

Contract C19010

CERONE DIVISION EMERGENCY GENERATOR REPLACEMENT

Volume 2

Technical Specifications

Issued for Bid
June 12, 2019

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8.0 TECHNICAL SPECIFICATIONS

TABLE OF CONTENTS

Section	Page
ENGINEER'S SEAL PAGE	1
DIVISION 1 GENERAL REQUIREMENTS	5
01 11 00 Summary of Work	5
01 12 92 Schedule of Values	9
01 31 19 Project Meetings	11
01 73 00 Execution	13
01 77 00 Closeout Procedures	21
01 78 39 Project Record Documents	23
DIVISION 2 EXISTING CONDITIONS.....	29
02 32 19 Potholing.....	29
02 41 19 Selective Demolition	31
02 80 00 Hazardous Material Removals	37
DIVISION 3 CONCRETE.....	45
03 10 00 Concrete Forming and Accessories	45
03 20 00 Concrete Reinforcing	51
03 30 00 Cast-In-Place Concrete.....	57
DIVISION 7 THERMAL AND MOISTURE PROTECTION.....	75
07 46 46 Fiber-Cement Siding.....	75
DIVISION 9 FINISHES	79
09 91 23 Painting	79
DIVISION 23 FUELING.....	87
23 12 00 Fueling System	87
DIVISION 26 ELECTRICAL	103
26 05 00 Common Work Results for Electrical	103
26 05 19 600 Volt or Less Wire and Cable	109
26 05 26 Grounding	115
26 05 29 Hangers and Supports for Electrical Systems	121
26 05 33 Raceways and Boxes for Electrical Systems.....	129
26 05 43 Underground Ducts and Raceways for Electrical Systems.....	135
26 05 53 Electrical Identification	143
26 08 00 Acceptance Testing	147
26 27 00 Mini-Power Centers	151
26 32 13 Engine Generator	155
26 36 23 Transfer Switches.....	173
DIVISION 31 EARTHWORK.....	181
31 10 00 Site Clearing	181
31 23 16 Structural Excavation / Earthwork	183
31 23 23 Structural Fill	185

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ENGINEER'S SEAL PAGE

The Technical Specifications contained herein have been prepared by or under the direction of the following Registered Person. Notice to Bidders, Information and Instructions, Bid Submittal Forms, Contract Forms, and Prices, General Conditions and Special Conditions have been prepared by VTA, in conjunction with the Technical Specifications contained herein and the Contract Drawings that are a part of the Contract Documents.

TECHNICAL SPECIFICATION SECTIONS:

01 10 00 02 32 19 07 46 46 09 91 23
01 12 92 02 41 19
01 31 19 02 80 00
01 73 00
01 77 00
01 78 39



LICENSED ARCHITECT
JOHN O'BRIEN,
LICENSE NUMBER C-23931
VTA

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TECHNICAL SPECIFICATION SECTIONS:

03 10 00	31 10 00
03 20 00	31 23 16
03 30 00	31 23 23

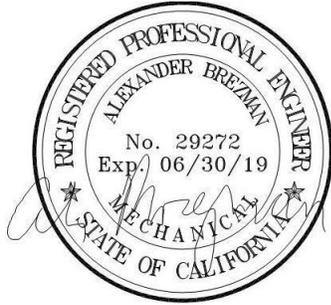


REGISTERED STRUCTURAL ENGINEER
MAHVASH HARMS, LICENSE NUMBER S2639
BIGGS CARDOSA ASSOCIATES

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TECHNICAL SPECIFICATION SECTIONS:

23 12 00

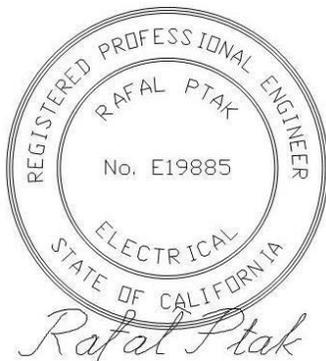


REGISTERED PROFESSIONAL ENGINEER
ALEXANDER BREZMAN, LICENSE NUMBER M29272
BLYMYER ENGINEERS

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TECHNICAL SPECIFICATION SECTIONS:

26 05 00
26 05 19
26 05 26
26 05 29
26 05 33
26 05 43
26 05 53
26 08 00
26 27 00
26 32 13
26 36 23



REGISTERED PROFESSIONAL ENGINEER
RAFAL PTAK, LICENSE NUMBER E19885
BLYMYER ENGINEERS

DIVISION 1 – GENERAL REQUIREMENTS

SECTION 01 10 00 – SUMMARY

PART 1 - GENERAL

1.01 GENERAL PROJECT SUMMARY

- A. The Cerone Division Emergency Generator Replacement Project is described under **Section 1.3 Description of Work** of the Contract Documents.
- B. The Project also includes:
 - 1. Asbestos abatement.
 - 2. Removal, handling, and disposal of material, substrates, or portions thereof, that contain lead paint and polychlorinated biphenyls (PCBs).
 - 3. Closure, removal, handling, and disposal of Aboveground Storage Tanks (ASTs), boilers, and generators containing hazardous material.
 - 4. Regulatory Compliance:
 - a. Preparation and implementation of Site Safety Plans.
 - b. Preparation and implementation of Erosion and Sedimentation Control Action Plan (Appendix G).
 - c. Preparation and implementation of Hazardous Materials Management Plan (HMMP).
 - d. Obtaining permits from all concerned regulatory entities (including those listed in **Section 6.7 Permits, Fees and Inspections** and Appendix N.
 - e. Preparation of pertinent manifests or Bill of Lading for transportation and disposal of hazardous and non-hazardous materials and substances.

1.02 INTERPRETATION

- A. These Technical Specifications impose requirements and prohibitions on Contractor. Contractor must interpret these Technical Specifications accordingly, even if no actor or subject is specified in a particular sentence or statement.

1.03 NOT USED

1.04 JOB CONDITIONS

- A. Refer to **Section 6.11 Work Sequence and Constraints** for requirements pertaining to:
 - 1. Work sequence and constraints
 - 2. Work hours
 - 3. Potholing
 - 4. Temporary power and cutovers
 - 5. Staging and phasing
- B. Use of Cerone Division: The Worksite area (as identified on the Contract Drawings) will be limited as indicated on the Contract Drawings. Contractor (i) must limit access to these

areas to the most direct route from the Cerone Division entrance, (ii) is responsible for restricting the movements of staff, subcontractors, and all associated personnel to the construction limits, and (iii) has no privilege of access beyond the established limits except as permitted for the installation of utilities and services.

1. Construction will be performed on an active site with ongoing 24-hour-a-day bus maintenance and operations activities. All construction activities are subordinate to the ongoing function of these maintenance and operation activities.
 2. Contractor's access to Cerone Division is limited to the access routes shown on Volume 3 Contract Drawings, Sheet G-1.0.
- C. Any additional construction lay-down area required, in addition to that shown on the Contract Drawings, will be at Contractor's own cost.
- D. Store materials and equipment under Contractor's control in a manner that does not interfere with VTA operations. Obtain and pay for use of additional storage space or work areas needed for construction operations.

1.05 HAZARDOUS MATERIALS:

- A. A limited asbestos, PCBs survey was conducted by Burns McDonnell in preparation for the planned construction, and was issued on November 5, 2018. The survey report is included in Appendix O (Hazardous Material Survey Report) of the Contract Documents. Asbestos was identified in gaskets used for joints and seals at boilers, generators and associated piping, corrugated exhaust deflectors, as well as caulk and pavement sealants. Lead containing material was identified on painted surfaces throughout the exterior and interior of the building. Examine report to become aware of hazardous materials impacted by Work shown on the Contract Documents.

1.06 PROJECT MEETINGS:

- A. Pre-Construction and Construction Progress Meetings: Refer to Section 01 31 19, Project Meetings of these Technical Specifications.
- B. Additional meetings will be scheduled, as necessary, to resolve issues of an immediate or short-term nature that cannot wait until the regularly scheduled Construction Progress Meeting. Although the VTA Resident Inspector has primary responsibility for determining the need for these meetings, Contractor may request a special meeting through the VTA Resident Inspector.

1.07 IDENTIFIED AGENCIES

- A. Refer to **Section 6.7 Permits, Fees and Inspections.**

1.08 CODES AND STANDARDS

- A. Conform to provisions of all applicable regulatory requirements and codes. Nothing in the Drawings or Technical Specifications is to be construed to permit Work not conforming to applicable regulatory requirements, codes, and standards.
1. Maintain copies of all codes and regulatory requirements at Worksite during construction.

- B. Should there be any direct conflict between the Drawings and/or Technical Specifications and the regulatory requirements/codes, the regulatory requirements/codes take precedence. However, when materials, workmanship, arrangement or construction indicated in the Technical Specifications and Contract Drawings is of a superior quality or capacity to that required by the regulatory requirements/codes, the Drawings and/or Technical Specifications take precedence. Ruling and interpretations of enforcing agencies are considered to be regulatory requirements.
- C. Any material specified by reference to the number, symbol, or title of a specific standard such as a American National Standard, Industry or Government Code, a trade association code or standard, or other similar standard, shall comply with the requirements in the latest revisions thereof and any amendments or supplements thereto in effect on the date of these Technical Specification. The standards referred to, except as modified in the Technical Specifications, have full force and effect as though printed in these Technical Specifications.

1.09 SCHEDULING

- A. Refer to **Section 6.21 Progress Schedule**.

1.10 QUALITY ASSURANCE PLAN

- A. Contractor shall assume responsibility for executing a quality control and quality assurance program. Refer to **Section 6.26 Quality Assurance and Quality Control Requirements**, and Appendix M, Quality Assurance and Quality Control Requirements.
- B. Contractor's Quality Assurance Plan submittal must include a schedule of tests, inspections, and quality control services called for in these Technical Specifications.

1.11 SUBMITTALS

- A. Refer to:
 - 1. Appendix B, Contract Data Requirements
 - 2. **Section 7.41 Product Options, Supplier Approval and Substitutions**
 - 3. **Section 7.43, Submittal of Shop Drawings, Product Data and Samples**
 - 4. **Section 7.49.1 Certificates of Compliance**
 - 5. **Section 8 Technical Specifications**

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 10 00

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SECTION 01 12 92 – SCHEDULE OF VALUES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Preparation and submittal of Schedule of Values for Lump Sum contracts.

1.02 RELATED SECTIONS

- A. **Section 6.21 Progress Schedule**
- B. **Section 7.59.1 Schedule of Values**

1.03 DEFINITION

- A. The Schedule of Values is an itemized list furnished by Contractor that establishes the value of each part of the Work for a Lump Sum contract. The Schedule of Values is used as the basis for preparing applications for payments.

1.04 PREPARATION

- A. The Schedule of Values will correlate directly with the tasks enumerated in Contractor's Baseline schedule.
- B. Use the Technical Specifications table of contents as a guide for listing the value of Work by sections. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
 - 1. Related Technical Specifications Section or Division.
 - 2. Description of Work.
 - 3. Name of subcontractor.
 - 4. Name of manufacturer or fabricator.
 - 5. Name of supplier.
 - 6. Dollar value for labor and materials shown separately for each category, and percentage of the Contract price allocated to each category value.
- C. Temporary facilities and other major cost items that are not direct costs of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.
- D. Provide a separate line item in the Schedule of Values for each part of the Work where invoices submitted by Contractor may include materials or equipment purchased or fabricated and stored but not installed.
 - 1. Differentiate between items stored on the Worksite and items stored off site.
- E. Each item in the Schedule of Values must be complete. Include total cost and proportionate share of general overhead and profit for each item.
- F. The summation of extensions of quantities and unit prices and related costs must equal the amount of the Lump Sum Contract price indicated in the Bid Form Schedule of Quantities and Prices.

1.05 SUBMITTAL

- A. Submit the Schedule of Values in accordance with the requirements of General Conditions Section 7.59.1 Schedule of Values.
- B. Submit Schedule of Values no later than **10** Working Days following NOA.
 - 1. A proposed Schedule of Values may be rejected by VTA if any item is determined by VTA to be unbalanced or VTA deems it to be incomplete.
 - 2. VTA may, in its sole discretion, request a detailed cost breakdown of any items. This breakdown will be for the purpose of enabling Contractor and VTA to check and verify the periodic invoices to be submitted by Contractor in connection with request for partial payments.
 - 3. The Schedule of Values will also be used in the calculation of changes, whether additive or deductive, to the extent applicable.
- C. **Contractor's submittal of a Schedule of Values acceptable to VTA is one of the prerequisites for issuance of a Notice to Proceed.**
- D. Progress payments will be made in accordance with the approved Contractor's Schedule of Values and progress payment protocols set forth in **Section 7.59 Progress Payment.**

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 12 92

SECTION 01 31 19 – PROJECT MEETINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Requirements for:
 - 1. Pre-construction meeting.
 - 2. Construction progress meetings.

1.02 RELATED SECTIONS

- A. **Section 6.17 Contractor Cooperation and Coordination**
- B. **Section 7.26 Pre-Construction Meeting**
- C. **Section 7.27 Project Meetings**

1.03 PRE-CONSTRUCTION MEETING

- A. Prior to issuance of the Notice to Proceed, a pre-construction meeting will be held at a time and place to be designated by notice from VTA. The purpose of this meeting is to introduce VTA's Resident Inspector for construction management to their counterparts in Contractor's organization and to establish lines of communication among these representatives. Contractor's Project Manager, superintendent, quality representatives, safety representative, EEO officer and subcontractor representatives must attend. Not less than four working days before the meeting, VTA will distribute a notice of this meeting, along with an agenda of the subjects to be addressed.
- B. Contractor shall perform the following at this pre-construction meeting:
 - 1. Introduce Contractor's representatives and briefly describe each person's responsibilities.
 - 2. Distribute and discuss the list of major subcontractors, their areas of responsibility, sequence of critical work, and tentative schedule of construction.
 - 3. Discuss use of office, storage areas, staging areas, construction areas, and temporary easements.
 - 4. Discuss construction safety.
 - 5. Define housekeeping procedures.
 - 6. Discuss construction methods.
 - 7. Discuss quality control/quality assurance.
 - 8. Describe construction sequencing of the entire contract, general jobsite layout, erosion and sedimentation control plans, haul routes, noise abatement, dust abatement, air and water pollution control, temporary access closings, and pavement restoration, as applicable.
 - 9. Discuss coordination and notifications required for utility work and services.
 - 10. Discuss deliveries and priorities of major equipment.
 - 11. Discuss breakdown of lump sum items.

