid Transmit Mode - No transmission/ weak signal/Adequate signal/Excellent signal
 - 3. The Sensors shall sense and report room temperatures to the WRZ Receiver.
 - a. The Sensors shall use direct sequence spread spectrum RF technology.
 - b. The Sensors shall operate on the 2.4 GHZ ISM Band.
 - c. The Sensors shall meet the IEEE 802.15.4 standard for low-power, low duty-cycle RF transmitting systems.
 - d. The sensors shall be FCC compliant to CFR Part 15 subpart B Class A.
 - e. The sensors shall be available with
 - 8) Warmer/Cooler Set Point Adjustment
 - 9) No Set Point Adjustment
 - 10) Set Point Adjustment Scale - 55 to 85° F.
 - f. The sensors shall be assembled in NEMA 1 plastic housings.
- C. TEC thermostats and temperature sensor locations shown on sheet M7.3.

2.8 SYSTEM TOOLS

- A. System Configuration Tool (SCT)

1. The Configuration Tool shall be a software package enabling a computer platform to be used as a stand-alone engineering configuration tool for a Network Automation Engine (NAE) or a Network Integration Engine (NIE).
 2. The configuration tool shall provide an archive database for the configuration and application data.
 3. The configuration tool shall have the same look-and-feel at the User Interface (UI) regardless of whether the configuration is being done online or offline.
 4. The configuration tool shall include the following features:
 - a. Basic system navigation tree for connected networks
 - b. Integration of BACnet enabled devices
 - c. Customized user navigation trees
 - d. Point naming operating parameter setting
 - e. Graphic diagram configuration
 - f. Alarm and event message routing
 - g. Graphical logic connector tool for custom programming
 - h. Downloading, uploading, and archiving databases
 5. The configuration tool shall have the capability to automatically discover field devices on connected buses and networks. Automatic discovery shall be available for the following field devices:
 - a. BACnet Devices
 6. The configuration tool shall be capable of programming the Field Equipment Controllers.
 - a. The configuration tool shall provide the capability to configure, simulate, and commission the Field Equipment Controllers.
 - b. The configuration tool shall allow the FECs to be run in Simulation Mode to verify the applications.
 - c. The configuration tool shall contain a library of standard applications to be used for configuration.
 7. The configuration tool shall be capable of programming the field devices.
 - a. The configuration tool shall provide the capability to configure, simulate, and commission the field devices.
 - b. The configuration tool shall allow the field devices to be run in Simulation Mode to verify the applications.
 - c. The configuration tool shall contain a library of standard applications to be used for configuration
 8. A wireless access point shall allow a wireless enabled portable PC to make a temporary Ethernet connection to the automation network.
 - a. The wireless connection shall allow the PC to access configuration tool through the web browser using the User Interface (UI).
 - b. The wireless use of configuration tool shall be the same as a wired connection in every respect.
 - c. The wireless connection shall use the Bluetooth Wireless Technology.
- B. Wireless MS/TP Converter (BTCVT)

- a. The converter shall provide a temporary wireless connection between the SA or FC Bus and a wireless enabled portable PC.
- b. The converter shall support downloading and troubleshooting FEC and field devices from the PC over the wireless connection.
- c. The converter shall employ Bluetooth Wireless Technology.
- d. The converter shall be powered through a connection to either the Sensor-Actuator (SA) or the Field Controller (FC) Bus.
- e. The converter shall operate over a minimum of thirty three (33) feet within a building.
- f. The converter shall have LED indicators to provide information regarding the following conditions:
 - 1) Power - On/Off
 - 2) Fault - Fault/No Fault
 - 3) SA/FC Bus - Bus Activity/ No Bus Activity
 - 4) Blue - Bluetooth Communication Established/ Bluetooth Communication Not Established
- g. The SWCVT shall comply with FCC Part 15.247 regulations for low-power unlicensed transmitters.

2.9 DATA POINTS FOR FUTURE USE

- A. Provide all analog and digital input and output data points shown on drawing M7.1 to a BACnet device using Modbus Ethernet, OPC, DNP3, or Approved Equal communication protocol such that a third party can use all the data points to determine energy in, energy out, performance efficiency, etc. for public display.

PART 3 - EXECUTION

3.1 GENERAL

- A. Furnish all labor, materials, equipment, and service necessary for a complete and operating Direct Digital Control Building Automation Control System, as indicated, and described herein.
- B. All labor, material, equipment, and software necessary to meet the functional intent of the Building Automation Control System as specified herein and as indicated shall be included.
- C. Equipment and labor not specifically referred to herein, or on the plans, that are required to meet the functional intent of the Building Automation Control System, shall be provided without additional cost to the owner.
- D. Clearly identify and label equipment and controls, such as starters, switches, relays, as to function and position with permanently engraved plastic nameplates.
- E. Wiring of control equipment in accordance with wiring diagrams and functional operation of the control system shall be the responsibility of the Building Automation Control System contractor.

- F. Final Adjustment of Equipment: After completion of installation, adjust temperature sensors, control valves, actuators, motors, and similar equipment provided under the scope of work of this section. Cooperate with the air balance contractor as required.
- G. Perform final adjustment by specially trained personnel in direct employ by the manufacturer of the primary Building Automation Control System.
- H. Wiring and raceways included with the BACS scope of works includes but is not limited to the following:
 - 1. Power wiring for all controllers, sensors, relays and other equipment shall be taken from the local HVAC controls panels except equipment provided with dedicated supplies provided by Division 16.
 - 2. Controls wiring shall be routed from the local HVAC controls panels.
 - 3. Conduit shall be used for the following:
 - a. All exposed and concealed low voltage wiring in all areas below 8 feet above floor level.
 - b. All mechanical and equipment rooms, exterior locations and any other areas where physical protection and/or access is required as defined elsewhere in the contract documents.
 - c. All in-wall drops to equipment monitoring and/or control points including but not limited to water flow meters, equipment mounted alarms, etc.
 - d. All areas where specifically indicated.
 - 4. J-Hooks and or designated LV raceway shall be used for the following:
 - a. All low voltage wiring above 8 feet above floor level in open and accessible areas where conduit is not required, to cable trays or other conduits.
 - b. All areas where specifically indicated.

3.2 CARE AND CLEANING

- A. Repair or replace broken, damaged, or otherwise defective parts, materials, and work. Leave entire work in condition satisfactory to owner's representative.
- B. At completion, carefully clean and adjust equipment, fixtures, and trim installed as part of this work.
- C. Leave systems and equipment in satisfactory operating condition.

3.3 OPERATION TEST/BMS COMMISSIONING

A. BMS commissioning shall consist of a point per point conformation and system operational demonstration conducted jointly by the contractor and the owner. The contractor and BACS contractor/vendor will conduct two levels of Quality Assurance to verify that the required installation and performance of the Building Automation Control System has been met.

1. Static Commissioning:

a. A point to point examination and documentation of the successful installation of the BACS system and its components in its entirety. The start up of all HVAC equipment and associated systems will not commence until this work has been completed and the documentation received by the owner.

2. Dynamic Commissioning:

a. A point by point demonstration and documentation of the successful performance of the BACS system and its components in its entirety.

b. The verification demonstrations of all HVAC equipment and associated systems will not commence until this work has been completed and the documentation received by the owner.

B. In General the Commissioning process will comprise the following:

1. Review of points list and documentation.
2. Installation compliance as indicated.
3. Point-to-point check.
4. Control devices calibration and operation.
5. BMS programming and documentation.
6. BMS endurance test.
7. Control loop trends.
8. Reports and alarms.
9. Analog input calibration.
10. Analog output check and spring ranges.
11. Digital input range set points.
12. Digital output in autolog.
13. Point by point performance verification.
14. O & M training and documentation.
15. Opposite season verification and documentation.
16. Review and document BMS architecture.