12. Discuss construction progress schedule.

1.04 CONSTRUCTION PROGRESS MEETINGS

- A. VTA will schedule construction progress meetings each week, or more often as necessary for the competent and timely execution of the Contract. Contractor's personnel indicated above in Article 1.03, Pre-Construction Meeting, paragraph A must attend these meetings. Contractor will provide a 3-week construction schedule, and Contractor will update this schedule on a weekly basis. Progress meetings must include representatives of subcontractors who are or will be performing work during the next week.
- B. The agenda for construction progress meetings will be prepared by the VTA Resident Inspector with input from Contractor and will include the following:
1. Introduction of new attendees and areas of responsibility.
 2. Review of minutes of previous meetings, amendment of minutes if necessary, and acceptance of minutes.
 3. Analysis of work accomplished since the previous meeting, offsite fabrication problems, product delivery problems, submitted schedule slippages, problems arising from proposed changes, and other circumstances which might affect progress of the Work. Contractor will create and bring to the progress meeting an updated schedule showing all activities started, completed, and on-going during previous week and such activities scheduled for the next week.
 4. Discussion of sequence of work on the critical path, and schedule of construction using the progress schedule. Each activity must have a current status and forecast completion. Contractor shall report on all activities which are forecasted to be completed beyond the approved schedule date(s) and shall identify means of maintaining the approved schedule.
 5. Discussion of work quality observations, problems, and employee work standards.
 6. Discussion of coordination of utility work, including power shutdowns and cutovers.
 7. Discussion of changed conditions, time extensions, and other relevant subjects as they affect the progress of the Work.
 8. Discussion of corrective measures to maintain construction progress schedule when necessary.
 9. Discussion of potential claims and pending disputed issues.
 10. Inquiries, requests for information, and Change Notices/Change Orders.
 11. Discussion of upcoming month's Work.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 31 19

SECTION 01 73 00 – EXECUTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. General administrative and procedural requirements governing execution of the Work including, but not limited to:
 - 1. Construction layout
 - 2. Installation of the Work
 - 3. Cutting and patching
 - 4. Open trench safety
 - 5. Progress cleaning
 - 6. Starting and adjusting
 - 7. Protection of installed construction

1.02 RELATED SECTIONS

- A. Technical Specifications Section 02 32 19, Potholing
- B. Technical Specifications Section 02 41 19, Selective Demolition
- C. Division 23 and Division 26 of the Technical Specifications:
 - 1. These sections contain specific requirements on the extent and limitations applicable to demolition, cutting and patching, or altering existing construction applicable to fueling, mechanical, and electrical installations.

1.03 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.04 SAFETY REQUIREMENTS

- A. General: Maintain neat, orderly, and hazard-free on-site operations in conformance with CAL OSHA requirements until final acceptance of the Work.

1.05 QUALITY ASSURANCE

- A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
 - 1. Do not cut and patch construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
 - 2. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

1.06 PROJECT CONDITIONS

- A. Maintain access to existing walkways and other adjacent occupied or used facilities.
 - 1. Do not close or obstruct walkways or other occupied or used facilities without written permission from VTA.
- B. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to VTA for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 - 2. Examine for suitable conditions where products and systems are to be installed.
 - 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes.

3.02 PREPARATION

- a. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- b. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Contract Drawings.

3.03 CONSTRUCTION LAYOUT

- a. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings.
- b. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

3.04 UTILITY SERVICES

- A. Do not cut, remove, relocate, or abandon existing site or building utilities, until provisions have been made to bypass them.
 - 1. Provide temporary utilities that bypass area of selective demolition and that maintain continuity of service to affected areas of the site and buildings.
 - 2. There must be no unplanned power interruptions and shutdowns.
- B. Do not disable a fire protection system (sprinklers, fire alarm system components, etc.) unless prior approval has been provided by VTA.
 - 1. If a system is disabled, fire watch personnel must be present until that system is reconnected or other arrangements have been made and approved by VTA.
- C. Contractor will be held responsible for any damage done to any utility in the performance of Work.
 - 1. If it becomes necessary to repair, reconstruct, or relocate utilities within the Contract Worksite, all such work must be accomplished at no additional cost to VTA.

3.05 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Where possible, select tools or equipment that minimize production of excessive noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed.
 - 1. Check shop drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work.
 - 1. Where size and type of attachments are not indicated, verify size and type required for load conditions.
- I. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by VTA.
- J. Allow for movement, including thermal expansion and contraction.
- K. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.
- L. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints as directed by VTA. Fit exposed connections together to form hairline joints.
- M. Repair or remove and replace damaged, defective, or nonconforming Work.

3.06 CUTTING AND PATCHING

- A. Perform cutting and patching for the following:
 - 1. Cutting and patching existing construction altered or disturbed to accommodate new construction.
 - 2. Cutting and patching existing construction damaged or defaced during new construction.
 - 3. Cutting and patching required to install or correct non-coordinated Work.
 - 4. Cutting and patching required to remove and replace defective and non-conforming Work.
 - 5. Cutting and patching required to uncover work to inspect hidden conditions.
 - 6. Cutting and patching required to repair independent testing agency methods and operations.
 - 7. Any other cutting and patching not yet performed as part of the Work specified in other Technical Specifications sections.
- B. Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
 - 2. Temporary Support: Provide temporary support of Work to be cut.
 - 3. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Work that might be exposed during cutting and patching operations.

4. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.
- C. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction.
1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 4. Excavating and Backfilling: Comply with requirements set forth in the Contract Documents where excavating and backfilling is required by cutting and patching operations.
 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
- D. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in the Contract Documents, where applicable.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 3. Existing bolts, anchors and fastenings embedded in concrete that are used to support the removed items shall be removed to a depth of at least one inch below the finish surface. The resulting holes shall be filled with repair mortar.
 4. Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

5. Patching at Lead-Containing Paint Locations (LCP): Stabilize LCP locations by removing loose and flaking paint. Prepare surface for repainting by applying an encapsulation coating (specifically made for application over lead-based paint) to the area.
- E. Penetrations at Fire-Rated Construction: Seal all penetrations of fire rated walls and partitions using firestopping and smoke seal material in compliance with an applicable Underwriter's Laboratory listed assembly, to full thickness of the penetrated elements.
- F. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

TRAFFIC CONTROL AND BARRIERS FOR CONSTRUCTION

- A. Traffic control and barriers for construction must include the provisions for protecting pedestrian and vehicular traffic in the yard during the work and non-work hours, and for protection of open trenches during construction.
- B. At the end of each work day, all excavations resulting in open trenches of the sidewalk, driveway, or other areas of the bus right of way require steel plate bridging. Areas other than sidewalk, driveway or bus right of way shall be covered by steel plate, fenced off, or secured by other means to prevent injury and to protect the Worksite.
- C. Steel plates must be flush or transitioned with the sidewalk, driveway, or bus right of way. Whenever the grade difference between the existing pavement and the excavated area is greater than $\frac{3}{4}$ inch, provide a transitioned surface using hot-patched asphalt concrete.

3.08 PROGRESS CLEANING

- A. General: Clean Worksite daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
 1. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to all applicable laws, regulations, and rules.
 - a. Use containers intended for holding waste materials of type to be stored.
 2. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
- B. Site: Maintain Worksite free of waste materials and debris.
- C. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.
 - a. Remove liquid spills promptly.
 - b. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

3.09 STARTING AND ADJUSTING

- A. Coordinate startup and adjusting of equipment and operating components with requirements in:
 - 1. Technical Specifications Section 23 12 00 – Fueling System
 - 2. Technical Specifications Section 26 32 13 – Engine Generator
- B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.10 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.
- C. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 01 73 00

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SECTION 01 77 00 – CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Requirements preparatory to final inspection.
- B. Final inspection.
- C. Acceptance of the Work and final payment.

1.02 RELATED SECTIONS

- A. **Section 6.18 Substantial Completion and Acceptance**
- B. **Section 6.20 Project Close-Out Requirements – Record Drawings**
- C. **Section 7.55 Final Inspection and Acceptance of All or a Portion of the Work**
- D. **Section 7.62 Final Payment**
- E. Technical Specifications Section 01 78 39, Project Record Documents

1.03 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following:
 - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 - 2. Provide VTA at least seven calendar days in advance of the requested date of inspection.
 - 3. VTA will perform the inspection within three days of the requested date.
 - 4. Prior to the requested date of inspection, Contractor must perform or provide the following, as applicable:
 - a. Remove from the Worksite all temporary facilities, except as may be required for punch list work.
 - b. Complete startup testing of systems.
 - c. Submit test/adjust/balance records.
 - d. Complete, sign and submit to VTA record drawings and specifications, record shop drawings, record permits, warranties, and operations and maintenance manuals.
 - e. Complete final cleaning. Conduct cleaning and waste removal operations to comply with local laws and ordinances and Federal and local environmental regulations.
 - f. Complete touchup painting, and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, VTA will either proceed with inspection or notify Contractor of

unfulfilled requirements. VTA will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by VTA, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work is identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.
3. Contractor shall be represented during the inspection by its principal superintendent and such subcontractors and suppliers as may be necessary to answer the questions of the VTA inspection team.

1.04 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final inspection for determining date of final completion, complete the following:
 1. Submit certified copy of VTA's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by VTA.
 1. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
- C. Inspection: Submit request for final inspection for acceptance.
 1. The request must be made in writing, addressed to VTA, at least seven calendar days in advance of the requested date of the final inspection.
- D. The date of final completion will establish the completion date of the Work, for determining liquidated damages.

1.05 ACCEPTANCE OF THE WORK AND FINAL PAYMENT

- A. Final completion and acceptance of the Work will be made in accordance with **Section 7.55 Final Inspection and Acceptance of All or a Portion of the Work**. Final payment will be made in accordance with **Section 7.62 Final Payment**.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 77 00

SECTION 01 78 39 – PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Annotating, maintaining, and delivering project record documents.

1.02 RELATED SECTIONS

- A. **Section 6.20 Project Close-Out Requirements – Record Drawings**
- B. **Section 7.54 Redlined Construction Drawings**
- C. **Section 7.73 Warranty**

PART 2 - PRODUCTS

2.01 DOCUMENTS

- A. Four sets of red-lined conformed Contract Documents – Volume 1.
- B. Four half-size sets of red-lined Contract Documents – Volume 2 (“Contract Drawings”).
- C. Four half-size sets of record red-lined shop drawings.
- D. Six copies of operation and maintenance manuals.
- E. Four copies of warranties.
- F. Four copies of regulatory applications and permits.
- G. Four copies of test and inspection reports.

PART 3 - EXECUTION

3.01 MAINTENANCE OF DOCUMENTS

- A. Store the project record documents during construction, at Contractor’s field office, apart from other documents. Maintain in a clear, dry, and legible condition.
- B. Do not use project record documents for “in the field” construction purposes.
- C. Make project record documents available for auditing by VTA or any other authorities having jurisdiction.

3.02 PROJECT RECORD DOCUMENTS

- A. General:
 - 1. Legibly record the changes concurrent with the construction progress on at least a weekly basis. Do not conceal the Work until the changes have been recorded.
 - a. In the event that project record documents are not updated, VTA may withhold all or part of Contractor's progress billing until the contract record documents are updated to the satisfaction of VTA.
 - 2. Conformed Contract Documents – Volume 1:

- a. Mark the cover of the Conformed Contract Documents – Volume 1 with “PROJECT RECORD DOCUMENT”, in ½-inch high printed letters.
Mark each page with “PROJECT RECORD DOCUMENT” as a header centered at the top of the page, in ¼-inch high printed letters.
 3. Conformed Contract Documents – Volume 2 (“Contract Drawings”):
 - a. Mark each page of the Contract Drawings with "PROJECT RECORD DRAWING", in ½-inch high printed letters.
 - b. Indicate a new entry in the revision block that reads "PROJECT RECORD DRAWING". The revision shall be initialed and dated by Contractor's representative.
- B. Conformed Contract Documents – Volume 1:
1. Technical Specifications: Legibly mark up each Section of the Technical Specifications to indicate the actual product installation where installation varies from that indicated in the Technical Specifications.
 - a. Identify proprietary name and model number of products, materials, and equipment actually installed, including substitutions and product options.
 - b. Mark RFI numbers and Change Notice and Change Order numbers, where applicable. Such reference to RFI numbers and Change Notice and Change Order numbers will not be accepted as the sole description of the change. All changes must be shown completely.
 2. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
- C. Conformed Contract Documents – Volume 2 (“Contract Drawings”):
1. Maintain one set of marked Contract Drawings to show the actual installation where installation varies from that shown originally. Where more than one change is made in any area of the drawings, clearly identify the sequences of changes graphically, by overlay or by marking a legible reproducible of the preceding changes. Overlays and or new reproducibles must be inserted in a manner that precludes losing or damaging the documents.
 2. Mark the Contract Drawings to show the horizontal location, elevation, and dimensions of each underground or otherwise concealed structure, utility, subsurface obstruction, and appurtenance not shown on the Contract Drawings, or the elevations and dimensions which vary from those indicated. Reference locations and elevations to permanent surface features.
 3. Mark the Contract Drawings or shop drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where shop drawings are marked, show cross-reference on the Contract Drawings.

4. Mark with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
5. Mark important additional information that was either shown schematically or omitted from original Contract Drawings.
6. Mark RFI numbers and Change Notice and Change Order numbers, where applicable. Such reference to RFI numbers and Change Notice and Change Order numbers will not be accepted as sole description of the change. All changes shall be shown completely.
7. Clearly indicate all changes by a "cloud" drawn around the area or areas affected.
8. Prepare new record drawings where VTA determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
 - a. Drawing information must fit in the standard drawing size for the project 22" x 34", which includes the border frame of the drawing.
 - b. The project title and Contract number must appear on the drawing.

3.03 OPERATIONS AND MAINTENANCE MANUALS

- A. General: Assemble a complete set of operation and maintenance data indicating the operation and maintenance of each system, subsystem, and piece of equipment not part of a system. Include operation and maintenance data required in individual Technical Specification sections, and as follows:
 1. Operation Data:
 - a. Emergency instructions and procedures.
 - b. System, subsystem, and equipment descriptions, including operating standards.
 - c. Operating procedures, including startup and shutdown operations.
 - d. Description of controls and sequence of operations.
 - e. Piping and wiring diagrams.
 2. Maintenance Data:
 - a. Manufacturer's information, including list of spare parts.
 - b. Name, address, and telephone number of Installer or supplier.
 - c. Maintenance procedures, including maintenance and service schedules for preventive and routine maintenance.
 - d. Maintenance record forms.
 - e. Sources of spare parts and maintenance materials.
 - f. Copies of warranties.
 3. Regulatory Permits:
 - a. Permit applications.