3.4 OPERATOR INSTRUCTION

- A. Contractor shall schedule with the owner's representative and provide forty (40) hours of on Site, or off Site, operator instruction to the owner's operating personnel.
- B. Operator instruction during normal working hours shall be performed by a competent representative familiar with the BMS hardware, software, and accessories

END OF SECTION

SECTION 15940

MECHANICAL CONTROL SEQUENCE**PART 1 - GENERAL****1.1 SUMMARY**

A. Section includes: Control sequences for:

1. Water-Source Heat Pumps
2. Primary Loop Hydronic Pumps
3. Secondary Loop Hydronic Pumps
4. Exhaust Fans
5. Fire/Smoke Dampers (FSD's)

1.2 WATER SOURCE HEAT PUMP UNIT CONTROL SEQUENCE FOR GENERAL OFFICE

- A. Sequence typical for HP-1 through HP-19 & HP-22 through HP-47, the corresponding thermostats or temperature sensors, and the corresponding integrated Secondary Hydronic Pumps.
- B. Temperature control: The unit shall cycle cooling or heating necessary to maintain Set Point as sensed by the corresponding thermostat or temperature sensor. Set points for cooling and heating at each zone shall be dictated by the Building Management System.
- C. Daytime Operation: To be active during occupied days and hours.
1. Normal condition: All Heat Pumps shall be engaged in fan mode only.
 2. When a zone is no longer occupied:
 - a. Disengage the Water Source Heat Pump for that zone.
 3. Upon call for space cooling or heating by one of the thermostat or temperature sensor:
 - a. Engage the Water Source Heat Pump compressor for that zone.
 - b. Engage the corresponding Secondary Loop Hydronic Pump.
 4. When the temperature reaches the set point at the thermostats or temperature sensor:
 - a. Disengage the Water Source Heat Pump compressor for that zone.
 - b. Disengage the corresponding Secondary Loop Hydronic Pump.
- D. Off-hours Operation: To be active during off-hours and weekends.

1. Normal condition: All Secondary Loop Hydronic Pumps and Heat Pumps shall be disengaged.
2. Owner shall be able to input a set point for the equipment to maintain during off-hours operation.
 - a. Engage any Heat Pumps and hydronic pump as necessary to maintain the off-hours set point.
3. One hour before occupied period begins:
 - a. Engage all Water Source Heat Pumps at zones where the daytime set point requires cooling or heating.
 - b. Engage the corresponding Secondary Loop Pump.
4. Return all equipment to Daytime Operation when the building is first occupied.

1.3 MECHANICAL HVAC UNIT CONTROL SEQUENCE FOR SERVER ROOM

- A. Sequence typical for HP-20 & HP-21, terminal equipment controller (TEC-2), and the integrated Secondary Hydronic Pumps for HP-20 & HP-21. The server room shall be designated as a critical zone.
- B. Temperature control: The unit shall cycle cooling or heating necessary to maintain Set Point as sensed by the corresponding thermostat. Set points for cooling at in the server room shall be dictated by the corresponding thermostat.
- C. Critical Operation: To be active 24-hours per day.
 1. Normal condition: HP-21 shall be engaged. HP-20 shall be disengaged.
 2. When the temperature rises above the set point of 68 deg F at TEC-2:
 - a. Verify that HP-21 is engaged.
 - b. Verify the Secondary Loop Hydronic Pump for HP-21 is engaged.
 3. If the thermostat rises above 72 deg F at TEC-2:
 - a. Verify that HP-21 is engaged.
 - b. Verify the Secondary Loop Hydronic Pump for HP-21 is engaged.
 - c. Engage HP-20.
 - d. Engage the Secondary Loop Hydronic Pump for HP-20.
 4. When the temperature falls below 72 deg F at TEC-2:
 - a. Disengage HP-20.
 - b. Disengage the Secondary Loop Hydronic Pump for HP-20.
 5. When the temperature reaches the set point of 68 deg F at TEC-2:

- a. Disengage HP-21.
 - b. Disengage the Secondary Loop Hydronic Pump for HP-21.
- D. Emergency Operation: To be active in the event of HP-21 failure.
- 1. Normal condition: HP-20 shall be engaged.
 - a. Engage alarm to indicate that HP-21 in server room is not functioning.
 - 2. When full functionality of HP-21 and its components is restored:
 - a. Set the server room system to the Normal Condition, as described above.

1.4 WATER SOURCE HEAT PUMP UNIT CONTROL SEQUENCE FOR REDWOOD CONFERENCE

- A. Sequence typical for HP-39 & HP-40, three temperature sensors, and the integrated Secondary Hydronic Pumps for HP-39 & HP-40.
- B. Temperature control: The units shall cycle cooling or heating necessary to maintain Set Point as sensed by the corresponding temperature sensor. Set points for cooling and heating at each zone shall be dictated by the Building Management System.
- C. Normal Operation: To be active during occupied days and hours.
 - 1. Normal condition: All Heat Pumps shall be engaged in fan mode only.
 - 2. Upon call for space cooling or heating by the Redwood North room temperature sensor:
 - a. Engage HP-39 compressor.
 - b. Engage the Secondary Loop Hydronic Pump for HP-39.
 - 3. Upon call for space cooling or heating by the Redwood South room temperature sensor:
 - a. Engage HP-40 compressor.
 - b. Engage the Secondary Loop Hydronic Pump for HP-40.
 - 4. When the average temperature between the three Redwood Conference temperature sensors rises above, or drops below the set point:
 - a. Engage HP-39 compressor.
 - b. Engage HP-40 compressor.
 - c. Engage the Secondary Loop Hydronic Pump for HP-39.
 - d. Engage the Secondary Loop Hydronic Pump for HP-40.
 - 5. When the average temperature between the three Redwood Conference temperature sensors satisfies the set point, and Redwood North does not require conditioning:
 - a. Disengage HP-39 compressor, return to fan mode only.
 - b. Disengage the Secondary Loop Hydronic Pump for HP-39.

6. When the average temperature between the three Redwood Conference temperature sensors satisfies the set point, and Redwood South does not require conditioning:
 - a. Disengage HP-40 compressor, return to fan mode only.
 - b. Disengage the Secondary Loop Hydronic Pump for HP-40.

1.5 PRIMARY LOOP HYDRONIC PUMP SEQUENCE

- A. Sequence typical for base-mounted 3 HP Primary Loop Hydronic Pumps.
- B. Flow shall be dictated by temperature sensors TS-1 and TS-2, monitoring the Primary Loop.
- C. Critical Operation: To be active 24-hours per day.
 1. Normal Condition: Primary Loop entering water temperature (TS-1) shall be maintained at a minimum of 50 deg F in the winter and a maximum of 90 deg F in the summer.
 2. Primary Loop Hydronic Pumps shall engage to maintain the Normal Condition.
 - a. Stage 1: Engage Master Primary Hydronic Pump P-1.
 - b. Stage 2: Engage Primary Hydronic Pump P-2.
- D. Hydronic Pump Failure Operation:
 1. To be active during one Primary Hydronic Pump Failure.
 - a. When the building return temperature (TS-2) reaches 100 deg F during cooling demand or 42 deg F during heating demand:
 - 1) Disengage: HP-13, 17, 22, 26, 31, 32, 37, 38, 41, and 44.
 - 2) Engage a unique alarm to notify maintenance staff.
 - b. If after 30 minutes the building return temperature (TS-2) does not fall below 100 deg F during cooling demand or rise above 42 deg F during heating demand:
 - 1) Disengage: HP-3, 11, 30, 42, and 45.
 - 2) Engage a unique alarm to notify maintenance staff.
 - c. If after 60 minutes the building return temperature (TS-2) does not fall below 100 deg F during cooling demand or rise above 42 deg F during heating demand:
 - 1) Disengage: HP-2, 8, 9, 33, and 43.
 - 2) Engage a unique alarm to notify maintenance staff.
 - d. When the building return temperature reaches 96 deg F during cooling demand or 46 deg F during heating demand:
 - 1) Restore all heat pumps to normal operating condition.

- e. Owner shall have the ability to make future changes to the heat pumps which are disengaged.

1.6 EXHAUST FAN SEQUENCE

- A. Sequence typical for all existing exhaust fans.
- B. Bathrooms:
 - 1. To be engaged during occupied hours.
- C. Kitchens/Break Rooms:
 - 1. Wall mounted switch engages fan.
- D. Janitorial Closets containing chemicals:
 - 1. Exhaust fan to be engaged 24 hours per day.
- E. Electrical Rooms:
 - 1. Exhaust fans connected to a line thermostat.
- F. Copy Room 221:
 - 1. To be interlocked with HP-26.
- G. Copy Room 240:
 - 1. To be interlocked with HP-35.