- b. Permits.
 - c. Permit inspection reports and correction lists.
 - 4. Drawings:
 - a. Shop drawings, including mechanical schematics, piping and wiring diagrams, connection diagrams.
 - 5. Serial Numbers:
 - a. SERIAL NUMBERS of all installed equipment.
- B. Prepare data in the form of an instructional manual that satisfies the following requirements:
 - 1. Binders: Commercial quality, 8-1/2" x 11' three-ring binders with hardback, cleanable, vinyl covers, thickness necessary to accommodate contents, with pocket inside the covers to receive folded oversized sheets.
 - 2. Cover: Identify each binder on front and spine with typed or printed title OPERATION AND MAINTENANCE MANUAL, project name, contractor information (name, address, telephone number).
 - 3. Inside Cover: Provide complete table of contents.
 - 4. Tabs: Typed description of product for each separate product or system.
 - 5. Text: Manufacturer's printed data (when available) or typewritten data on 20-pound bond paper.
 - 6. Drawings: Reduce full size drawings to 11' x 17" size.

3.04 WARRANTIES

- A. Warranty Definitions:
 - 1. Standard product warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to VTA.
 - 2. Special warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights to VTA. When the Contract Documents require Contractor, or Contractor and subcontractor, supplier or manufacturer to execute a special warranty, Contractor must prepare a written document that contains appropriate terms and identification, ready for execution by the required parties.
- B. Form of Submittal: Compile copies of each required warranty properly executed by Contractor, or by Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of these Technical Specifications.
- C. Provide additional copies of each warranty to include in operation and maintenance manuals.

- D. Bind warranties in heavy-duty, commercial-quality, durable 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, and sized to receive 8-1/2 by 11 inch paper.
 - 1. Provide heavy paper dividers for each separate warranty. Provide and mark the tabs to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address, and telephone number of the Installer.
 - 2. Identify each binder on the front with the typed or printed title "WARRANTIES", Project title or name, and the name of Contractor.

3.05 REGULATORY APPLICATIONS AND PERMITS

- A. Submit copies of permit applications, permits, inspection reports, notices, receipts for fee payments, correspondence, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.
- B. Form of Submittal: Organize documents in proper sequence based on the orders and requests of the authorities having jurisdiction (AHJ).
- C. Bind the reports in heavy-duty, commercial-quality, durable 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, and sized to receive 8-1/2 by 11 inch paper.
 - 1. Provide heavy paper dividers for each separate AHJ. Provide and mark the tabs to identify the Technical Specification Section. Provide a typed Table of Contents indicating the AHJ and the Technical Specification Section and title of each document.
 - 2. Identify each binder on the front with the typed or printed title "Regulatory Applications and Permits", Project title or name, and the name of Contractor.

3.06 TEST AND INSPECTION REPORTS

- A. Prepare and submit certified written reports specified in other Sections. Include the following:
 - 1. Date of issue.
 - 2. Project title and Contract number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of test and inspection method.
 - 7. List of test equipment, and calibration date.
 - 8. Identification of product and Technical Specifications section.
 - 9. Complete test results.

10. Analysis and interpretation of test results, including professional opinion on whether tested or inspected Work complies with Contract Documents requirements.
 11. Name and signature of responsible inspector or engineer.
 12. Recommendations on retesting and reinspecting.
- B. Form of Submittal: Compile copies of each required test and inspection report. Organize the reports into an orderly sequence based on the table of contents of the Technical Specifications.
- C. Bind the reports in heavy-duty, commercial-quality, durable 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, and sized to receive 8-1/2 by 11 inch paper.
1. Provide heavy paper dividers for each separate report. Provide and mark the tabs to identify the Technical Specification Section. Provide a typed Table of Contents indicating the Technical Specification Section and title of the required test and inspection report.
 2. Identify each binder on the front with the typed or printed title "Test and Inspection Reports", Project title or name, and the name of Contractor.

END OF SECTION 01 78 39

DIVISION 2 – EXISTING CONDITIONS

SECTION 02 32 19 – POTHOLING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Requirements for potholing of existing utilities.

1.02 RELATED SECTIONS

- A. Technical Specifications Section 31 10 00, Site Clearing

1.03 SYSTEM DESCRIPTION

- A. Provide potholing to verify the location and type of existing utilities in regard to protection of existing facilities and connections to existing utilities.

1.04 SUBMITTALS

- A. Submittal procedures must be in accordance with the applicable provisions of:
 - 1. **Section 6.6 Contract Data Requirements**
 - 2. **Section 7.41 Product Options, Supplier Approval and Substitutions**
 - 3. **Section 7.43 Submittal of Shop Drawings, Product Data and Samples**
 - 4. **Section 7.49.1 Certificates of Compliance**
 - 5. Appendix B, Contract Data Requirements
- B. Proposed potholing excavation equipment.
- C. Preliminary pothole plan showing the proposed pothole locations.
- D. Report for each pothole dug under the provisions of this Section. Reports must be typed and clearly drawn to show all necessary details, including:
 - 1. Drawing showing location, date, depth, conditions encountered, person in charge of potholing, and any other information requested by VTA.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 POTHOLING

- A. Review the Contract Drawings showing new construction and existing utilities. Pothole existing utilities, taking care not to damage the utilities. Pothole to a depth of 6' unless a utility is encountered shallower.
- B. Use a hand held locator paired with "hand dig" equipment or "soft dig" vacuum excavation equipment.
- C. Chronologically number each pothole and mark the number of the pothole onto the pavement or ground adjacent to the pothole.

- D. Record the number of the pothole and identify the pothole, including top and bottom of utility depths, width, and type of utility encountered. Provide these notes to VTA at the end of each day that potholing is performed.
- E. Compare pothole markings to determine if existing utilities shown on the Contract Drawings have been identified in the field. If pothole markings and Contract Drawings do not match, notify VTA of findings immediately.
- F. If during potholing, existing utilities not shown on the Contract Drawings are found, or not found to be within reasonable proximity as shown on the Contract Drawings, take all precautionary measures to protect existing facilities from damage and notify VTA of findings immediately.
- G. Backfill holes and repair surfacing with asphalt concrete or concrete to match existing surface.
- H. Contractor will bear full responsibility for all damages and costs of repairs to existing utilities. Should any such utility be damaged during construction, all expenses of the restoration of the utility to its original service will be borne by Contractor.
- I. Unless otherwise indicated on the Contract Drawings, protect in place all water, propane gas and sewer lines; electrical and telephone conduits or structures; diesel, transmission fluid and motor oil lines, and other surface or subsurface structures of any nature that may be affected by the Work.

END OF SECTION 02 32 19

SECTION 02 41 19 – SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This Section includes demolition and removal of selected portions of a building, including removal of foundations.

1.02 RELATED SECTIONS

- A. Technical Specifications Section 01 73 00, Execution, for general requirements for patch and repair procedures.
- B. Technical Specifications Section 02 80 00, Hazardous Material Removals, for:
 - 1. Asbestos abatement, and removal, handling and disposal of materials, substrates, or portions thereof, that contain lead paint and polychlorinated biphenyls (PCBs).
 - 2. Closure, removal, handling and disposal of Aboveground Storage Tanks (ASTs - boilers, generators) containing hazardous material.
- C. Technical Specifications Section 31 10 00, Site Clearing, for removal of above and below grade site improvements.
- D. Refer to Contract Drawings and Division 23 and Division 26 of the Technical Specifications sections for specific requirements of the extent and limitations applicable to demolition, cutting and patching, or altering existing construction applicable to fueling, mechanical and electrical installations.
- E. Section 6.14.2 Hazardous Substances.

1.03 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: Detach items from existing construction and deliver them to VTA.
- C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them.
- D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.04 MATERIALS OWNERSHIP

- A. Except for items or materials indicated to be salvaged, reinstalled, or otherwise indicated to remain on VTA property, demolished materials will become Contractor's property and must be removed, recycled, or disposed from project site in an appropriate and legal manner.

1.05 HAZARDOUS MATERIALS

- A. A limited asbestos, lead, and polychlorinated biphenyls (PCBs) survey, in preparation for the planned construction, was conducted by Burns McDonnell, and issued on November 5, 2018. Survey report is included in Appendix O of the Contract Documents.
- B. Examine asbestos, lead, and PCB report (Appendix O) to become aware of hazardous materials impacted by work shown on the Contract Documents.

1.06 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with governing regulatory requirements before beginning selective demolition. Comply with hauling and disposal regulations of Authorities Having Jurisdiction.

1.07 SUBMITTALS

- A. Submittal procedures must be in accordance with the applicable provisions of:
 - 1. **Section 6.6 Contract Data Requirements**
 - 2. **Section 7.41 Product Options, Supplier Approval and Substitutions**
 - 3. **Section 7.43 Submittal of Shop Drawings, Product Data and Samples**
 - 4. **Section 7.49.1 Certificates of Compliance**
 - 5. Appendix B, Contract Data Requirements
- B. Schedule of Selective Demolition Activities: Refer to **Section 6.11 Work Sequence and Constraints**. Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
 - 2. Interruption of utility services.
 - 3. Coordination for shutoff, capping, and continuation of utility services.
- C. Closeout Submittals:
 - 1. Receipt and weight tickets from landfill operator or recycler (as applicable).
 - 2. Completed waste manifests.

1.08 PROJECT CONDITIONS

- A. VTA will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so VTA operations will not be disrupted.
- B. Maintain access to existing walkways and other adjacent occupied or used facilities.
 - 1. Do not close or obstruct walkways or other occupied or used facilities without permission from VTA.
- C. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

PART 2 - PRODUCTS

2.01 SALVAGED ITEMS

- A. The Contract Drawings indicate the existing materials that are to be reinstalled in the new construction. Contractor shall remove, protect, and reinstall these items as indicated.
 - 1. Items for "Reinstallation" are indicated as such in the Contract Drawings.
- B. Materials scheduled for reinstallation which are damaged by Contractor to the extent that they cannot be reinstalled must be replaced by Contractor with equal quality material at no additional cost to VTA.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- B. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- C. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.02 PREPARATION

- A. Temporary Facilities:
 - 1. Provide temporary barricades, warning signs, lights, delineators, shields, and other provisions necessary to protect passerby from injury or discomfort around the demolition area.
 - 2. Cover and protect furnishings and equipment that have not been removed, and are to remain in place during construction activities.

3.03 POLLUTION CONTROLS

- A. Stockpiling of Excavated Soil, Concrete and Surface Materials: Construct a staging area in the area directed by VTA for stockpiling of all excavated soil, concrete and surface materials. Stockpile excavated soil and debris on plastic sheeting and cover with plastic sheeting.
- B. Disposal: Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas. Do not allow debris to accumulate in building or on site.
- C. Cleaning: Clean adjacent areas and equipment of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.
- D. No project related waste materials are to be disposed of in VTA's on-site waste bins or be allowed to remain on site after completion of project activities.

3.04 DEMOLITION

- 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 limitation of the Authorities Having Jurisdiction 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. To minimize disturbance of adjacent surfaces, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
 2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 3. Do not use sanding, abrasive blasting, or any other removal method that will create airborne lead or lead aerosols.
- 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 VTA.
- C. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse.
 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
 3. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- D. Existing Items to Remain:
1. Protect construction indicated to remain against damage during selective demolition.
 2. Existing facilities, equipment or work that is not indicated to be removed, but interferes with new construction, must be removed as required to perform new Work.
- E. Lead Paint:
1. Removal of lead paint prior to demolition is not required if the paints is securely adhered to the substrates (non-flaking or non-peeling). Disposal of demolition debris in this case can be handled as non-hazardous waste. Spot abate all loose and flaking paint as hazardous waste.
- F. Plumbing:
1. Concealed piping within and below slab construction shall be identified, and capped a minimum of 3 inches below finish floor.

2. Demolition of those portions of lines remaining must be capped with a fully threaded cap capable of withstanding 150% line pressure.
- G. Electrical:
1. Remove all abandoned electrical conduit, fastenings, boxes, unistrut, miscellaneous angles and supports.
 2. Restore to its original operating condition all existing equipment and/or electrical wiring which is to remain, but has been removed to facilitate the installation of new equipment. Replace all removed wiring with new wiring.
 3. Removed fixtures and equipment must have all wiring removed back to the panel from which it is served.
 - a. Mark all disassociated breakers "spare".
 - b. If removal of wiring affects power to other outlets and fixtures to remain, provide J-boxes, etc., as necessary, to restore power to those outlets and fixtures.
- H. Provide additional select demolition as indicated in other Technical Specifications sections and Contract Drawings, and as required for new construction.

3.05 DISPOSAL OF REMOVED MATERIALS

- A. Transport and dispose/recycle all removed materials generated during the performance of work, to an approved disposal site according to appropriate federal, state and local laws.
- B. All waste must be hauled by a licensed waste hauler with all required licenses from all state and local Authorities Having Jurisdiction.
- C. Comply with DOT, state and local regulations for containers. The most stringent regulation will apply.

3.06 DISPOSAL FACILITIES TESTING:

- A. Contractor will be solely responsible for any testing of all demolition and removed items during the performance of work on this Contract.
- B. Perform all sampling and analytical work as required by treatment/disposal facilities receiving the material.
- C. All records, including waste manifests and Bill of Lading, must be provided to VTA.

3.07 CLEANING

- A. Clean adjacent portion of the structure and improvement of dust, dirt and debris caused by demolition operations.
- B. Sweep the Worksite and broom clean on completion of selective demolition operations and every workday during the performance of the Contract.
- C. Keep Worksite free from accumulation of waste materials.
- D. Return adjacent areas to conditions existing prior to the start of the Work.

3.08 CLOSEOUT DOCUMENTATION

- A. Prepare closeout documentation in accordance with Technical Specifications Section 01 77 00, Closeout Procedures, and Technical Specifications Section 01 78 39, Project Record Documents, to include the following:
1. Receipt and weight tickets from landfill operator or recycler (as applicable).
 2. Completed waste manifests.

END OF SECTION 02 41 19

SECTION 02 80 00 – HAZARDOUS MATERIAL REMOVALS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. This Section includes:
 - 1. The removal, handling and disposal of material, substrates, or portions thereof, that contain asbestos, lead paint and polychlorinated biphenyls (PCBs).
 - 2. Closure, removal, handling and disposal of Aboveground Storage Tanks (ASTs - boilers, generators) containing hazardous material.

1.02 RELATED SECTIONS

- A. **Section 6.14.2 Hazardous Substances**

1.03 REFERENCES

- A. A limited asbestos, lead, and polychlorinated biphenyls (PCB) survey, in preparation for the planned construction, was conducted by Burns McDonnell, and issued on November 5, 2018. Survey report is included in Appendix O of the Contract Documents.
- B. Asbestos was identified in:
 - 1. Gaskets used for joints and seals at boilers, generators and associated piping.
 - 2. Corrugated exhaust deflectors.
 - 3. Caulk and pavement sealants.
- C. Lead containing material was identified on painted surfaces throughout the exterior and interior of the building.
- D. PCB containing material was identified in:
 - 1. Corrugated exhaust deflectors.
 - 2. Caulk and pavement sealants.
- E. Examine asbestos, lead, and PCB report to become aware of hazardous materials impacted by work shown on the Contract Documents.