1.7 FIRE/SMOKE DAMPER (FSD)

- A. Damper Actuation: Duct smoke detector mounted within 5' of the FSD shall close the FSD if smoke is detected. The Fire Alarm System shall be notified, which will send signal to DDC Building Management System
- B. Interlock with Water Source Heat Pump. End Switch shall monitor the position of FSD's. Upon signal of closed damper from End Switch, disengage the Water Source Heat Pump which supplies air through the FSD.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 15950

TESTING, ADJUSTING, AND BALANCING (TAB) OF HVAC SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Balancing Air Systems:
 - a. Constant-volume air systems (high speed).
2. Balancing Hydronic Piping Systems:
 - a. Constant-flow hydronic systems.
 - b. Primary-secondary hydronic systems.

B. Related Sections:

1. Section 15815 (Ductwork and Accessories)
2. Section 15745 (Water Source Heat Pumps)

1.2 REFERENCES

- A. ASHRAE 111, Section 5, "Instrumentation."

1.3 DEFINITIONS

- A. NEBB: National Environmental Balancing Bureau.
- B. TABB: Testing, Adjusting, and Balancing Bureau.

1.4 SUBMITTALS

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Final Report

1. General: Prepare a TABB certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
 - a. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 - b. Include a list of instruments used for procedures, along with proof of calibration.

2. Final Report Contents: In addition to certified field-report data, include the following:
 - a. Pump curves.
 - b. Fan curves.
 - c. Manufacturers' test data.
 - d. Field test reports prepared by system and equipment installers.
 - e. Other information relative to equipment performance; do not include Shop Drawings and product data.

3. General Report Data: In addition to form titles and entries, include the following data:
 - a. Title page.
 - b. Name and address of the TAB contractor.
 - c. Project name.
 - d. Project location.
 - e. Engineer's name and address.
 - f. Contractor's name and address.
 - g. Report date.
 - h. Signature of TAB supervisor who certifies the report.
 - i. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 - j. Summary of contents including the following:
 - 1) Indicated versus final performance.
 - 2) Notable characteristics of systems.
 - 3) Description of system operation sequence if it varies from the Contract Documents.
 - k. Nomenclature sheets for each item of equipment.
 - l. Data for heat pumps, including manufacturer's name, type, size, and fittings.
 - m. Notes to explain why certain final data in the body of reports vary from indicated values.
 - n. Test conditions for fans and pump performance forms including the following:
 - 1) Settings for outdoor air dampers.
 - 2) Conditions of filters.
 - 3) Cooling coil, wet- and dry-bulb conditions.
 - 4) Fan drive settings including settings and percentage of maximum pitch diameter.
 - 5) Other system operating conditions that affect performance.

4. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
 - a. Quantities of outdoor, supply, return, and exhaust airflows.
 - b. Water flow rates.
 - c. Duct, outlet, and inlet sizes.
 - d. Pipe and valve sizes and locations.
 - e. Balancing stations.

- f. Position of balancing devices.
5. Heat Pump Test Reports:
 - a. Unit Data:
 - 1) Unit identification.
 - 2) Location.
 - 3) Make and type.
 - 4) Model number and unit size.
 - 5) Manufacturer's serial number.
 - 6) Unit arrangement and class.
 - 7) Discharge arrangement.
 - 8) Sheave make, size in inches, and bore.
 - 9) Center-to-center dimensions of sheave, and amount of adjustments in inches.
 - 10) Number, make, and size of belts.
 - 11) Number, type, and size of filters.
 - b. Motor Data:
 - 1) Motor make, and frame type and size.
 - 2) Horsepower and rpm.
 - 3) Volts, phase, and hertz.
 - 4) Full-load amperage and service factor.
 - 5) Sheave make, size in inches, and bore.
 - 6) Center-to-center dimensions of sheave, and amount of adjustments in inches.
 6. Round and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
 - a. Report Data:
 - 1) System and air-handling-unit number.
 - 2) Location and zone.
 - 3) Duct static pressure in inches wg.
 - 4) Duct size in inches.
 - 5) Indicated air flow rate in cfm.
 - 6) Indicated velocity in fpm.
 - 7) Actual air flow rate in cfm.
 - 8) Actual average velocity in fpm.
 7. Base Mounted Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
 - a. Unit Data:
 - 1) Unit identification.
 - 2) Location.

- 3) Service.
- 4) Make and size.
- 5) Model number and serial number.
- 6) Water flow rate in gpm.
- 7) Water pressure differential in feet of head.
- 8) Required net positive suction head in feet of head.
- 9) Pump rpm.
- 10) Impeller diameter in inches.
- 11) Motor make and frame size.
- 12) Motor horsepower and rpm.
- 13) Voltage at each connection.
- 14) Amperage for each phase.
- 15) Full-load amperage and service factor.
- 16) Seal type.

b. Test Data (Indicated and Actual Values):

- 1) Static head in feet of head.
- 2) Pump shutoff pressure in feet of head.
- 3) Actual impeller size in inches.
- 4) Full-open flow rate in gpm.
- 5) Full-open pressure in feet of head.
- 6) Final discharge pressure in feet of head.
- 7) Final suction pressure in feet of head.
- 8) Final total pressure in feet of head.
- 9) Final water flow rate in gpm.
- 10) Voltage at each connection.
- 11) Amperage for each phase.

8. Instrument Calibration Reports:

a. Report Data:

- 1) Instrument type and make.
- 2) Serial number.
- 3) Application.
- 4) Dates of use.
- 5) Dates of calibration.

1.5 QUALITY ASSURANCE

A. Contractor Qualifications: Engage a TAB entity certified by AABC or NEBB.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC or NEBB.
2. TAB Technician: Employee of the TAB contractor and who is certified by AABC or NEBB as a TAB technician.

B. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- C. Field quality-control test reports. Information shall be required for test and balance.
- D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."
- E. Certified TAB reports.
- F. Sample report forms.
- G. Instrument calibration reports, to include the following:
1. Instrument type and make.
 2. Serial number.
 3. Application.
 4. Dates of use.
 5. Dates of calibration.

1.6 PROJECT CONDITIONS

- A. Full Owner Occupancy: Owner shall occupy the Site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

- A. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- 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. Verify that locations of these balancing devices are accessible.

- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Section 15815 (Ductwork and Accessories) and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- G. Examine test reports specified in individual system and equipment Sections.
- H. Examine heat pump equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- I. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.
- J. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- K. Examine system pumps to ensure absence of entrained air in the suction piping.
- L. Examine operating safety interlocks and controls on HVAC equipment.
- M. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Complete system-readiness checks and prepare reports. Verify the following:
 - 1. Permanent electrical-power wiring is complete.
 - 2. Hydronic systems are filled, clean, and free of air.
 - 3. Automatic temperature-control systems are operational.
 - 4. Equipment and duct access doors are securely closed.
 - 5. Balance, smoke, and fire dampers are open.
 - 6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
 - 7. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 - 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 15815 (Ductwork and Accessories).
 - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 15815 (Ductwork and Accessories).
- B. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- D. Check airflow patterns from the outdoor-air louvers and dampers through the supply-fan discharge.
- 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 dampers for proper position to achieve desired airflow path.
- H. Check for airflow blockages.
- I. Check condensate drains for proper connections and functioning.
- J. Check for proper sealing of heat pump components.
- K. Verify that air duct system is sealed.

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. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
 2. Measure fan static pressures as follows to determine actual static pressure:
 - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - a. Report the cleanliness status of filters and the time static pressures are measured.
 4. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
 5. Obtain approval from Owner for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Section 15745 (Water Source Heat Pumps) for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload shall occur. Measure amperage in full-cooling, full-heating, 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 within specified tolerances.
1. Measure airflow of submain and branch ducts.
 - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
 3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus 5 percent.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts.
- C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
1. Open all manual valves for maximum flow.
 2. Check liquid level in expansion tank.
 3. Check makeup water-station pressure gage for adequate pressure for highest vent.
 4. Check flow-control valves for specified sequence of operation, and set at indicated flow.
 5. Set system controls so automatic valves are wide open to heat exchangers.
 6. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
 7. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.7 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

- A. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:
1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
 - a. Monitor motor performance during procedures and do not operate motors in overload conditions.

3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
 4. Report flow rates that are not within plus or minus 10 percent of design.
- B. Set calibrated balancing valves, if installed, at calculated presettings.
- C. Measure flow at all stations and adjust, where necessary, to obtain first balance.
1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.
- D. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.
- E. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
1. Determine the balancing station with the highest percentage over indicated flow.
 2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
 3. Record settings and mark balancing devices.
- F. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.
- G. Check settings and operation of each safety valve. Record settings.

3.8 PROCEDURES FOR PRIMARY-SECONDARY HYDRONIC SYSTEMS

- A. Balance the primary circuit flow first and then balance the secondary circuits.

3.9 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
1. Manufacturer's name, model number, and serial number.
 2. Motor horsepower rating.
 3. Motor rpm.
 4. Efficiency rating.
 5. Nameplate and measured voltage, each phase.
 6. Nameplate and measured amperage, each phase.
 7. Starter thermal-protection-element rating.

END OF SECTION

DIVISION 16

ELECTRICAL

SECTION 16050

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Conduit, raceways and fittings.
 - 2. Wires and Cables for 600 Volts and less.
 - 3. Wire connections and devices.
 - 4. Outlet boxes.
 - 5. Pull and junction boxes.
 - 6. Disconnect Switches and Fuses
 - 7. Supporting Devices.
 - 8. Identifying Devices.
 - 9. Grounding and Bonding
 - 10. Required Demolition

1.2 REFERENCES

- A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
- B. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.
- C. ANSI C80.5 - Rigid Aluminum Conduit.
- D. NECA (INST) - Standard of Installation; National Electrical Contractors Association.
- E. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
- F. NFPA 70 - National Electrical Code.
- G. NEC Article 250, Part V

1.3 SUBMITTALS

- A. Product Data
 - 1. A list of conduit types indicating where each type of conduit will be used. Indicate conduit manufacturers and fittings to be used.
 - 2. Wires and Cables.
 - 3. Wiring Devices and Plates
 - 4. Nameplates, including engraving schedules where engraved plates are specified.
 - 5. Fused disconnect switches.

1.4 QUALITY ASSURANCE

- A. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 CONDUITS, RACEWAYS, AND FITTINGS

- A. Rigid Steel Conduit

1. Rigid steel conduit shall be full weight, pipe size, finished inside and out by hot-dip galvanizing after fabrication.
 2. Couplings shall be electroplated steel.
 3. Insulating Bushings: Threaded polypropylene or thermo-setting phenolic rated 150°C minimum.
 4. Insulated grounding Bushings: Threaded cast malleable iron body with insulated throat and steel "lay-in" ground lug with compression screw.
 5. Insulated Metallic Bushings: Threaded cast malleable iron body with plastic insulated throat rated 150°C.
 6. Running threads are not acceptable.
- B. Electrical Metallic Tubing (EMT):
1. Conduit: Conduit shall be formed of cold rolled strip steel.
 2. Couplings: Electroplated steel, UL listed rain and concrete tight through 1-1/4" trade size. All EMT fittings shall be compression type.
 3. Connectors: Steel, gland compression type with insulated plastic throat, 150°C temperature rated. All EMT fittings shall be compression type.
- C. Liquid Tight Flexible Metal Conduit:
1. Conduit: Conduit shall be fabricated in continuous lengths from galvanized steel strip, spirally wound. Flexible conduit, except where installed in concealed dry locations, shall be liquid tight with plastic jacket extruded over the outer zinc coating. No aluminum substitute will be accepted.
 2. Fittings: Connectors shall be the screw clamp on screw-in (Jake) variety with cast malleable iron bodies and threaded male hubs with insulated throat or insulated bushings. Set screw type connectors are not acceptable. Liquid tight fittings shall be of cadmium plated cast malleable iron, with insulated throat.
- D. Surface Raceways:
1. Surface raceway shall be metallic two channel raceway.
- E. Non-Metallic Conduit
1. Schedule 40 PVC underground

2.2 WIRING AND CABLE

- A. Manufacturers:
1. CABLEC
 2. Triangle
 3. Southwire
 4. or Approved Equal
- B. Conductor material: All wire and cable shall be insulated, stranded copper conductors. Soft drawn annealed copper wire 98% conductivity, bearing the UL label.
- C. Minimum conductor size: AWG No. 12 for all power and lighting branch circuits. AWG No. 14 for all signal and control circuits.
- D. Color Coding: System conductors shall be identified as to voltage and phase connections by means of color impregnated insulation or approved colored marking tape as follows:
1. For 120/208 volt, 3 phase, 4 wire systems.
 - a. Phase A - Black
 - b. Phase B - Red
 - c. Phase C - Blue
 - d. Neutral - White
 - e. Ground - Green

2. For 120/240 volt, single phase, 3 wire system.
 - a. Phase A - Black
 - b. Phase B - Red
 - c. Phase C - Orange for High Leg (208v to neutral)
 - d. Neutral - White
 - e. Ground - Green
- E. Secondary Wire and Cable, 0 to 600 Volts;
 1. NEC Type THWN, or Type XHHW for feeders and branch circuits in wet or dry locations. NEC type THHN for branch circuits in dry locations.

2.3 WIRE CONNECTION

- A. Wire Joints: Wires in sizes from #18 to #8 AWG, stranded conductor, with insulation rated 105 degrees C. or less shall be joined with electrical spring connectors of three part construction incorporating a non-restricted, zinc coated steel spring enclosed in a steel shell with an outer jacket of vinyl plastic with a flexible insulating skirt.
- B. Mechanical Compression Connectors and Taps: Stranded conductors from #6 AWG to 750 Kcmil shall be joined or tapped using bolted pressure connectors having cast bronze compression bolts. Fittings shall be wide range-taking and designed to facilitate the making of parallel taps, tees, crosses or end-to-end connections. Split-bolt connectors will not be acceptable.
- C. Terminating Lugs: Conductors from size No. 6 AWG to 750 MCM, copper, shall be terminated using tin plated hydraulically operated crimping tools and dies as stipulated by the lug manufacturer.
 1. Manufacturers:
 - a. 3M "Scotchlok" series 30014
 - b. Burndy Type Ya-L series
 - c. Brady
 - d. Or Approved Equal
- D. Splicing and Insulating Tape (600 volts and below): General purpose electrical tape shall be suitable for temperatures from minus 18 degrees C to 105 degrees C, shall be black, ultraviolet proof, self-extinguishing, 7 mil thick vinyl with a dielectric strength of 10,000 volts.
- E. Insulating Putty (600 volts and below): Pads or rolls of non-corrosive, self-fusing, one eighth inch thick rubber putty with PVC backing sheet. Putty shall be suitable for temperatures from minus 17.8 degrees C to 37.8 degrees C and shall have a dielectric strength of 570 volts/mil minimum.
- F. Insulating Resin: Two Part liquid epoxy resin with resin and catalyst in pre measured, sealed mixing pouch. Resin shall have a set up time of approximately 30 minutes at 21.1 degrees C, and shall have thermal and dielectric properties equal to the insulation properties of the cables immersed in the resin.
- G. Terminal Strip Connectors: Terminate wire in locking tongue style, pressure type, solderless lug where applicable.

2.4 OUTLET BOXES

- A. Standard outlet boxes: Galvanized, die formed or drawn steel, knock-out type of size and configuration best suited to the application indicated on the plans. Minimum box size, 4 inch square by 1-1/2 inch deep, indoor use. FS cast boxes are required for outdoor use.