1.04 REGULATORY REQUIREMENTS

- A. General Requirements:
 - 1. All Work must be in accordance with this Technical Specification Section and the latest regulations from the U.S. Environmental Protection Agency (EPA), the U.S. Department of Transportation (DOT), the Occupational Safety and Health Administration (OSHA), the State of California Department of Industrial Relations - Division of Occupational Safety and Health (DOSH), the State of California Department of Industrial Relations (Cal/OSHA), and any other applicable federal, state and regional AHJ. Whenever there is a conflict or overlap of the above references, the most stringent provision is applicable.

- B. Hazardous Material Storage Tank and Piping System (Fueling, Generators, Boilers. Comply with all applicable provisions of:
 - 1. California Aboveground Petroleum Storage Act (APSA).
 - 2. “Aboveground Tank Closure Guidelines” and “Guidelines for On-Site Cleaning of Hazardous Materials Storage Tank Systems”, issued by the County of Santa Clara Department of Environmental Health - Hazardous Materials Compliance Division (HMCD). HMCD is the Certified Unified Program Agency (CUPA) for Santa Clara County.
 - 3. California Code of Regulations, Title 8, Department of Industrial Relations, Division of Industrial Safety – Boiler and Fired Pressure Vessel Safety Orders, as administered by the California Department of Industrial Relations, Division of Occupational Health (DOSH) - Pressure Vessel Unit.
 - 4. “Manual of Procedures”, issued by the Bay Area Air Quality Management District.

1.05 QUALITY ASSURANCE

- A. Contractor Qualifications for Hazardous Material Storage Tank (generators, boilers and associated fuel piping) Closure and Removal:
 - 1. Contractor must assign an individual to perform the Work described in this section who satisfies the following minimum requirements:
 - a. The assigned individual must have a HAZ - Hazardous Substance Removal Certification issued by the California State Licensing Board.
 - b. The assigned individual must have completed, within the past five years, at least one commercial dismantling and removal of a petroleum storage tank system located in the State of California.
- B. Contractor Qualifications for Asbestos Abatement:
 - 1. Contractor must assign an individual to perform the Work described in this section who satisfies the following minimum requirements:
 - a. A California licensed C-22 - Asbestos Abatement Contractor.
- C. Standards: In addition to complying with pertinent regulations of governmental agencies having jurisdiction, comply with pertinent provisions of the federal Resource Conservation and Recovery Act (RCRA); OSHA Chapter 30, Title 22, Articles 5,6, 6.5 and 15 of the California Code of Regulations; and Chapter 6.5, Division 20 and Chapter 7 of the California Health and Safety Code, and 29 CFR 1910.120 and 29 CFR 1926.650 through 1926.653, and Uniform Fire Code: California Code of Regulations (CCR) Title 23, Division 3, Chapter 16.
- D. Ensure all workers have current, unexpired 40-Hour Hazardous Waste Operations and Emergency Response Training (HAZWOPER) certification during the duration of the Contract Work.

1.06 PERMITS

- A. Secure permits and inspections from all necessary local, regional, state, and federal agencies. These agencies include, but are not limited to: Bay Area Air Quality Management District (BAAQMD) and the Santa Clara County Department of Environmental Health - Hazardous Materials Compliance Division (HMCD).
- B. Contractor shall maintain current and unexpired license and certification for asbestos or hazardous substance removal, as required by applicable state or local jurisdictions for the removal, transporting, disposal or other regulated activity relative to the Work of this Contract.

1.07 SUBMITTALS

- A. Submittal procedures must be in accordance with the applicable provisions of:
 - 1. **Section 6.6 Contract Data Requirements**
 - 2. **Section 7.41 Product Options, Supplier Approval and Substitutions**
 - 3. **Section 7.43 Submittal of Shop Drawings, Product Data and Samples**
 - 4. **Section 7.49.1 Certificates of Compliance**
 - 5. Appendix B, Contract Data Requirements
- B. Hazardous Material Management Plan (HMMP), to include the following:
 - 1. Work Plan: Detailed, job-specific plan for the management and abatement of hazardous materials encountered during performance of Work. Provide a plan of action with methods and procedures covering each of the identifiable abatement and/or regulated areas. All procedures used must provide containment of debris and/or contaminated dust and not allow airborne contamination of adjacent areas. Identify proposed treatment/disposal facilities.
 - 2. Abatement Schedule: Provide a schedule detailing the estimated start and finish dates, crew size, preparation (setup) time, and removal.
 - 3. Notification Plan: Implementation plan for notification to AHJs.
 - 4. Organization structure.
 - 5. Medical surveillance program.
 - 6. Respiratory protection program.
 - 7. Contractor's standard operating procedures for safety and health.
 - 8. Worker certification for personnel to be engaged in the Work of this Section. Provide for each worker.
 - 9. Training Program: Proof that training of all personnel engaged in Work under this Section is current and in accordance with regulatory requirements.
 - 10. Emergency response work plan to be adhered to when response is needed in a situation immediately dangerous to human life and the environment.

11. Site specific health and safety plan prepared and signed by a certified industrial hygienist, which addresses toxic effects to workers from containment activities and hazards, protective clothing and equipment, environmental monitoring.
 12. Detailed equipment list to be used.
 13. MSDS for all chemicals to be used.
- C. Closeout Submittals:
1. Air sampling results for all work areas.
 2. Completed hazardous material waste manifests and Bill of Lading.
 3. Analytical results of profile sampling/waste profiling data, for acceptance to treatment/disposal facility.
 4. Regulatory applications, notifications and permits from all AHJs.
 5. Regulatory Certificates of Inspection from all AHJs.
 6. Contractor's final clearance inspection letter, certifying that all abatement activity is completed.

1.08 TESTING

- A. Monitor airborne fiber counts outside the work area. The purpose of this air monitoring will be to detect airborne fiber counts which may significantly challenge the ability of the work area isolation procedures to protect the balance of the building or outside of the building from contamination by airborne fibers.

1.09 SAFETY REQUIREMENTS

- A. Contractor removing hazardous waste must be certified in Hazardous Materials Handling as specified by Title III of the Superfund Amendments and Reauthorization Act and in accordance with 29 CFR 1910.120 and any other applicable local, regional, state or federal regulations. Provide and wear protective clothing and equipment.
- B. All vehicles used to haul hazardous material from this site must display evidence of proper Department of Health Services (DOHS) and Department of Transportation (DOT) registration as a hazardous waste hauling vehicle.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 EXAMINATION

- 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.

3.02 WORK AREA PREPARATION

- A. Seal all openings, supply and exhaust vents, and convectors within ten (10) feet of the work area with 6 mil polyethylene sheeting secured and completely sealed with plastic adhesion tape.
- B. Completely isolate work area from other parts of the building so as to prevent hazardous materials containing dust or debris from passing beyond the isolated area. Should the area beyond the work areas become contaminated with hazardous materials containing dust or debris as a consequence of the work, clean those areas in accordance with the procedures indicated in Section 3.05 Project Decontamination (below).
- C. Provide warning signs at each visual and physical barrier.

3.03 WORKER PROTECTION

- A. Provide workers with training in accordance with 29 CFR 1926.
- B. Provide medical examinations for all workers who may encounter an airborne fiber level of 0.1 f/cc of asbestos or 50 ug/m³ of lead of greater for an 8-hour time weighted average.
- C. Provide workers with appropriate personal protective equipment (PPE), including but not limited to, disposable full-body coveralls and disposable head covers, work boots, hard hats, goggles, and work gloves that meets OSHA and EPA standards. PPE must be worn by all workers in the work area.

3.04 RESPIRATORY PROTECTION

- A. All workers involved in hazardous materials abatement must be trained in proper respiratory use and require that each worker always wear a respirator, properly fitted on the face in the work area from the start of any operation which may disturb hazardous materials until the work area is completely decontaminated. Use respiratory protection appropriate for the fiber level encountered in the work area or as required for other toxic or oxygen deficient situation encountered.

3.05 PROJECT DECONTAMINATION

- A. Clean all surfaces of the work area including but not limited to, sheeting, tools, and scaffolding by use of damp-cleaning and mopping. Continue cleaning until there is no visible debris from removed materials on plastic sheeting or other surfaces.
- B. Visual Inspection: Perform a visual inspection of the entire work area, all plastic sheeting, seals over ventilation openings, doorways, windows and other openings. Look for debris from any sources, residue on surfaces, dust or other matter. If any such debris, residue, dust or other matter is found, repeat cleaning and continue decontamination procedure from that point.
- C. Final Air Sampling: After work area is found to be visually clean, perform a final air sampling and analyze in accordance with Section 3.06 Work Area Clearance (below). If release criteria are not met, repeat cleaning and continue decontamination procedure from that point.
- D. If release criteria is met, remove the interior of the decontamination unit leaving in place only the critical barriers separating the work area from the rest of the building.

3.06 WORK AREA CLEARANCE

- A. Perform final visual and tactile inspection as prerequisite for air sampling and analysis.
- B. Perform air sampling and analysis inside the work area in order to determine if elevated airborne asbestos concentration during the abatement operations have been reduced to the recommended EPA post-abatement asbestos re-occupancy criteria of < 0.01 fibers per cubic centimeter (f/cc).
- C. Release Criteria: Decontamination of the work area is complete when all sample results are below the 0.01 fibers per cubic centimeter (f/cc) of air.
- D. Submit a final clearance inspection letter to VTA certifying that all abatement activity has been completed.

3.07 HANDLING AND DISPOSAL OF HAZARDOUS WASTE MATERIAL

- A. All asbestos and lead containing waste and contaminated waste must be double bagged in pre-labeled 6 mil airtight puncture resistance bags with labeling in accordance to OSHA and EPA guidelines.
- B. Bags must be sealed with tape in the work area and not be allowed to dry out prior to sealing bags. Bags must be decontaminated of any bulk debris by wet wiping.
- C. Seal lead waste in leak-proof impermeable containers labeled in accordance with EPA guidelines.
- D. Lead Paint: Removal of lead paint prior to demolition is not required if the paints are securely adhered to the substrates (non-flaking or non-peeling). Disposal of demolition debris in this case can be handled as non-hazardous waste. Spot abate all loose and flaking paint as hazardous waste.
- E. All hazardous waste materials are to be hauled by a waste hauler with all required licenses from state and local Authority Having Jurisdiction.
- F. All vehicles used to haul hazardous material shall display evidence of current Department of Health Services (DOHS) and Department of Transportation (DOT) registration as a hazardous waste hauling vehicle.

3.08 GENERATOR AND BOILER CLOSURE WORK

- A. All closure work described herein will be performed by a contractor having Hazardous Substance Removal Certification (HAZ) issued by the California Contractor's State License Board (CSLB), unless otherwise noted.
- B. Complete the "Aboveground Tank Closure Permit Application" and pay for the tank closure permit fee. Payment of the tank closure permit fee must be submitted with the closure permit application. VTA will submit Contractor's completed application and Contractor's permit fee to County of Santa Clara Department of Environmental Health - Hazardous Materials Compliance Division (HMCD).
- C. The completed tank closure permit and permit fee must be submitted to HMCD at least 14 days prior to tank removal.

- D. Tank removal may commence only after the HMCD inspector has given approval. Contractor's tank removal and sampling activities must be witnessed by a representative of HMCD.
- E. Remove all hazardous materials, including fuel from tanks and piping prior to tank removal.
- F. Drain, cap, dismantle, and triple rinse all tanks and piping.
- G. Containerize and transport off site for disposal all cleaning rinseate. All sludge, loose scale, residue, rinseate, and debris generated during the tank cleaning process shall be managed as hazardous waste.
- H. All cracks, holes, and other damaged section of the tank and piping must be plugged.
- I. Prior to tank removal, add dry ice (carbon dioxide) or other methods approved by HMCD sufficient to achieve an atmosphere of either less than 10% oxygen or less than 20% Lower Explosive Limit (LEL). Confirm LEL readings with a properly calibrated combustible gas indicator (CGI). Record the readings in the Tank Closure Certification form.
- J. Submit Tank Closure Certification form for each tank cleaned. Form must be prepared by a contractor having a Hazardous Substance Removal Certification (HAZ) issued by the California Contractor's State License Board (CSLB), or a Certified Industrial Hygienist, or Certified Safety Professional.
- K. All tanks and piping must be manifested and hauled by a licensed hazardous waste transporter to a permitted hazardous waste facility, whether or not tanks and piping have been rinsed on site.
- L. Submit Bill of Lading for transport of each tank.
- M. Submit disposal certification for each tank.
- N. Submit Bill of Lading or Uniform Hazardous Waste Manifest for transport of residual fuel removed from each tank.
- O. Submit copies of Uniform Hazardous Waste Manifests associated with wastes generated during tank and pipe cleaning activities.

3.09 DISPOSAL FACILITIES TESTING

- A. Contractor will be solely responsible for any testing of all demolition and removed items during the performance of Work under this Contract.
- B. Perform all testing as required by acceptance requirements of treatment/disposal facilities receiving the material.
- C. Perform all sampling and analytical work required in accordance with local, state, and federal environmental regulation requirements.
- D. All analytical work must be performed by a certified environmental laboratory hired by Contractor.
- E. All records, including waste manifests, Bill of Lading must be provided to VTA.

3.10 CLOSEOUT DOCUMENTATION

- A. Prepare closeout documentation in accordance with Technical Specifications Section 01 77 00, Closeout Procedures, and Section 01 78 39, Project Record Documents, to include the following:
1. Air sampling results for all work areas.
 2. Completed hazardous waste manifests and Bill of Lading.
 3. Analytical results of profile sampling/waste profiling data, for acceptance to treatment/disposal facility.
 4. Regulatory applications, notifications, and permits from all AHJs.
 5. Regulatory certificates of inspection from all AHJs.
 6. Contractor's final clearance inspection letter, certifying that all abatement activity is completed.

END OF SECTION 02 80 00

DIVISION 3 – CONCRETE

SECTION 03 10 00 – CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Formwork for concrete, with shoring, bracing and anchorage.

1.02 RELATED REQUIREMENTS

- A. Technical Specifications Section 03 20 00, Concrete Reinforcing
- B. Technical Specifications Section 03 30 00, Cast-In-Place Concrete

1.03 REFERENCE STANDARDS

- A. American Concrete Institute (ACI):
 - 1. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.
 - 2. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute.
 - 3. ACI 318 – Building Code Requirements for Structural Concrete and Commentary.
 - 4. ACI 347 – Guide to Formwork for Concrete.
- B. American Society for Testing Materials (ASTM):
 - 1. ASTM D994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
 - 2. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

1.04 SUBMITTALS

- A. Submittal procedures must be in accordance with the applicable provisions of:
 - 1. **Section 6.6 Contract Data Requirements**
 - 2. **Section 7.41 Product Options, Supplier Approval and Substitutions**
 - 3. **Section 7.43 Submittal of Shop Drawings, Product Data and Samples**
 - 4. **Section 7.49.1 Certificates of Compliance**
 - 5. Appendix B, Contract Data Requirements
- B. Formwork release agent or form liner proposed for use with each formed surface.
- C. Shop Drawings
 - 1. Shop drawings must be prepared, stamped, and signed by a Civil or Structural Engineer registered in the State of California.