- B. Cast Metal Outlet Boxes: FS cast boxes are required for outdoor use. Four-inch round, galvanized cast iron alloy with threaded hubs and mounting lugs as required. Boxes shall be furnished with cast cover plates of the same material as the box and neoprene cover gaskets.
 - 1. Manufacturers
 - a. Thomas and Betts
 - b. Crouse-Hinds VXF series
 - c. Appleton JBX series
 - d. Or Approved Equal
- C. Conduit Outlet Bodies: Cadmium plated, cast iron alloy. Obround conduit outlet bodies with threaded conduit hubs and neoprene gasketed, cast iron covers. Outlet bodies shall be used to facilitate pulling of conductors or to make changes in conduit direction only. Splices are not permitted in conduit outlet bodies.
 - 1. Manufacturers
 - a. Thomas and Betts
 - b. Crouse Hinds Form 8 Condulets
 - c. Appleton form 35 Unilets
 - d. Or Approved Equal

2.5 PULL AND JUNCTION BOXES

- A. Sheet Metal Boxes: Use standard outlet or concrete ring boxes wherever possible; otherwise use minimum 15 gauge sheet metal, NEMA 1 boxes, sized to code requirements with covers secured by cadmium plated machine screws located 6 inches on centers.
 - 1. Manufacturers
 - a. Circle AW Products
 - b. Hoffman Engineering Co.
 - c. Appleton
 - d. Or Approved Equal
- B. Cast Metal Boxes: Use standard cast malleable iron outlet or device boxes wherever possible; otherwise use cadmium plated, cast malleable iron junction boxes with bolt-on, interchangeable conduit hub plates with neoprene gaskets.
 - 1. Manufacturers
 - a. Appleton RS series
 - b. Crouse Hinds RS series
 - c. Hoffman
 - d. Or Approved Equal

2.6 DISCONNECT SWITCHES

- A. All disconnect switches shall be heavy-duty type and have the number of poles, voltage rating, and horsepower rating as required by the motor or equipment. Disconnect switches shall be in enclosures to suit conditions, NEMA 3R for outdoor and NEMA 1 for indoor. Disconnect switches shall be fused unless otherwise indicated.
 - 1. Manufacturers
 - a. Square D - Class 3110
 - b. ITE Seimens
 - c. General Electric
 - d. Or Approved Equal

2.7 FUSES

- A. Dual Element, Time Delay, UL Class RK5. Rejection type. Size and Voltage as indicated on equipment.
 - 1. Manufacturers
 - a. Bussman
 - b. Little Fuse
 - c. AEM
 - d. Or Approved Equal

2.8 ELECTRICAL SUPPORTING DEVICES

- A. Concrete Fasteners: Phillips "Red-Head" or Approved Equal, self drilling expansion type concrete anchor.
- B. Conduit Straps: Hot-dip galvanized, cast malleable iron, two hole type strap with cast clamp-backs and spacers as required.
- C. Construction Channel: 1-1/2 inch by 1-1/2 inch 12 gauge galvanized steel channel with 17/32 inch diameter bolt holes, 1-1/2 inch on center, in the base of the channel.
- D. Cable Ties and Clamps: one piece, nylon, reusable type lashing ties.
- E. Fasteners (General) : Wood screws for fastening to wood. Machine screws for fastening to steel. Toggle bolts for fastening to hollow concrete block, gypsum board, or plaster walls. Expansion anchors for attachments to pre-poured concrete.
- F. Manufacturers:
 - 1. Oz/Gedney
 - 2. Unistrut
 - 3. Thomas Betts
 - 4. Panduit
 - 5. or Approved Equal

2.9 IDENTIFYING DEVICES

- A. Nameplates: Engraved black bakelite, 1 inch by 3-1/2 inch, 1/8 inch high white letters, machine screw retained. For permanent identification of all switchboards, panelboards, circuit breakers in separate enclosures, motor starters, relays, time switches, disconnect switches and other cabinet-enclosed apparatus including terminal cabinets or match existing as closely as possible.
- B. Wire & Terminal Markers: Self-adhering, pre-printed vinyl with self-laminating wrap around strip. Markers shall be legible after termination.

2.10 GROUNDING AND BONDING

- A. Ground Rods
 - 1. Manufacturers
 - a. Blackburn
 - b. Erico
 - c. Cadweld
 - d. Or Approved Equal
 - 2. Size: 3/4" x 10' Ground Rods
- B. Grounding Electrode Conductor, 2/0 for foundation foots, and per NEC.
- C. Grounding Well - Christy Box, Valve Box or Approved equal.

PART 3 EXECUTION

3.1 CONDUIT INSTALLATION

A. General

1. All conduit runs indicated are sized based on the use of rigid steel conduit and THWN copper conductors. If conductor type is changed, resize conduits to meet code. In no case is conduit to be sized smaller than 3/4" trade diameter.
2. Low voltage wiring shall be installed in conduit, minimum 3/4" trade diameter.
3. Conduits shall be tightly covered and well protected during construction using metallic bushings and bushing "pennies" to seal open ends.
4. In making joints in rigid steel conduit, ream conduit smooth after cutting and threading.
5. Clean any conduit in which moisture or any foreign matter has collected before pulling in conductors. Paint all field threaded joints to prevent corrosion.
6. In all empty conduits or ducts, install an 1100 pound tensile strength polyethylene pulling rope.
7. Conduit systems shall be electrically continuous throughout. Install code size, uninsulated, copper grounding conductors in all conduit runs, grounding conductor shall be bonded to conduit, equipment frames and properly grounded.

B. Layout

1. All new conduits shall be concealed. Any field conditions that does not allow concealment of conduits shall be reviewed with the Owner prior to rough-in.
2. Locations of conduit runs shall be planned in advance of the installation and coordinated with concrete work, plumbing and framing.
3. Where practical install conduits in groups in parallel vertical or horizontal runs and at elevations that avoid unnecessary off-sets.
4. Low voltage conduit shall be grouped separately and labelled every 10 ft interval as to system (i.e. fire, control, etc)
5. Exposed conduit shall be run parallel or at right angles to the centerlines of the columns and beams.
6. Conduits shall not be placed closer than 12 inches from a parallel hot water or steam line or three inches from such lines crossing perpendicular to the runs.
7. In long runs of conduit, provide sufficient pull boxes per NEC inside buildings to facilitate pulling wires and cables. Support pull boxes from structure independent of conduit supports. These pull boxes are not shown on the plans.

C. Supports

1. All raceway systems shall be secured to building structures using specified fasteners, clamps and hangers spaced according to NEC.
2. Support single runs of conduit using two hole pipe straps. Where run horizontally on walls in damp or wet locations, install "clamp blocks" to space conduit off the surface.
3. Multiple conduit runs shall be supported using "trapeze" hangers fabricated from 3/8 inch diameter, threaded steel rods secured to building structures. Fasten conduit to construction channel with standard two hole pipe clamps. Provide lateral seismic bracing for hangers.
4. Installation
 - a. Locate and install anchors, fasteners, and supports in accordance with NECA 1.
 - 1) Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
 - 2) Do not drill or cut structural members.

- b. Rigidly weld support members or use hexagon-head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
 - c. Install surface-mounted cabinets and panelboards with minimum of four anchors.
 - d. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1 inch (25 mm) off wall.
 - e. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.
- D. Terminations and Joints
1. Raceways shall be joined using specified couplings or transition couplings where dissimilar raceway systems are joined.
 2. Rigid conduit connection to enclosures shall be made by Myers type grounding hubs only. EMT connections to enclosures shall be made with compression connector with grounding lock-nuts or bushings.
 3. Conduit terminations exposed at weatherproof enclosures and cast outlet boxes shall be made watertight using appropriate connectors and hubs.
 4. Install expansion couplings where any conduit crosses a building separation or expansion joint.
 5. Install cable sealing bushings on all conduits originating outside the building walls and terminating in switchgear, cabinets or gutters inside the building. Install cable sealing bushings or caulk conduit terminations in all grade level or below grade exterior pull, junction or outlet boxes.
- E. Penetrations
1. Furnish and install metal sleeves for all exposed interior conduit runs passing through concrete floors or walls. Following conduit installation, seal all penetrations using non-iron bearing, chloride free, non-shrinking, dry-pack, grouting compound.
 2. Install specified watertight conduit entrance seals and membrane clamps at all below grade wall and floor penetrations. Conduits penetrating exterior building walls and building floor slab shall be insulated rigid steel.
 3. Conduits penetrating rated walls, floors, etc. shall be fireproofed.

3.2 CONDUIT AND RACEWAYS APPLICATION

- A. Rigid Steel Conduit: For all exterior applications, all conduits larger than 2" trade diameter, indoor, below eight (8) feet.
- B. Electrical Metallic Tubing (EMT): Interior only and above eight (8) feet or when entering a panel from above.
- C. Liquidtight Flexible Metallic Conduit: In damp and wet locations for connections to motors, transformers, vibrating equipment and machinery. Connections to all pump motors, flow switches, and similar devices.