2. Formwork: Include size of members, bracing, jointing, special form joint or reveals, location and pattern of form tie placement, and other items that affect the structural integrity of formwork or exposed concrete visually.
3. Identify construction and contraction joint locations.

1.05 QUALITY ASSURANCE

- A. Codes and Standards: Comply with the provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified.
 1. California Code of Regulations, Title 24, Part 2, "California Building Code".
 2. ACI 318.
 3. ACI 347.

PART 2 - PRODUCTS

2.01 FORMWORK – GENERAL

- A. Maximum deflection of facing materials reflected on concrete surfaces exposed to public view must be 1/240 of the span between structural members of the formwork.
- B. Formed Construction and Contraction Joints
 1. Locate and form construction joints that least impair strength of the structure and meet the requirements of Technical Specifications Section 03 30 00 - Cast-in-Place Concrete, Part 3, Paragraph 3.05.
 2. Unless otherwise specified or permitted, locate and detail formed construction joints to the following requirements:
 - a. Locate construction joints within the middle third of the spans of slabs, beams, and girders. When a beam intersects a girder within this region, offset the joint in the girder a distance equal to or greater than twice the width of the beam;
 - b. Locate joints in walls and columns at the underside of slabs, beams, or girders and at the tops of footings or slabs; and
 - c. Make joints perpendicular to the main reinforcement.
 3. Provide keyways where indicated on Contract Documents. Unless otherwise specified, longitudinal keyways indicated on the Contract Documents, must be a minimum of 1-1/2 in. deep in joints in walls and between walls and slabs or footings.
 4. Provide construction and contraction joints where indicated in the Contract Documents. Submit for acceptance the location of construction and contraction joints differing from those indicated on the Contract Documents.

2.02 FORM MATERIALS

- A. Form-facing materials: Materials for form faces in contact with concrete must meet the requirements of "Concrete Finishing" set forth in Technical Specifications Section 03 30 00, Cast-in-Place Concrete and the following requirements, unless otherwise specified in Contract Documents.

1. For smooth-form finish, use plywood, tempered concrete-form-grade hardboard, metal, plastic, paper, or other acceptable materials capable of producing the desired finish for form-facing materials. Form-facing materials must produce a smooth, uniform texture on the concrete. Do not use form-facing materials with raised grain, torn surfaces, worn edges, dents, or other defects that will impair the texture of concrete surfaces. Facing materials must be supported with studs or other backing capable of maintaining deflections within the tolerances specified in Part 2, Paragraph 2.01 of this Technical Specifications section.

2.03 FORMWORK ACCESSORIES

- A. Use commercially manufactured accessories for formwork accessories that are partially or wholly embedded in concrete, including ties and hangers. Do not use nonfabricated wire form ties. Where indicated in the Contract Documents, use form ties with integral water barrier plates in walls or other acceptable positive water barriers.

2.04 FORMWORK RELEASE AGENT

- A. Use commercially manufactured formwork release agents that prevent formwork absorption of moisture, prevent bond with concrete, and do not stain the concrete surfaces.

2.05 EXPANSION JOINT FILLER

- A. Pre-molded expansion joint filler must conform to ASTM D994 or ASTM D1751.

2.06 FABRICATION AND MANUFACTURE

- A. Formwork must be tight to prevent loss of mortar from concrete.
- B. Place 3/4 inch chamfer strips in the corners of formwork to produce beveled edges on permanently exposed surfaces unless otherwise specified. Do not bevel reentrant corners or edges of formed joints of concrete unless specified in the Contract Documents.
- C. Inspect formwork and remove deleterious material immediately before concrete is placed. Provide temporary openings where needed at the base of column and wall formwork to facilitate cleaning and inspection.
- D. Fabricate form ties so ends or end fasteners can be removed with minimum spalling at the faces of concrete.

PART 3 - EXECUTION

3.01 EARTH FORMS

- A. Where sides of excavations have been cut neat and accurate to size for pouring of concrete directly against the excavation, forms for footings will not be required. Remove loose soil prior to placing concrete.

3.02 CONSTRUCTION AND ERECTION OF FORMWORK

- A. At construction joints, lap contact surface of the form sheathing for flush surfaces exposed to view over the hardened concrete in the previous placement. Ensure formwork is sealed against hardened concrete to prevent offsets or loss of mortar at construction joints and to maintain a true surface.

- B. Provide positive means of adjustment (such as wedges or jacks) of shores and struts. Do not make adjustments in the formwork after concrete has reached its time of initial setting. Brace formwork securely against lateral deflection and lateral instability.
- C. Fasten form wedges in place after final adjustment of forms and before concrete placement.
- D. Anchor formwork to shores, supporting surfaces, or members to prevent upward or lateral movement of the formwork system during concrete placement. Form supports must be placed on adequate foundations and have sufficient strength and bracing to prevent settlement or distortion from the weight of the concrete or other cause. Support must rest on double wedged shim, or other approved means, so that the forms will be maintained at the proper grade.
- E. Provide runways for moving equipment and support runways directly on the formwork or structural member without resting on the reinforcing steel.
- F. All formed joints on concrete surfaces to be exposed must be taped and must align so joints will not be apparent on the concrete surfaces.
- G. Any movement or bellying of forms during construction must be considered just cause for their removal and, in addition, the concrete work so affected.
- H. Bolts, rods, or other approved devices must be used for internal form ties and must be of sufficient quantities to prevent spreading of the forms. Ties must be placed at least 1 inch away from the finished surface of the concrete. Bolts and rods that are to be completely withdrawn must be coated with grease.
- I. Boards or other form materials that have been damaged or checked or warped prior to placing of concrete must be removed from the forms and replaced with approved materials or otherwise corrected to the satisfaction of VTA.
- J. Keep watch on and maintain forms during placing of concrete. Remedy any displacement or looseness of forms or reinforcement before placing of concrete.

3.03 APPLICATION - FORM RELEASE AGENT

- A. Cover surfaces of formwork with an acceptable material that will prevent bond with the concrete. A field-applied formwork release agent or a factory-applied liner may be used. If a formwork release agent is used, apply to the surfaces of the formwork in accordance with the manufacturer's recommendations before placing reinforcing steel. Do not allow formwork release agent to puddle in the forms. Do not allow formwork release agent to contact reinforcing steel or hardened concrete against which fresh concrete is to be placed.

3.04 INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Position and support expansion joint materials, waterstops, and other embedded items to prevent displacement. Fill voids in sleeves, inserts, and anchor slots temporarily with readily removable material to prevent entry of concrete into voids.
- B. Place sleeves, inserts, anchors, and embedded items required for adjoining Work or for support of adjoining work before concrete placement. Holes, notches, conduits, pipes,

etc. are not allowed in concrete slabs, walls, members, etc. unless shown on the Contract Drawings.

3.05 FORM CLEANING

- A. Clean surfaces of formwork and embedded materials of mortar, grout, and foreign materials before concrete is placed.

3.06 FORMWORK TOLERANCES

- A. Unless otherwise specified in the Contract Documents, construct formwork so concrete surfaces conform to the tolerance limits of ACI 117.
- B. To maintain specified tolerances, camber formwork to compensate for anticipated deflections in formwork during concrete placement. Set formwork and intermediate screed strips for slabs accurately to produce designated elevations and contours of the finished surface before removal of formwork. Ensure that edge forms and screed strips are strong enough to support vibrating screeds or roller pipe screeds when the finish specified requires the use of such equipment.
- C. When formwork is cambered, set screeds to the same camber to maintain specified concrete thickness.

3.07 FORM REMOVAL

- A. Remove top forms on sloping surfaces of concrete as soon as removal will not allow concrete to sag. Perform needed repairs or treatment required at once and follow immediately with specified curing.
- B. Do not damage concrete during removal of formwork for columns, walls, slabs, sides of beams, and other parts not supporting the weight of the concrete. Perform needed repair and treatment required on vertical surfaces at once and follow immediately with specified curing.
- C. Leave formwork in place to support slabs for at least 10 days until concrete has attained 3000 psi minimum.
- D. In removing plywood forms, do not use metal pinch bars. Start at top edge or vertical corner where it is possible to insert wooden wedges. Wedging must be done gradually and shall be accompanied by light tapping of the plywood panels to crack them loose. Do not remove forms with a single jerk after it has been started at one end.

END OF SECTION 03 10 00

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SECTION 03 20 00 – CONCRETE REINFORCING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Reinforcing steel for concrete and masonry.
- B. Supports and accessories for steel reinforcement

1.02 RELATED REQUIREMENTS

- A. Technical Specifications Section 03 10 00, Concrete Forming and Accessories
- B. Technical Specifications Section 03 30 00, Cast-In-Place Concrete

1.03 REFERENCE STANDARDS

- A. American Concrete Institute (ACI):
 - 1. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.
 - 2. ACI 301 - Specifications for Structural Concrete for Buildings.
 - 3. ACI 318 - Building Code Requirements for Structural Concrete and Commentary..
 - 4. ACI SP-66 - ACI Detailing Manual.
- B. American Society of Testing Materials (ASTM):
 - 1. ASTM A1064 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - 2. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 3. ASTM A185 – Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
 - 4. ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 - 5. ASTM A 641 - Standard Specification for Galvanized Carbon Steel Wire.
 - 6. ASTM A706 - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
 - 7. ASTM A767 - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
 - 8. ASTM A775 - Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
 - 9. ASTM A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
 - 10. ASTM A884 - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.

11. ASTM A934 - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
 12. ASTM D3963 - Standard Specification for Fabrication and Jobsite Handling of Epoxy Coated Reinforcing Steel Bars.
 13. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.
- C. AWS D1.4 - Structural Welding Code - Reinforcing Steel; American Welding Society.
- D. CRSI (DA4) - Manual of Standard Practice; Concrete Reinforcing Steel Institute.

1.04 SUBMITTALS

- A. Submittal procedures must be in accordance with the applicable provisions of:
1. **Section 6.6 Contract Data Requirements**
 2. **Section 7.41 Product Options, Supplier Approval and Substitutions**
 3. **Section 7.43 Submittal of Shop Drawings, Product Data and Samples**
 4. **Section 7.49.1 Certificates of Compliance**
 5. Appendix B, Contract Data Requirements
- B. Shop Drawings (Placing drawings)
1. Comply with requirements of ACI SP-66. Show details for congested areas and connections.
- C. Product Data
1. Manufacturer's catalog sheets including instructions for use and description of application and ICC/IAPMO evaluation report for the following items:
 - a. Mechanical anchorage devices for splices.
- D. Mill Certificates
1. Mill Certificates for each size of bar for each heat to be used on project and certify that reinforcing steel supplied for this project meet or exceed specified requirements.
 2. Include name of mill, date of rolling, date of shipping to fabricator and must be signed by fabricator certifying that each material complies with or exceeds the specified requirements. A Mill Certificate must be furnished with each lot of material delivered to the project and the lot shall be clearly identified in the Mill Certificate.
 3. When Mill Certificates cannot be provided, engage a professional testing agency, at Contractor expense, to verify compliance and to provide laboratory test reports.

1.05 QUALITY ASSURANCE

- A. Perform Work of this section in accordance with the CBC ACI 301, ACI SP-66, ACI 318, and AWS D1.4, except as modified by the Contract Documents.
- B. Identify each lot of fabricated reinforcing steel to be shipped to the site by assigning an individual lot number that identifies steel by heat number and is tagged in such a manner that each such lot can be accurately identified at the Worksite.
- C. Remove all unidentified reinforcing steel, anchorage assemblies and bar couplers received at the Worksite.

1.06 STORAGE OF MATERIALS

- A. Store reinforcement during fabrication and at site to avoid excessive rusting or coating with grease, oil, soil, or other objectionable materials. Epoxy-coated and galvanized reinforcement must be handled and stored by methods that will not damage the coating. Bundles must not be dropped or dragged. Reinforcing steel must be transported and stored in a manner that will not damage any applied coating. Since the epoxy coating is flammable, the coated reinforcement must not be exposed to any fire or flame.

PART 2 - PRODUCTS

2.01 REINFORCING BARS

- A. Reinforcing Steel:
 - 1. Bars for reinforcement must conform to the requirements of ASTM A706, deformed low-alloy steel bars for these applications:
 - a. Horizontal Bars, Beams.
 - b. All Reinforcing Bars, Footings.
 - c. All Reinforcing Bars to be Welded.
 - 2. Bars for reinforcement not noted above must be deformed grade steel conforming to the requirements of ASTM A706 or A615, Grade 60.
 - 3. Uncoated steel unless noted otherwise.
 - 4. Galvanized in accordance with ASTM A767, Class II where required by Contract Documents chromate wash treated after fabrication and bending. Repair coating damage in accordance with ASTM A780.
 - 5. Epoxy coated in accordance with ASTM A775 or ASTM A934 where required by Contract Documents. Repair damaged areas with patching material conforming to ASTM A775.

2.02 WIRE

- A. All wire for concrete reinforcement must conform to ASTM A1064.

2.03 REINFORCEMENT ACCESSORIES

- A. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement. Reinforcement supports must conform to the requirements of ACI 301.

2.04 OTHER MATERIALS

- A. All other materials, not specifically described by these specifications but required for complete and proper placement of reinforcement shall be new, first quality of their respective kinds, and subject to the approval of VTA.

2.05 FABRICATION

- A. Perform welding in accordance with AWS D1.4. Do not weld crossing bars (tack welds) for assembly of reinforcement, supports, or embedded items. After completing welds on galvanized or epoxy-coated reinforcement, repair coating damage.
- B. Fabricate and handle epoxy-coated reinforcing in accordance with ASTM D3963. Coated reinforcement must not be field cut, unless permitted by VTA. Field cutting of coated reinforcement must be performed using hydraulic-powered or friction cutting tools to minimize coating damage and field touch-up. Flame cutting of coated reinforcement will not be permitted. Field cut coated reinforcement must be repaired immediately with compatible patching material/coating and suitable for repairs in the field per patching material/coating manufacturer's recommendation.

PART 3 - EXECUTION

3.01 EXISTING CONDITIONS

- A. Prior to commencing Work described in this section, carefully inspect the completed Work of other trades and verify that all Work is sufficiently complete to permit the start of Work under this section.
- B. In the event conduits, pipes, inserts, sleeves, or any other items interfere with placing the reinforcement as indicated on the Contract Drawings or approved shop drawings, immediately notify VTA and obtain approval on procedure before placement of reinforcement is started.

3.02 BENDING

- A. Bends for reinforcing steel must be made in accordance with ACI 301 and ACI 318. Do not field bend reinforcing steel in a manner that will damage material or cause the bars to be bent on too tight a radius. Do not straighten bent or kinked bars. Replace bent and kinked bars.