3.3 CABLE AND WIRE INSTALLATION

- A. Examination
 1. Verify that interior of building has been protected from weather.
 2. Verify that mechanical work likely to damage wire and cable has been completed.
 3. Verify that raceway installation is complete and supported.
 4. Verify that field measurements are as indicated.
- B. Preparation

1. In existing conduits that will be reused, pull out existing conductors.
 2. Completely and thoroughly swab raceway before installing wire.
 3. Use 50/50 solution of Simple Green or Approved Equal. Use CO₂ to blow water and soap into conduit - let soak to break up dried out pulling compounds, then pull conductors. Pull one conductor at a time if will not pull all out together.
- C. General
1. Conductors shall not be in conduit until all work of any nature that may cause injury is completed. Care should be taken in pulling conductors that insulation is not damaged. U.L. approved non-petroleum base and insulating type pulling compound shall be used as needed.
 2. All cables shall be installed and tested in accordance with manufacturer's requirements and warranty.
 3. Block and tackle, power driven winch or other mechanical means shall not be used in pulling conductors of size smaller than AWG # 1.
- D. Splicing and Terminating
1. All aspects of splicing and terminating shall be in accordance with cable manufacturer's published procedures.
 2. Make up all splices in outlet boxes with connectors as specified herein with separate tails of correct color to be made up to splice. Provide at least six (6) inches of tails packed in box after splice is made up.
 3. All wire and cable in panels, control centers and equipment enclosures shall be bundled and clamped.
 4. Encapsulate splices in exterior outlet, junction and pull boxes using insulating resin kits. All splices for exterior equipment in pump rooms shall be made up watertight.
 5. Insulate mechanical compression taps AWG # 1/0 and larger using pre-molded, snap-on insulating boots or specified conformable insulating putty overwrapped with two half-lapped layers of insulating tape.
 6. Apply 4 layers half-lap with 2" over-lay on each conductor.
- E. Identifications
1. Securely tag all branch circuits, noting the purpose of each. Mark conductors with vinyl wrap-around markers. Where more than two conductors run through a single outlet, mark each circuit with the corresponding circuit number at the panelboard.
 2. Color code conductors size #6 and larger using specified phase color markers and identification tags per paragraph 2.2D.
 3. All terminal strips are to have each individual terminal identified with specified vinyl markers.
 4. All identification shall be legible and readable after completion of installation.
- F. Electrical Connections
1. Make electrical connections in accordance with equipment manufacturer's instructions.
 2. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.
 3. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
 4. Provide receptacle outlet to accommodate connection with attachment plug.
 5. Provide cord and cap where field-supplied attachment plug is required.
 6. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

7. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
8. Install terminal block jumpers to complete equipment wiring requirements.
9. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

3.4 INSTALLATION OF BOXES

A. General

1. Leave no un-used openings in any box. Install close-up plugs as required to seal openings.
2. Exposed outlet boxes and boxes in damp or wet locations shall be cast metal with gasketed cast metal cover plates.

B. Box Layout

1. Outlet boxes shall be installed at the locations and elevations shown on the drawings or specified herein. Make adjustments to locations as required by structural conditions and to suit coordination requirements of other trades.
2. Install junction or pullboxes where required to limit bends in conduit runs to not more than 360 degrees or where pulling tension achieved would exceed the maximum allowable for the cable to be installed. Consult wire and cable manufacturer.

3.5 INSTALLATION OF WIRING DEVICES

A. General

1. Install all devices flushmounted unless otherwise indicated. Comply with layout drawings for general locations. Notify Owner for locations that have conflict with other devices or manner not suitable for installation. Avoid place devices behind open doors.
2. Align devices horizontally and vertically. Device plates shall be aligned vertically with tolerance of 1/16". All four edges of device plates shall be in contact with the wall surface.
3. Mounting height as indicated and according to ADA requirements.
4. Install device plates on all outlet boxes. Provide blank plates for all empty, spare, and boxes for future use.
5. Securely fasten devices into boxes and attach appropriate cover plates.
6. Caulk around edges or outdoor device plates and boxes when rough wall surfaces prevent raintight seal.
7. Fireproof around opening of devices located or penetrating fire-rated construction assemblies.

B. Identification

1. Label all outlets and switches. Mark each wiring device where circuits and panel supply is derived from.
2. All identification shall be legible and readable after completion of installation

3.6 INSTALLATION OF FUSES AND DISCONNECT SWITCHES

- A. Fuses shall be installed where indicated. Sizes are based on Climatemaster equipment. Listed or labeled equipment must be in accordance with instructions included in the listing or labeling. Be sure to observe maximum branch circuit fuse size labels.
- B. Disconnect switches shall be mounted on the units. Coordinate with mechanical contractor to ensure switches are not mounted on a removable access panel.

- C. Label each disconnect fuse with equipment tag as indicated in the single line diagram, or as directed.

3.7 ELECTRICAL EQUIPMENT GROUNDING

- A. Ground non-current carrying metal parts of electrical equipment enclosures, frames, conductor raceways or cable trays to provide a low impedance path for line-to-ground fault current and to bond all non-current carrying metal parts together. Install a ground conductor in each raceway system in addition to conductors shown. Equipment ground conductor shall be electrically and mechanically continuous from the electrical circuit source to the equipment to be grounded. Size ground conductors per NEC 250 unless larger conductors are shown on the drawings.
- B. Grounding conductors shall be identified with green insulation, except where a bare ground conductor is specified. Where green insulation is not available, on larger sizes, black insulation shall be used and suitably identified with green tape at each junction box or device enclosure.
- C. Install metal raceway couplings, fittings and terminations secure and tight to insure good ground continuity. Provide insulated grounding bushing and bonding jumper where metal raceway is not directly attached to equipment metal enclosure and at concentric knock-outs.
- D. Motors shall be connected to equipment ground conductors with a conduit grounding bushing and with a bolted solderless lug connection on the metal frame.
- E. Conduit terminating in concentric knockouts at panelboards, cabinets and gutters shall have insulated grounding bushings and bonding jumpers installed interconnecting all such conduits and the panelboard cabinet, gutter, etc.
- F. Performance: Measure ground resistance, 25 Ohms or less.

3.8 BONDING

- A. Bonding shall be provided to assure electrical continuity and the capacity to conduct safely any fault current likely to be imposed.
- B. Bonding shall be in accordance with NEC Article 250, Part V.

3.9 WORKMANSHIP

- A. Preparation, handling, and installation shall be in accordance with manufacturer's written instructions and technical data particular to the product specified
- B. Conform to the National Electrical Contractor's Association "Standard of Installation" for general installation practice.

3.10 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

END OF SECTION

SECTION 16441
SWITCHBOARDS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Service and distribution switchboards rated 600 V and less.
 - 2. Transient voltage suppression devices.
 - 3. Disconnecting and overcurrent protective devices.
 - 4. Instrumentation.
 - 5. Control power.
 - 6. Accessory components and features.
 - 7. Identification.
 - 8. Mimic bus.
- B. Related Sections:
 - 1. Section 16050 (Basic Electrical Materials and Methods)

1.2 PERFORMANCE REQUIREMENTS

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

1.3 REFERENCES

- A. NEMA PB 2 Deadfront Distribution Switchboards.
- B. NFPA 70 National Electrical Code
- C. UL 891 Switchboards
- D. SEI/ASCE 7 Minimum Design Loads for Building and Other Structures
- E. Nema 250 Enclosure for Electrical Equipment
- F. IEEE C62.41 Recommended Practice of Surge Voltages
- G. UL 1449 Surge Protective Devices
- H. UL 489 Molded Case Circuit Breakers
- I. IEEE 57.13 Standard Requirements for Instrument Transformers
- J. NEMA EI 21.1 Instrument Transformers for Revenue Metering
- K. ANSI C39.1 Requirements for Electrical Analog Indicating Instruments
- L. ANSI C12.1 Electric Meter Codes

1.4 SUBMITTALS

- A. Product Data: For each type of switchboard, overcurrent protective device, transient voltage suppression device, ground-fault protector, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

- B. Shop Drawings: For each switchboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of proposed devices, equipment features, and ratings.
 - 2. Detail enclosure types for types other than NEMA 250, Type 1.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Detail short-circuit current rating of switchboards and overcurrent protective devices.
 - 5. Include descriptive documentation of optional barriers specified for electrical insulation and isolation.
 - 6. Detail utility company's metering provisions with indication of approval by utility company.
 - 7. Include evidence of Nationally Recognized Testing Laboratory (NRTL) listing for series rating of installed devices.
 - 8. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 9. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graph paper; include selectable ranges for each type of overcurrent protective device.
 - 10. Include diagram and details of proposed mimic bus.
- C. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.
- D. Quality Assurance/ Quality Control Submittals
 - 1. Seismic Qualification Certificates
 - 2. Field Quality-Control Reports
- E. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Seismic Qualification Certificates: Submit certification that switchboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in California Code Include the following:
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- E. Field Quality-Control Reports:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.