3.03 PLACING

- A. Place all reinforcement in strict conformance with the requirements of the Contract Drawings, both as to location, position and spacing of members. Support and secure against displacement by the use of adequate and proper wire supporting and spacing devices, tie wires, etc. so that reinforcement remains in its proper position in the finished structure. Reinforcement may not be wet set in concrete pours.

- B. Tolerances: Do not exceed the placing tolerances specified in ACI 318 and ACI 117, whichever is more stringent, before concrete is placed. Placing tolerances must not reduce cover requirements except as specified in ACI 117.
- C. Minimum concrete cover for reinforcement and couplers must be as indicated in the Contract Drawings. Concrete cover is measured from the theoretical excavation line, not the line of any over excavation. Where less than 3 inches cover is noted and concrete will be placed against soil, increase the section thickness to attain 3 inches cover.
- D. Preserve clear space between parallel bars of not less than 1-1/2 times the nominal diameter of round bars and in no case let the clear distance be less than 1-1/2 inches nor less than 1-1/3 times the maximum size of aggregate for concrete. Bars placed in shotcrete shall have a minimum clearance between bars of 2-1/2 inches for No. 5 and smaller and 6 bar diameters for bars larger than No. 5. When two curtains of steel are provided in shotcrete wall, the curtain nearer the nozzle must have a minimum spacing equal to 12 bar diameters and the remaining curtain shall have a minimum spacing of six bar diameters.
- E. Use templates for placement of column dowels unless otherwise permitted by VTA.
- F. Lap splices must be contact lap splices in accordance with ACI 318, unless noted otherwise on the Contract Drawings. Bars must be wired together at laps. Wherever possible, stagger splices in adjacent bars. Splice bars in members such as spandrels, beams, etc, as follows: Top bars at centerline of span, bottom bars at the support. Make all splices in welded wire reinforcement at least 1-1/2 meshes wide or 12 inches, whichever is greater. When splicing in areas to receive shotcrete, lap splices must be non-contact with at least 2 inches clearance between bars.
- G. Butt splices must be accomplished by mechanical anchorage devices. Stagger these devices 2 feet, unless noted otherwise on the Contract Documents.
- H. Bars must not be cut by gas torch.

3.04 CLEANING REINFORCEMENT

- A. Take all means necessary to ensure that steel reinforcement, at the time concrete is placed around it, is completely free from rust, soil, loose mill scale, oil, paint and all coatings which will destroy or reduce the bond between steel and concrete.

END OF SECTION 03 20 00

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SECTION 03 30 00 – CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Cast-in-place structural concrete.

1.02 RELATED REQUIREMENTS

- A. Technical Specifications Section 03 10 00, Concrete Forming and Accessories
- B. Technical Specifications Section 03 20 00, Concrete Reinforcing
- C. Division 23 and Division 26 of the Technical Specification for fueling and electrical items for casting into concrete.
- D. Technical Specifications Section 31 23 16, Structural Excavation/Earthwork
- E. Technical Specifications Section 31 23 23, Structural Fill

1.03 REFERENCE STANDARDS

- A. American Concrete Institute (ACI):
 - 1. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.
 - 2. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
 - 3. ACI 301 - Specifications for Structural Concrete for Buildings.
 - 4. ACI 302.1R - Guide for Concrete Floor and Slab Construction.
 - 5. ACI 306.1 - Cold Weather Concreting.
 - 6. ACI 308R - Guide to Curing Concrete.
 - 7. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.
- B. American Society of Testing Materials (ASTM):
 - 1. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
 - 2. ASTM C33 - Standard Specification for Concrete Aggregates.
 - 3. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - 4. ASTM C42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

5. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
6. ASTM C143 - Standard Test Method for Slump of Hydraulic-Cement Concrete.
7. ASTM C150 - Standard Specification for Portland Cement.
8. ASTM C157 - Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
9. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.
10. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
11. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
12. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
13. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.
14. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
15. ASTM C567 - Standard Test Method for Determining Density of Structural Lightweight Concrete.
16. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
17. ASTM C881 - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
18. ASTM C 979 - Standard Specification for Pigments for Integrally Colored Concrete.
19. ASTM C1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
20. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
21. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete.
22. ASTM C1218 - Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.

23. ASTM C1602 - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
24. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
25. ASTM D4832 - Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders.
26. ASTM E1155 - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers.

1.04 QUALITY ASSURANCE

- A. Comply with the provisions of the current governing California Building Code, ACI 301, and ASTM C94 except where more stringent requirements are shown or specified in the Contract Documents.
- B. Sampling, Testing and Inspection:
 1. General:
 - a. Engage a testing agency, at Contractor expense, to perform inspection and field quality control testing. Testing agencies must meet the requirements of ASTM C1077. Submit testing agency qualifications to VTA for approval prior to commencing Work.
 - b. Cooperate with and notify VTA at least 24 hours in advance of inspection required and provide all samples and facilities required for inspection.

1.05 SUBMITTALS

- A. Submittal procedures must be in accordance with the applicable provisions of:
 1. **Section 6.6 Contract Data Requirements**
 2. **Section 7.41 Product Options, Supplier Approval and Substitutions**
 3. **Section 7.43 Submittal of Shop Drawings, Product Data and Samples**
 4. **Section 7.49.1 Certificates of Compliance**
 5. Appendix B, Contract Data Requirements
- B. Product Data
 1. Manufacturer's catalog sheets including instructions for use and description of application must be provided on each of the following materials:
 - a. Epoxies
 - b. Grout
 - c. Admixtures
 - d. Curing compounds
 - e. Chemical hardener

- f. Adhesive anchoring system
- C. Mix Designs
 - 1. Submit for each class of concrete. Show names and brands of all materials, proportions, slump, strength, gradation of coarse and fine aggregates, and location to be used on job. Field test records or test data that is used to establish the average compressive strength of the mixture must be submitted.
- D. Concrete Placement Schedule: Show all proposed construction joint locations, limits of each placement sequence, order of placement and type of joint proposed at each joint location.
- E. Samples: Select samples to fairly represent average quality and grading of aggregates proposed for the Work.
- F. Certificates of Compliance
 - 1. Provide Certificate of compliance for each type of aggregate, cementitious material and admixture to be used in each class of concrete or a Certificate of compliance for each class of concrete.
 - 2. Certificates of compliance for cementitious materials must include type, manufacturing location, shipping location; for aggregates: type, pit or quarry location, producers' name, grading, specific gravities and certification evidence not more than 90 days old; for admixtures: type, brand name, producer, manufacturer's technical data sheet, and certification data; and for water: source of supply that are used in each class of concrete and must be signed by the concrete supplier certifying that each material item complies with, or exceeds the specified requirements. Furnish Certificates of Compliance 60 days in advance of any concrete pours.
 - 3. When certificates of compliance cannot be provided, engage a professional testing agency, at Contractor expense, to verify compliance of each type of material to be used in each class of concrete.
 - 4. Certificate of compliance for the vapor retarder/barrier material. When a certificate of compliance cannot be provided, laboratory test reports must be provided. The cost of testing must be paid for by Contractor.
 - 5. Certificates of compliance for vapor retarder/barrier shall include the name, and description of the product and must state that the product complies with ASTM E1745 and ASTM E154.
- G. Inspection and testing agency qualifications.
- H. Field quality control tests and inspection reports.
- I. Weight and Batch Tags:
 - 1. Provide a weight and batch tag upon delivery of each load of concrete. The batch tag must show weight of all materials.
 - a. Each mix design must be verified by trial batch tests or field test records and certified to by a principal of a testing agency who is a registered Civil

or Structural Engineer in the State of California Agency field test records, in order to be acceptable, must satisfy the requirement of ACI 318 section 5.3 otherwise trial mixture meeting the requirements of ACI 318 section 5.3 shall be made. Submit data on qualifications of proposed testing agency for acceptance and hire the accepted testing agency to provide trial mixture test data for each type of concrete on the worksite.

1.06 SEQUENCING AND SCHEDULING

- A. Obtain information and instructions from other trades and suppliers in ample time to schedule and coordinate the installation of items furnished by them to be embedded in concrete so provision for their work can be made without delaying the project.
- B. Perform any coring and infill of cored holes that were required by failed test results from test panels, failure or delay in complying with these requirements, at no cost to VTA.

PART 2 - PRODUCTS

2.01 FORMWORK

- A. Comply with requirements of Technical Specifications Section 03 10 00, Concrete Forming and Accessories.

2.02 REINFORCEMENT

- A. Comply with requirements of Technical Specifications Section 03 20 00, Concrete Reinforcing.

2.03 CEMENTITIOUS MATERIALS

- A. Portland Cement: ASTM C150, Type II.
- B. Fly Ash: ASTM C618, Class F or Class C.
 - 1. Fly ash may substitute for portland cement up to a maximum of 25% of total cementitious materials by weight (fly ash, if used, must substitute for 15% of the total cementitious materials by weight, minimum).
 - a. Substitutions that combine fly ash and ground granulated blast-furnace slag are limited to a combined total of 50% of the total cementitious material by weight with fly ash no more than 25% of the total cementitious materials by weight.
 - b. Reduce slag and fly ash substitution rates by at least 50% for cold weather concreting as defined in ACI 306.1.
- C. Ground-granulated Blast-furnace Slag: ASTM C989 grades 100 or 120
 - 1. Ground-granulated Blast-furnace Slag may substitute for portland cement up to a maximum of 50% of the total cementitious material by weight.
- D. Use cementitious materials that are of the same brand and type and from the same plant of manufacture as the cementitious materials used in the concrete represented by the submitted field test records or used in the trial mixtures.
- E. Color Additives: ASTM C979, synthetic or natural mineral-oxide pigments or liquid coloring admixtures, temperature stable and nonfading.

- F. Fiber Reinforcement: Synthetic Fiber; fibrillated polypropylene fibers designed for use in concrete, complying with ASTM C1116, Type III, 1/2 inch to 1-1/2 inch in length.

2.04 AGGREGATES

- A. Aggregates for hardrock concrete must conform to ASTM C33.
- B. Lightweight Aggregate: ASTM C330.
- C. Aggregates used for entire project must be obtained from the same sources and have the same size ranges as the aggregates used in the concrete represented by submitted historical data or used in trial mixtures.

2.05 WATER

- A. Mixing water for concrete must be clean and free from deleterious amounts of chlorides, acids, alkalis, or organic materials.

2.06 CHEMICAL ADMIXTURES

- A. Do not use chemicals that contain calcium chloride or will result in total soluble chloride ions in hardened concrete at ages from 28 to 42 days contributed from water, aggregates, cementitious materials, and admixtures in excess of 0.30 percent by weight of cement for reinforced concrete and 0.06 percent by weight of cement for prestressed concrete. Measure water-soluble chloride-ion content in accordance with ASTM C1218. Admixtures containing chloride salts must not be used where concrete is poured on top of the metal deck. Calcium chloride or any admixture containing chloride ions must not be used in drilled piers.
- B. Air Entrainment Admixture: ASTM C260.
 - 1. Manufacturer:
 - a. Sika Aer; Sika Corporation.
 - b. MB-VR or MB-AE; Master Builders.
 - c. Darex AEA; W.R. Grace.
 - d. Or equal.
- C. High Range Water Reducing and Retarding Admixture: ASTM C 494 Type G.
- D. High Range Water Reducing Admixture (Super Plasticizer): ASTM C494 Type F.
 - 1. Manufacturer:
 - a. WRDA19; W.R. Grace.
 - b. Sikament; Sika Chemical Corporation.
 - c. Pozzolith 400; Master Builders.
 - d. Or equal.
- E. Water Reducing and Retarding Admixture: ASTM C494 Type D.
 - 1. Manufacturer:
 - a. Pozzolith 300-R; Master Builders.
 - b. Daratard; W.R. Grace.
 - c. Plastiment; Sika Chemical Corporation.

- d. Or equal.
- F. Water Reducing Admixture: ASTM C494 Type A.
 - 1. Manufacturer:
 - a. Eucon WR-75; Euclid Chemical Company.
 - b. Pozzolith 344; Master Builders.
 - c. Plastocrete 160; Sika Chemical Corporation.
 - d. Or equal.
- G. Admixtures used in concrete must be the same as those used in the concrete represented by the submitted field test records or used in the trial mixtures.

2.07 ACCESSORY MATERIALS

- A. Non-Shrink Grout:
 - 1. ASTM C1107 Grade B or C, pre-mixed, high strength, Metallic or non-metallic flowable grout, which does not shrink as it cures. Water-soluble chloride ion content of grout less than 0.06 percent chloride ion by weight of cement when tested in accordance with ATM C1218.
 - a. Minimum Compressive Strength at 7 Days: 5000 psi.
 - b. Subject to compliance with requirements provide one of the following:
 - 1) Metallic
 - 2) Non-metallic
- B. Expansive Grout:
 - 1. Expansive grout must be composed of cement, sand, water and intraplast-N expanding grouting aid (manufactured by Sika). Expansive grout must be proportioned and installed in accordance with intraplast-N recommendations and must develop a minimum compressive strength of 3000 psi in 28 days.
- C. Post-Installed Anchoring Systems:
 - 1. Adhesive anchoring system
 - a. Adhesive anchoring system must be HILTI-HY 200 (ESR-3187) or equal, with a current ICC/IAPMO evaluation report.
 - 2. Expansion anchors and screw anchors
 - a. Expansion anchors must be HILTI KWIK BOLT TZ SS 304 (ESR-1917), or equal, with a current ICC/IAPMO evaluation report. Screw anchors must be Simpson Stainless Steel Titen HD (ESR-2713) or equal, with a current ICC/IAPMO evaluation report.
 - 3. Inserts
 - a. HILTI HIS-N Inserts (ESR-3187): ASTM A193 Grade B7 cap bolts and ASTM A194 nut, galvanized per ASTM A153 Class C or D.

- b. HILTI HIS-RN Inserts (ESR-3187): ASTM A193 Grade B8M stainless steel bolts and ASTM F594 nut. Nuts must be the same alloy group as the bolt.
- D. Cast-In-Place Anchors:
 - 1. Anchor Rods and Nuts: ASTM F1554 Grade 36 Class 2A (Grade 105 Class 2A where High Strength is noted) with matching finish ASTM A563 nuts. Rods embedded in concrete, grout, or adhesive must be galvanized unless noted otherwise. Embedded rods must be threaded full length unless noted otherwise.

2.08 BONDING AND JOINTING PRODUCTS

- A. Epoxy Bonding System: Epoxies must be a two component material for use on dry or damp surfaces and shall conform to the requirements of ASTM C881. Epoxy bonding agents and adhesives must be used in strict accordance with manufacturer's recommendations.
 - 1. Manufacturer:
 - a. Sikadur Armatec 110; Sika Chemical Corporation.
 - b. Or equal.
- B. Waterstops: Rubber, complying with COE CRD-C513.
 - 1. Manufacturer:
 - a. The Burke Company
 - b. Progress Unlimited
 - c. Williams Products
 - d. Edoco Technical Products
 - e. Or equal.
- C. Joint Filler: 1/2 inch thick unless otherwise noted on the Contract Drawings, with removable top section that will form 1/2 inch deep sealant pocket after removal.

2.09 CURING MATERIALS

- A. Curing Compound, Naturally Dissipating: Clear, water-based, liquid membrane-forming compound, that dissipates within 3 to 5 weeks; complying with ASTM C309.
- B. Curing and Sealing Compound, Low Gloss: Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C1315 Type 1 Class A.
- C. Curing and Sealing Compound, High Gloss: Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C1315 Type 1 Class A.
- D. Moisture-Retaining Sheet: ASTM C171.

2.10 CONCRETE MIX DESIGN

- A. Admixtures: Where admixtures are used they must be added as recommended in ACI 211.1 for normal weight concrete and at rates recommended by manufacturer. Admixtures are subject to VTA review.
- B. Fiber Reinforcement: Add to mix at rate of 1.5 pounds per cubic yard, or as recommended by manufacturer for specific project conditions.

C. Normal Weight Concrete Mix Requirements:

1. Shall be made with aggregates for hardrock concrete.
2. Minimum Compressive Strength, f'_c , when tested in accordance with ASTM C39 at 28 days: As scheduled below.
3. Minimum Cementitious Material Content:
 - a. For concrete ($f'_c = 3000$ psi and greater) used in floors and slab-on-grades, cementitious material content must not be less than indicated in the following table:

Nominal maximum Size of aggregate, in.	Minimum cementitious material content, sacks
1.5	5
1	5.5
3/4	6
1/2	6.5
 - b. For placing concrete under water, cementitious material content must not be less than 7 sacks per cy.
4. Maximum Water-Cement Ratio: As scheduled below. Significant volume of liquid admixtures must be considered as part of the mixing water.
5. Maximum Aggregate Size: Nominal maximum size of coarse aggregate must not exceed three-fourths of the minimum clear spacing between reinforcing bars, one-fifth of the narrowest dimension between sides of forms, or one-third of the thickness of slabs or toppings.

Concrete Class	Minimum 28-day Compressive Strength f'_c	Maximum Water/Cementitious Material Ratio	
		Non-Air Entrained	Air Entrained
Class D	3000 psi	0.55	0.55
Class F	2000 psi	0.67	0.62
Lean Concrete (CLSM)	300 psi		

D. Controlled Low Strength Material (CLSM) Mix Requirements:

1. Must be made with aggregates conforming to ASTM C33.
2. Minimum Compressive Strength, f'_c , when tested in accordance with ASTM D4832 at 28 days: As scheduled above.
3. Minimum Cement Content: 2 sacks.
4. Maximum Water-Cement Ratio: Sufficient to produce a fluid workable mixture without segregation of the aggregate when placed.

- E. Concrete Mix Designs: The following table presents a schedule of classes of concrete, maximum aggregate, maximum slump and air content for each type of concrete, which must be as follows:

Concrete Element	Class of Concrete	Max. Size Aggregate	Max. Slump (inch) at point of discharge
Foundation Walls and footings	D	1.5	3
Slabs on Grade	D	1	4
Structural Backfill	Lean	1.5	6
Yard Concrete Walks & Curbs	F	3/4	4

- F. Determine the slump by ASTM C143 at the point of truck discharge. Slump must not exceed 3" for any concrete placement where top of surface slopes more than 2%. When use of a Type I or II plasticizing admixture conforming to ASTM C1017 or when a Type F or G high-range water-reducing admixture conforming to ASTM C494 is permitted to increase the slump of concrete, concrete shall have a slump of 2 to 4 in. before the admixture is added and a maximum slump of 8 in. at the point of truck discharge after the admixture is added unless otherwise specified.
- G. Add an air entraining agent to the concrete to provide specified amounts of entrained air per table below unless noted otherwise. Measure air content at the point of delivery in accordance with ASTM C173. Tolerance is plus/minus 1.5%. For specified compressive strengths above 5000 psi, the air contents indicated in the following table may be reduced by 1%.

Nominal maximum aggregate size, inches	Air content, percent	
	Exposure Class F1	Exposure Classes F2 and F3
3/8	6	7.5
1/2	5.5	7
3/4	5	6
1	4.5	6
1.5	4.5	5.5

- H. Concrete not within the specified limits of air-entrainment, slump and temperature must not be used in the Work.

2.11 MIXING

- A. Use ready-mixed concrete complying with ASTM C94 and with the requirements of the Contract Documents. Mix for a period of not less than ten (10) minutes; at least three (3) minutes of the mixing period must occur immediately prior to discharging at the Worksite.
- B. CLSM must be placed within 3 hours after introduction of the cement to the aggregates.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify lines, levels, and dimensions before proceeding with Work of this section.

3.02 PREPARATION

- A. Vapor retarder/barrier Installation Requirement: Install vapor retarder/barrier under interior slabs on grade where required by Contract Drawings in accordance with manufacturer's instructions and ASTM E1643.

3.03 WEATHER REQUIREMENTS

- A. Reinforcement, forms, and ground which concrete will contact must be completely free of frost.
- B. When the average of the highest and lowest temperature during the period from midnight to midnight is expected to drop below 40° F for more than three successive days, deliver concrete to meet the following minimum temperatures immediately after placement:
 - 1. 55° F for sections less than 12 in. in the least dimension;
 - 2. 50° F for sections 12 to 36 in. in the least dimension;
 - 3. 45° F for sections 36 to 72 in. in the least dimension; and
 - 4. 40° F for sections greater than 72 in. in the least dimension.

The temperature of concrete as placed must not exceed these values by more than 20° F. These minimum requirements may be terminated when temperatures above 50° F occur during more than half of any 24 hour duration.

- C. The temperature of concrete as placed must not exceed 90° F. When temperature of steel reinforcement, embedments, or forms is greater than 120° F, fog steel reinforcement, embedments, and forms with water immediately before placing concrete. Remove standing water before placing concrete.
- D. Do not begin to place or continue to place concrete while rain, sleet, or snow is falling unless adequate protection is provided and, when required, acceptance of protection is obtained. Do not allow rain water to increase mixing water or to damage the surface of the concrete.

3.04 CONVEYING AND PLACING CONCRETE

- A. All concrete must be mixed, delivered and discharged in accordance with the requirements of ASTM C94. All concrete must be placed, finished and cured and all other pertinent construction practices must be in accordance with the requirements of ACI 301.
- B. Notify VTA not less than 48 hours prior to commencement of placement operations.
- C. Before placing, clean mixing and conveying equipment, clean forms and space to be occupied by concrete and wet forms. Remove ground water until completion of Work.
- D. Place no concrete in any unit of Work until all formwork has been completely constructed, all reinforcements secured in place, all items to be built into concrete are in place, and

form ties at construction joints tightened and all preparation have been checked by the Inspector. A placing record must be kept on the Worksite of the time and date of placing the concrete in each portion of the structure until the completion of the structure and must be open to the Inspector.

- E. Slabs and beams must not be subjected to occupant or storage loads exceeding 20 psf until specified strength is reached (28 days minimum).
- F. Place concrete so that a uniform appearance of surfaces will be obtained. Concrete must be free of all rock pockets, honeycombs and voids.
- G. The subgrade must be moist when the concrete is placed for floor slab to prevent excessive loss of water from the concrete mix.
- H. Pumping of concrete may require admixtures to increase slump beyond the maximum slump listed. Admixtures are subject to VTA's review and approval.
- I. Carry on concreting, once started, as a continuous operation until the section of approved size and shape is completed. Make pour cut-offs of approved detail and location.
- J. Handle concrete as rapidly as practicable from mixer to place of deposit by methods which prevent separation or loss of ingredients. Deposit as nearly as practicable in final position to avoid rehandling or flowing. Do not drop concrete freely where reinforcing bars will cause segregation, impact the soil face of excavations nor drop freely more than eight feet. Use hoppers, chutes or trunks of varying length so that the free unconfined fall of concrete shall not exceed eight feet. Deposit to maintain a plastic surface approximately horizontal. In walls, deposit in horizontal layers not over eighteen inches deep. In pouring columns, walls or thin sections of considerable heights, use openings in forms, elephant trunks, tremies or other approved devices which permit concrete to be placed without segregation or accumulation of hardened concrete on forms or metal reinforcement above the level of the concrete. Install so concrete will be dropped vertically.
- K. Consolidating: All concrete must be placed with mechanical vibration unless noted otherwise. Employ as many vibrators and tampers as necessary to secure the desired results. Minimum: one per each 20 cubic yards of concrete placed per hour. Eliminate the following practices: Pushing of concrete with vibrator; external vibration of forms; allowing vibrator to vibrate against reinforcing steel where steel projects into green concrete; allowing vibrator to vibrate contact faces of forms. Vibrators must function at a minimum frequency of 3600 cycles per minute when submerged in concrete. Supplement vibration by forking and spading along the surfaces of the forms and between reinforcing whenever flow is restricted. Drilled piers must be vibrated only to a depth of 3 times the pier diameter measured from the top of pier.
- L. Cylindrical Concrete Specimens: Mold cylinders in accordance with ASTM C31, and cure them under the same conditions for moisture and temperature as used for the concrete they represent.

3.05 SLAB JOINTING

- A. Saw Cut Control Joints: Saw cut joints with the Soff-Cut system or approved equal as soon as the surface is firm enough so that it will not be damaged by the blade, usually within 2

to 4 hours after placing; use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab.

3.06 FLOOR FLATNESS AND LEVELNESS TOLERANCES

- A. Maximum Variation of Surface Flatness
 - 1. 1/4 inch in 10 ft in accordance with the "10-ft straight edge method" in ACI 117.
 - 2. Correct the slab surface if minimum 10% of the data samples are greater than 1/4 inch or if some data are not less than 3/8 inch.

3.07 CONSTRUCTION JOINTS

- A. Location and details of construction joints must be as indicated on Contract Drawings, specified, or as approved by VTA. Locate so as not to impair the strength of the structure.
- B. Sandblast all construction joints using coarse sand or waterblast to clean and roughen entire surface of joint to 1/4 inch amplitude at all construction joints unless noted otherwise, exposing coarse aggregate solidly embedded in mortar matrix uniformly. Clean forms and reinforcing of drippings. Clear away debris by compressed air.

3.08 CONCRETE FINISHING

- A. Finishing Formed Surfaces: Finish per requirements of ACI 301.
 - 1. Use grout-cleaned finish for permanently exposed formed surfaces except foundation surfaces and smooth-rubbed finish for exposed foundation surfaces.
- B. Finishing Unformed Surfaces: Steel trowel finish. Start finishing after bleeding of concrete is finished. The presence of bleed water is detected visually but when concrete surface is getting dry fast and rate of evaporation is so high, place a clear plastic sheet over a section of the concrete to block evaporation and to allow observation of bleeding.
- C. Measure slabs-on-ground to verify compliance with the tolerance requirements of ACI 117 as specified below:
 - 1. 1/4 inch in 10 ft in accordance with the "10-ft straight edge method" in ACI 117.

3.09 CURING AND PROTECTION

- A. Comply with requirements of ACI 301. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at above 50° F for the period of time necessary for hydration of cement and hardening of concrete.
 - 1. Normal concrete: At least the first 7 days after placement.
 - 2. High early strength concrete: At least the first 3 days after placement.
- C. Curing methods must comply with ACI 308R.
- D. Curing compounds conforming to ASTM C309 or ASTM C1315 must be applied in accordance with the recommendations of the manufacturer and must not be used on any surface against which additional concrete or other cementitious finishing materials are to be bonded, where epoxy flooring is called for, where concrete topping is to receive

waterproofing membrane, where not recommended by integral color maker, nor on surfaces where such curing is prohibited by the project specifications.

- E. Unformed concrete surfaces: Start curing as soon as the bleed water sheen has disappeared and before surface is dry.
 - 1. Initial Curing: If surface drying starts before initial set of concrete, keep concrete continuously moist up to final set of concrete by fog spray. Time of initial set is also known as the vibration limit where concrete cannot be properly consolidated after reaching initial set. Before initial set, the concrete is not stiff enough to support the weight of a finisher or finishing machine. Water from fogging should be removed or allowed to evaporate before finishing.
 - 2. Final Curing: Begin immediately after finishing. If finishing is completed but concrete has not reached final set, keep concrete continuously moist by fog spray, a liquid-applied evaporation reducer spray, or liquid membrane-forming curing compound spray. Water from fogging should be removed or allowed to evaporate before finishing. After final set of concrete, curing must be accomplished by one of the following materials or methods:
 - a. Ponding, continuous fogging, or continuous sprinkling;
 - b. Application of a curing compound.
 - c. Application of mats or fabric kept continuously wet.
 - d. Application of moisture-retaining sheet conforming to ASTM C171.
 - e. Other moisture-retaining covering as reviewed by VTA.
- F. Formed concrete surfaces: Steel forms and all wood forms in contact with the concrete shall be kept wet until they are removed. After formwork removal cure concrete by one of the method in final curing.
- G. Remove protection in such a manner that the maximum decrease in temperature measured at the surface of the concrete in a 24 hr period must not exceed the following:
 - 1. 50° F for sections less than 12 in. in the least dimension;
 - 2. 40° F for sections from 12 to 36 in. in the least dimension;
 - 3. 30° F for sections 36 to 72 in. in the least dimension; or
 - 4. 20° F for sections greater than 72 in. in the least dimension.
- H. Measure concrete temperature using a method acceptable to VTA, and record the concrete temperature. When the surface temperature of the concrete is within 20° F of the ambient or surrounding temperature, protection measures may be removed.

3.10 PATCHING AND CLEANING

- A. After forms are removed, remove projecting fins, form ties, nails, etc. not necessary for the work or cut back one inch from the surface. Joint marks and fins in exposed Work must be smoothed off and cleaned as directed by VTA.
- B. Repair defects in concrete work as directed by VTA and per ACI 301. Chip voids and stone pockets to a depth of one inch or more as required to remove all unsound material. Voids,

surface irregularities, chipped areas, etc., must be filled by patching, gunite or rubbing, as directed by VTA. Repaired surfaces must duplicate appearance of unpatched work.

- C. Clean exposed concrete surfaces and adjoining work stained by leakage of concrete to approval of VTA.

3.11 CLEANUP

- A. Clean up all concrete and cement work on completion of this portion of the Work, except protective coatings or building papers must remain until floors have completely cured or until interior partitions are to be installed.