3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.
- B. Remove loose packing and flammable materials from inside switchboards and install temporary electric heating (250 W per section) to prevent condensation.
- C. Handle and prepare switchboards for installation according to NEMA PB 2.1.

1.7 SITE CONDITIONS

- A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.
- B. Environmental Limitations:
 1. Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above switchboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding 104 deg F.
 - b. Altitude: Not exceeding 6600 feet.
- C. Service Conditions: NEMA PB 2, usual service conditions, as follows:
 1. Ambient temperatures within limits specified.
 2. Altitude not exceeding 6600 feet.

1.8 COORDINATION

- A. Coordinate layout and installation of switchboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements as indicated.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.
 1. Warranty Period: Five years from date of Substantial Completion.
- B. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switchboard 11 months after date of Substantial Completion.

1.10 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Potential Transformer Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
2. Control-Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
3. Fuses and Fusible Devices for Fused Circuit Breakers: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
4. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
5. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
6. Indicating Lights: Equal to 10 percent of quantity installed for each size and type, but no fewer than one of each size and type.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

- A. Acceptable Manufacturers:
 1. Industrial Electric MFG.
 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 4. Siemens Energy & Automation, Inc.
 5. Square D; a brand of Schneider Electric.
 6. Or Approved Equal.
- B. Front-Connected, Front-Accessible Switchboards:
 1. Main Devices: Panel mounted.
 2. Branch Devices: Panel mounted.
 3. Sections front and rear aligned.
- C. Nominal System Voltage: 480Y/277 V.
- D. Main-Bus Continuous: as indicated
- E. Switchboards rely on natural convection for dissipating heat; therefore, NEMA 250, Type 12 enclosures are not usually available.
- F. Indoor Enclosures: Steel, NEMA 250, Type 1.
- G. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.
- H. Barriers: Between adjacent switchboard sections.
- I. Insulation and isolation for main and vertical buses of feeder sections.
- J. Utility Metering Compartment: Fabricated, barrier compartment and section complying with utility company's requirements; hinged sealed door; buses provisioned for mounting utility company's current transformers and potential transformers or potential taps as required by utility company. If separate vertical section is required for utility metering, match and align with basic switchboard. Provide service entrance label and necessary applicable service entrance features.
- K. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.
- L. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.
- M. Pull Box on Top of Switchboard:
 1. Adequate ventilation to maintain temperature in pull box within same limits as switchboard.

2. Set back from front to clear circuit-breaker removal mechanism.
 3. Removable covers shall form top, front, and sides. Top covers at rear shall be easily removable for drilling and cutting.
 4. Bottom shall be insulating, fire-resistive material with separate holes for cable drops into switchboard.
 5. Cable supports shall be arranged to facilitate cabling and adequate to support cables indicated, including those for future installation.
- N. Buses and Connections: Three phase, four wire unless otherwise indicated.
1. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity, silver-plated, with tin-plated aluminum or copper feeder circuit-breaker line connections.
 2. Load Terminals: Insulated, rigidly braced, runback bus extensions, of same material as through buses, equipped with compression connectors for outgoing circuit conductors. Provide load terminals for future circuit-breaker positions at full-ampere rating of circuit-breaker position.
 3. Ground Bus: Minimum-size required by UL 891, hard-drawn copper of 98 percent conductivity, equipped with compression connectors for feeder and branch-circuit ground conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.
 4. Main Phase Buses and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
 5. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with compression connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
 6. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.
- O. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.
- P. Bus-Bar Insulation: Factory-applied, flame-retardant, tape wrapping of individual bus bars or flame-retardant, spray-applied insulation. Minimum insulation temperature rating of 105 deg C.
- Q. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components including instruments and instrument transformers.

2.2 TRANSIENT VOLTAGE SUPPRESSION DEVICES

- A. Acceptable Manufacturers:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 3. Siemens Energy & Automation, Inc.
 4. Square D; a brand of Schneider Electric.
 5. Or Approved Equal.
- B. Surge Protection Device Description: IEEE C62.41-compliant, integrally mounted, bolt-on, solid-state, parallel-connected, modular (with field-replaceable modules) type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the switchboard short-circuit rating, and with the following features and accessories:
1. Fuses, rated at 200-kA interrupting capacity.
 2. Fabrication using bolted compression lugs for internal wiring.
 3. Integral disconnect switch.

4. Redundant suppression circuits.
 5. Redundant replaceable modules.
 6. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
 7. LED indicator lights for power and protection status.
 8. Audible alarm, with silencing switch, to indicate when protection has failed.
 9. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of system operation. Contacts shall reverse position on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
 10. Six-digit, transient-event counter set to totalize transient surges.
- C. Peak Single-Impulse Surge Current Rating: 160 kA per mode/320 kA per phase.
- D. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.
- E. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277 208Y/120-V, three-phase, four-wire circuits shall be as follows:
1. Line to Neutral: 800 V for 480Y/277 400 V for 208Y/120 .
 2. Line to Ground: 800 V for 480Y/277 400 V for 208Y/120.
 3. Neutral to Ground: 800 V for 480Y/277 400 V for 208Y/120.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
1. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 2. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and I^2t response.
 3. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 4. MCCB Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs: Compression style, suitable for number, size, trip ratings, and conductor material.
 - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
 - d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - e. Communication Capability: Din-rail-mounted communication module with functions and features compatible with power monitoring and control system.
 - f. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
 - g. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.

- h. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
- i. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.

2.4 INSTRUMENTATION

- A. Instrument Transformers: IEEE C57.13, NEMA EI 21.1, and the following:
 - 1. Potential Transformers: IEEE C57.13; 120 V, 60 Hz, single secondary; disconnecting type with integral fuse mountings. Burden and accuracy shall be consistent with connected metering and relay devices.
 - 2. Current Transformers: IEEE C57.13; 5 A, 60 Hz, secondary; wound type; double secondary winding and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.
 - 3. Control-Power Transformers: Dry type, mounted in separate compartments for units larger than 3 kVA.
 - 4. Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondary wiring to ground overcurrent relays, via shorting terminals, to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit-breaker, ground-fault protection.
- B. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:
 - 1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:
 - a. Phase Currents, Each Phase: Plus or minus 1 percent.
 - b. Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
 - c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
 - d. Megawatts: Plus or minus 2 percent.
 - e. Megavars: Plus or minus 2 percent.
 - f. Power Factor: Plus or minus 2 percent.
 - g. Frequency: Plus or minus 0.5 percent.
 - h. Accumulated Energy, Megawatt Hours: Plus or minus 2 percent; accumulated values unaffected by power outages up to 72 hours.
 - i. Retain one or both of first two subparagraphs below. Retain first subparagraph for local recording of demand; retain second for remote recording of demand or if retaining "Impulse-Totalizing Demand Meter" Paragraph below.
 - j. Megawatt Demand: Plus or minus 2 percent; demand interval programmable from five to 60 minutes.
 - k. Contact devices to operate remote impulse-totalizing demand meter.
 - 2. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.
- C. Ammeters, Voltmeters, and Power-Factor Meters: ANSI C39.1.
 - 1. Meters: 4-inch diameter or 6 inches square, flush or semiflush, with antiparallax 250-degree scales and external zero adjustment.
 - 2. Voltmeters: Cover an expanded-scale range of nominal voltage plus 10 percent.
- D. Instrument Switches: Rotary type with off position.
 - 1. Voltmeter Switches: Permit reading of all phase-to-phase voltages and, where a neutral is indicated, phase-to-neutral voltages.