3.12 GROUTING

- A. Column base plates: Grout must be mixed and placed in strict accordance with manufacturer's instructions. Care must be taken in the grouting to ensure that there are no voids or air pockets, and that there is full bearing between the base plates and the grout.
- B. Bearing plates and channels: The space between plates and channels bearing against masonry or concrete shall be filled with grout when required by VTA. The grout must be mixed and placed in strict accordance with manufacturer's instructions. Care must be taken in the grouting to ensure that there are no voids or air pockets, and that there is full bearing between the bearing plates and channels and the grout.

3.13 POST INSTALLED ANCHORS

- A. Anchor minimum edge distances defined by the current ICC/IAPMO evaluation report must be met at edges, control joints and cracks greater than 0.015 inches wide. Installation of anchors and adhesive including drilling, cleaning of holes and torque must be in accordance with the current ICC/IAPMO evaluation report. Verify whether the evaluation report requires a maximum or minimum torque. Confirm torque with a torque wrench calibrated to the inspector's torque wrench. Post installed anchors must be used only in applications permitted by the Evaluation Report. Anchors must use washer sized to prevent crushing of the attached member at installation torque.
- B. Provide stainless steel anchors at all locations.
- C. If reinforcement is encountered during drilling, abandon and shift the hole location to avoid the reinforcement. Provide a minimum of 2 anchor diameters or 1 inch, whichever is larger, of sound concrete between the anchor and the abandoned hole. Fill the abandoned hole with non-shrink grout. If the anchor or dowel may not be shifted as noted above, VTA will determine a new location.
- D. Adhesive Anchors:
 - 1. Adhesive anchoring system in concrete: HILTI-HY 200 (ESR-3187) or approved equal with a current ICC/IAPMO evaluation report.
 - 2. Insert the anchor or dowel in the hole with a twisting motion to the required embedment depth. Do not pump the anchor or dowel in and out of the hole.
 - 3. Wedge bars tight and centered in the hole with wooden wedges (golf tees) to hold it in place until the adhesive sets.

- E. Expansion Anchors:
 - 1. Install per the ICC/IAPMO report to the nominal embedment depth shown on the plans. Tightening of the anchor must not reduce the embedment below that specified on the plans by more than eight threads. Projecting portions of the anchor must not be cut off before inspection is complete.
 - 2. Expansion anchors: HILTI KWIK BOLT-TZ SS 304 (ESR-1917), or approved equal with a current ICC/IAPMO evaluation report

3.14 FIELD QUALITY CONTROL

- A. Testing agency, at Contractor's expense, will perform inspection and field quality control testing as indicated herein.
- B. Inspect the surfaces between plates and channels bearing on masonry and concrete to determine if grouting of space is necessary. If grouting of space is necessary, testing agency must inspect the grouting procedure.
- C. Acceptance of concrete strength must be in accordance with ACI 318 section 5.3.
- D. Test concrete cylinders in accordance with ASTM C39. If the strength of field-cured cylinders is less than 85% of companion laboratory-cured cylinders, provide corrective procedures for protecting and curing in-place concrete.
- E. Refer to Sheet S0.0 of the Contract Drawings for additional inspection and testing requirements, to be performed at Contractor's expense.
- F. Laboratory test reports must be signed by a principal of the testing agency who is a registered Civil Engineer in the State of California.
- G. Additional Tests: If test results indicate that specified concrete strengths and other characteristics have not been attained, or if deficiencies in protection and curing of concrete have occurred, Contractor will perform additional testing, at Contractor's expense. Contractor shall pay for all additional concrete testing and the cost of repairing areas damaged as a result of additional testing.

3.15 DEFECTIVE CONCRETE

- A. General: Work considered to be defective may be ordered by VTA to be replaced in which case Contractor must remove the defective work at his expense. To be considered defective, Work must include, but not be limited to, the following:
 - 1. Concrete in which defective or inadequate reinforcing steel has been placed.
 - 2. Concrete in incorrectly formed, or not conforming to details and dimensions on the drawings or with the intent of these documents, or concrete the surfaces of which are out of plumb or level.
 - 3. Concrete below specified strength.
 - 4. Concrete not meeting the maximum allowable drying shrinkage requirements.
 - 5. Concrete containing wood, cloth, or other foreign matter, rock pockets, voids, honeycombs, cracks or cold joints not scheduled or indicated on the drawings.

3.16 CORRECTION OF DEFECTIVE WORK

- A. Contractor will, at his expense, perform all corrective measures, as directed by VTA.
- B. Concrete work containing rock pockets, voids, honeycombs, cracks or cold joints not scheduled or indicated on the drawings, shall be chipped out until all unconsolidated material is removed.
- C. Secure approval of chipped-out areas before patching. Patch in accordance with ACI 301.

3.17 CLOSEOUT DOCUMENTATION

- A. Prepare closeout documentation in accordance with Technical Specifications Section 01 77 00, Closeout Procedures, and Technical Specifications Section 01 78 39, Project Record Documents, to include the following:
 - 1. Field test and inspection reports.

END OF SECTION 03 30 00

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DIVISION 7 – THERMAL AND MOISTURE PROTECTION

SECTION 07 46 46 – FIBER-CEMENT SIDING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Fiber-cement siding, trim, metal flashing, and sealant.

1.02 RELATED SECTIONS

- A. Steel Studs: See Contract Drawings.

1.03 COORDINATION

- A. Coordinate siding installation with flashings and other adjoining construction to ensure proper sequencing.

1.04 SUBMITTALS

- A. Submittal procedures must be in accordance with the applicable provisions of:
 - 1. **Section 6.6 Contract Data Requirements**
 - 2. **Section 7.41 Product Options, Supplier Approval and Substitutions**
 - 3. **Section 7.43 Submittal of Shop Drawings, Product Data and Samples**
 - 4. **Section 7.49.1 Certificates of Compliance**
 - 5. Appendix B, Contract Data Requirements
- B. Product Data: For each type of product to be used, including installation instructions, storage and handling requirements, manufacturer's best practice guide, technical data sheet.
- C. Samples: For each product specified, two samples, minimum size 4 by 6 inches, representing actual product and pattern.
- D. Manufacturer's product warranty.

1.05 QUALITY ASSURANCE

- A. Manufacturer's product warranty for fiber-cement siding must be for a period of not less than thirty (30) years.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations: Obtain products, including related accessories, from single source from single manufacturer.

2.02 FIBER-CEMENT SIDING

- A. General: ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84.
 - 1. James Hardie "HardiePanel", or equal.

- B. Labeling: Provide fiber-cement siding that is tested and labeled according to ASTM C 1186 by a qualified testing agency acceptable to authorities having jurisdiction.
- C. Nominal Thickness: Not less than 5/16 inch.
- D. Panel Size: 4' wide by 10' tall.
- E. Panel Texture: Smooth.
- F. Finish: Factory primed with manufacturer's standard acrylic primer.

2.03 ACCESSORIES

- A. Siding Accessories, General: Provide edge trim, outside corner caps, and other items as recommended by siding manufacturer for building configuration.
- B. Trim: Provide fiber-cement trim where indicated on Drawings.
- C. Water Resistant Barrier: James Hardie "HardiWrap Weather Barrier", or equal.
- D. Framing: 6" x 20 GA galvanized metal stud.

2.04 FLASHING

- A. Flashing: 20 GA hot dipped zinc-coated galvanized sheet metal flashing where indicated on Drawings.

2.05 FASTENERS

- A. Ribbed bugle-head screws of sufficient length to penetrate a minimum of 1/4 inch, or three screw-threads, into substrate.

2.06 SEALANT

- A. Premium grade, high performance, paintable, polyurethane based, non-sag elastomeric sealant complying with ASTM C920 Grade NS, Class 25 or higher.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of fiber-cement panels and related accessories.

3.02 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.

3.03 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
 - 1. Do not install damaged components.
 - 2. Install fasteners no more than 24 inches on-center.
 - 3. Install joint sealants to produce a weathertight installation.
- B. Painting: Paint all exposed fiber cement siding, flashing, sealant and trim in accordance with Technical Specifications Section 09 91 23, Painting.

1. Prime all field cut edges prior to installation.

3.04 ADJUSTING AND CLEANING

- A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.
- B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

3.05 CLOSEOUT DOCUMENTATION

- A. Prepare closeout documentation in accordance with Technical Specifications Section 01 77 00, Closeout Procedures, and Section 01 78 39, Project Record Documents, to include the following:
 1. Manufacturer's Warranty.

END OF SECTION 07 46 46

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DIVISION 9 – FINISHES
SECTION 09 91 23 – PAINTING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation and field application of paints.
 - 1. Surface preparation, priming, and coats of paint specified are in addition to priming and surface treatments specified under other Technical Specifications Sections.
 - 2. The intent of this Technical Specifications Section is for ALL new items furnished and installed in this Contract to be painted, unless indicated otherwise.
 - 3. The term “paint” as used herein means all coating systems materials, and includes primers, emulsions, acrylics, enamels, stain, sealers and fillers, and other applied materials whether used as prime, intermediate, or finish coats.

1.02 RELATED SECTIONS

- A. Technical Specifications Section 01 73 00, Execution, for cutting and patching requirements at lead containing paint locations.

1.03 SUBMITTALS

- A. Submittal procedures must be in accordance with the applicable provisions of:
 - 1. **Section 6.6 Contract Data Requirements**
 - 2. **Section 7.41 Product Options, Supplier Approval and Substitutions**
 - 3. **Section 7.43 Submittal of Shop Drawings, Product Data and Samples**
 - 4. **Section 7.49.1 Certificates of Compliance**
 - 5. Appendix B, Contract Data Requirements
- B. Product data: Provide data on all finishing products and special coatings, including VOC content.
- C. Samples: Submit painted samples, illustrating selected colors and sheen for each color and system selected. Submit on aluminum sheet, 8 x 10 inch in size.

1.04 QUALITY ASSURANCE

- A. Manufacturer qualifications: Nationally recognized company specializing in manufacturing the products specified, with minimum ten years documented experience.
- B. Paint coordination for factory applied primer:
 - 1. Provide finish coats that are fully compatible with the prime coatings used. Field-applied primers shall be supplied by the same manufacturer as the finish coats used. Review other Technical Specifications sections in which prime paints are specified to ensure compatibility of the coating system for each of the various

substrates. Provide barrier coats over incompatible primers or remove and re-prime as required.

- C. Use only materials which comply with Bay Area Air Quality Management District regulations.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to work site in sealed and labeled containers.
- B. Container label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Establish and maintain storage area conditions for paints and materials in accordance with manufacturer's written specifications. Store solvent-based paints and materials, in accordance with requirements of authorities having jurisdiction.

1.06 FIELD CONDITIONS

- A. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations, and the following:
 - 1. Maintain ambient temperature above 40 degrees F. during and 24 hours after installation.
 - 2. Apply water-borne paints when the temperature of surfaces to be painted and surrounding air temperature is between 50 degrees F. and 90 degrees F. Apply solvent-thinned paints only when the temperature of surfaces to be painted and the surrounding air temperature is between 45 degrees F. and 95 degrees F. Do not apply paints in precipitation, fog or mist, when relative humidity exceeds 85 percent, or at temperatures less than 5 degrees F. above dew point, or to damp or wet surfaces.
- B. Contractor is fully responsible for the controlling of over-spray and work environment during the application of all field applied paints.

1.07 EXTRA STOCK

- A. None required.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Kelly Moore numbers for Kelly-Moore products are specified in order to establish a quality standard for this project. It is understood such references are used to facilitate the description of the product and is deemed to be followed by the words "or equal".
- B. Acceptable manufacturers:
 - 1. Kelly Moore, Dunn Edwards, Sherwin Williams, or equal.
- C. Provide all paint and coating products used in each paint system from the same manufacturer. A paint system is defined to be all coats of all materials applied to any given surface area.

- D. Provide primers which are suitable for each surface to be painted and which are compatible with specified intermediate and finish coats.

2.02 PAINTS AND COATINGS - GENERAL

- A. Paints and coatings:
 - 1. Materials for use within each paint system must be compatible with one another and substrates indicated.
 - 2. Supply each coating material in quantity required to complete entire Contract Work from a single production run.
 - 3. Materials for primers and finish coats of paint must be ready-mixed and must not be changed. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is performed as specifically described in manufacturer's product instructions.
- B. Use manufacturer's highest quality products suitable for intended use, categorized as "best" or "premium" by the manufacturer.
- C. Volatile Organic Compound (VOC) content for interior paint: Comply with VOC content restrictions of authorities having jurisdiction.
- D. Colors: To be selected by VTA from manufacturer's full range of available colors.
 - 1. Color selection to be made by VTA after award of Contract.
 - 2. All exposed pipes and conduits, unistrut, hangers and supporting hardware, shall be the same color as the surface they are mounted on/under.

2.03 PAINT SYSTEMS

- A. Ferrous Metal (Shop primed):
 - 1. Alkyd Primer (for spot priming): 1760-120 Shop Coat Primer Red, or 1760-190 Shop Coat Primer Grey.
 - 2. Finish: Two (2) coats of 5885 Series DTM Acrylic Semi-Gloss Enamel. DFT (Dry): 1.7 – 2.2 mils per coat.
- B. Ferrous Metal (Not shop primed)
 - 1. Primer: One (1) coat of 5725 Series DTM Acrylic Metal Primer. DFT (Dry): 1.6 – 2.0 mils per coat.
 - 2. Finish: Two (2) coats of 5885 Series DTM Acrylic Semi-Gloss Enamel. DFT (Dry): 1.6 – 2.2 mils per coat.
- C. Galvanized Metal:
 - 1. Primer: One (1) coat of 5725 Series DTM Acrylic Primer. DFT (Dry): 1.6 – 2.0 mils per coat.
 - 2. Finish: Two (2) coats of 5885 Series DTM Acrylic Semi-Gloss Enamel. DFT (Dry): 1.6 – 2.2 mils per coat.
- D. Concrete and Masonry:

1. Primer: One (1) coat of 247 AcryShield Acrylic Masonry Primer. DFT (Dry): 1.5 – 2.0 mils per coat.
 2. Finish: Two (2) coats of 1247 AcryShield Acrylic Satin Enamel. DFT (Dry): 1.6 – 2.0 mils per coat.
- E. PVC:
1. Primer: One (1) coat of 295 Kel-Bond Acrylic Universal Primer. DFT (Dry): 1.5 – 2.0 mils per coat.
 2. Finish: Two (2) coats of 1250 AcryShield Acrylic Semi-Gloss Enamel. DFT (Dry) 1.6 – 2.2 mils per coat.
- F. Fiber Cement Siding:
1. Primer: One (1) coat of 295 Kel-Bond Acrylic Universal Primer. DFT (Dry): 1.5 – 2.0 mils per coat.
 2. Finish: Two (1) coats of 1250 AcryShield Acrylic Semi-Gloss Enamel. DFT (Dry) 1.6 – 2.2 mils per coat.

2.04 ACCESSORY MATERIALS

- A. Accessory materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether indicated or not; commercial quality.
- B. Patching material: 3M Acryl-Red Glazing Putty