2. Ammeter Switches: Permit reading of current in each phase and maintain current-transformer secondaries in a closed-circuit condition at all times.
- E. Feeder Ammeters: 2-1/2-inch minimum size with 90- or 120-degree scale. Meter and transfer device with off position, located on overcurrent device door for indicated feeder circuits only.
- F. Watt-Hour Meters and Wattmeters:
 1. Comply with ANSI C12.1.
 2. Three-phase induction type with two stators, each with current and potential coil, rated 5 A, 120 V, 60 Hz.
 3. Suitable for connection to three- and four-wire circuits.
 4. Potential indicating lamps.
 5. Adjustments for light and full load, phase balance, and power factor.
 6. Four-dial clock register.
 7. Integral demand indicator.
 8. Contact devices to operate remote impulse-totalizing demand meter.
 9. Ratchets to prevent reverse rotation.
 10. Removable meter with drawout test plug.
 11. Semiflush mounted case with matching cover.
 12. Appropriate multiplier tag.
- G. Impulse-Totalizing Demand Meter:
 1. Comply with ANSI C12.1.
 2. Suitable for use with switchboard watt-hour meter, including two-circuit totalizing relay.
 3. Cyclometer.
 4. Four-dial, totalizing kilowatt-hour register.
 5. Positive chart drive mechanism.
 6. Capillary pen holding a minimum of one month's ink supply.
 7. Roll chart with minimum 31-day capacity; appropriate multiplier tag.
 8. Capable of indicating and recording five-minute integrated demand of totalized system.

2.5 CONTROL POWER

- A. Control Circuits: 120-V ac, supplied from remote branch circuit.
- B. Electrically Interlocked Main and Tie Circuit Breakers: Two control-power transformers in separate compartments, with interlocking relays, connected to the primary side of each control-power transformer at the line side of the associated main circuit breaker. 120-V secondaries connected through automatic transfer relays to ensure a fail-safe automatic transfer scheme.
- C. Control-Power Fuses: Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.
- D. Control Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.

2.6 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Portable Test Set: For testing functions of solid-state trip devices without removing from switchboard. Include relay and meter test plugs suitable for testing switchboard meters and switchboard class relays.

- C. Spare-Fuse Cabinet: Suitably identified, wall-mounted, lockable, compartmented steel box or cabinet. Arrange for wall mounting.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Receive, inspect, handle, and store switchboards according to NEMA PB 2.1.
- B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.
- C. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install switchboards and accessories according to NEMA PB 2.1.
- B. Equipment Mounting: Install switchboards on concrete base, 4-inch nominal thickness. Comply with requirements for concrete base as indicated.
 - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
 - 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4. Install anchor bolts to elevations required for proper attachment to switchboards.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.
- D. Comply with mounting and anchoring requirements.
- E. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.
- F. Install filler plates in unused spaces of panel-mounted sections.
- G. Install overcurrent protective devices, transient voltage suppression devices, and instrumentation.
 - 1. Set field-adjustable switches and circuit-breaker trip ranges.
- H. Install spare-fuse cabinet.

3.3 CONNECTIONS

- A. Comply with requirements for terminating feeder. Drawings indicate general arrangement of bus, fittings, and specialties.

3.4 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Section 16050 (Basic Electrical Materials and Methods).

- B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Section 16050 (Basic Electrical Materials and Methods).
- C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Section 16050 (Basic Electrical Materials and Methods).

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.

3.6 TESTS AND INSPECTIONS:

- A. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- B. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- C. Perform the following infrared scan tests and inspections and prepare reports:
 - 1. Initial Infrared Scanning: After Substantial Completion and before Final Acceptance perform an infrared scan of each switchboard. Remove front panels so joints and connections are accessible to portable scanner.
 - 2. Instruments and Equipment:
 - a. Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - 3. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Switchboard will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.7 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as indicated.

3.8 PROTECTION

- A. Temporary Heating: Apply temporary heat, to maintain temperature according to manufacturer's written instructions, until switchboard is ready to be energized and placed into service.

3.9 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories, and to use and reprogram microprocessor-based trip, monitoring, and communication units. Provide one four hour session.

END OF SECTION

SECTION 16442**PANELBOARDS****PART 1 GENERAL****1.1 SUMMARY**

- A. Section Includes:
 - 1. Lighting and appliance branch-circuit panelboards.
- B. Related Sections:
 - 1. Section 16050 (Basic Electrical Materials and Methods)

1.2 PERFORMANCE REQUIREMENTS

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

1.3 REFERENCES

- A. NFPA 70 National Electrical Code
- B. UL 891 Switchboards
- C. SEI/ASCE 7 Minimum Design Loads for Building and Other Structures
- D. Nema 250 Enclosures for Electrical Equipment
- E. IEEE C62.41 Recommended Practice of Surge Voltages
- F. UL 1449 Surge Protective Devices
- G. UL 489 Molded Case Circuit Breakers
- H. NEMA PB 1 Panelboards

1.4 SUBMITTALS

- A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
 - 5. Include evidence of NRTL listing for series rating of installed devices.
 - 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 7. Include wiring diagrams for power, signal, and control wiring.
 - 8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

- C. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.
- D. Installation, Operation, and Maintenance Manual:
 - 1. Panelboards and associated appurtenances.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or a Nationally Recognized Testing Laboratory (NRTL).
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Seismic Qualification Certificates: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in this section. Include the following:
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- F. Field Quality-Control Reports:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- G. Comply with NEMA PB 1.
- H. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
- B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.7 SITE CONDITIONS

- A. Environmental Limitations:
 - 1. Do not deliver or install panelboards until spaces are enclosed and weathertight, when work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 - 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

- a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
 - b. Altitude: Not exceeding 6600 feet.
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
1. Ambient temperatures within limits specified.
 2. Altitude not exceeding 6600 feet.

1.8 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases as indicated.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.
1. Warranty Period: Five years from date of Substantial Completion.
- B. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.

1.10 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Keys: Two spares for each type of panelboard cabinet lock.
 2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard.
 3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Enclosures: Surface-mounted cabinets.
1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
 3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
 5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.

6. Finishes:
 - a. Panels and Trim: Galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - b. Back Boxes: Galvanized steel.
7. Directory Card: Inside panelboard door, mounted in transparent card holder.
- B. Incoming Mains Location: Top.
- C. Phase, Neutral, and Ground Buses:
 1. Material: Hard-drawn copper, 98 percent conductivity.
 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
 3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
 4. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
 5. Split Bus: Vertical buses divided into individual vertical sections.
- D. Conductor Connectors: Suitable for use with conductor material and sizes.
 1. Material: Hard-drawn copper, 98 percent conductivity.
 2. Main and Neutral Lugs: Mechanical type.
 3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
 4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
 6. Gutter-Tap Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
 7. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.
- E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.
- F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- G. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, listed and labeled for series-connected short-circuit rating by an NRTL.
- H. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Acceptable Manufacturers:
 1. General Electric Company; GE Consumer & Industrial - Electrical Distribution
 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 3. Siemens Energy & Automation, Inc.
 4. Square D; a brand of Schneider Electric.
 5. Or Approved Equal.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

- C. Mains: Circuit breaker and/or lugs only.
- D. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.
- E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.
- F. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.
- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Equipment Mounting: Install panelboards on concrete bases, 4-inch nominal thickness. Comply with requirements for concrete base as indicated.
 - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of base.
 - 2. For panelboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4. Install anchor bolts to elevations required for proper attachment to panelboards.
 - 5. Attach panelboard to the vertical finished or structural surface behind the panelboard.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- D. Mount top of trim 90 inches above finished floor unless otherwise indicated.
- E. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- F. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
- G. Install filler plates in unused spaces.
- H. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.
- I. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
- J. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 16050 (Basic Electrical Materials and Methods).

- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 16050 (Basic Electrical Materials and Methods).
- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 16050 (Basic Electrical Materials and Methods).

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- E. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 3. Perform the following infrared scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, and before Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Instruments and Equipment:
 - 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
- F. Panelboards will be considered defective if they do not pass tests and inspections.
- G. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

- A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as indicated
- C. Load Balancing: After Substantial Completion, and prior to Final Acceptance, measure load balancing and make circuit changes.
 - 1. Measure as directed during period of normal system loading.

2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.6 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION

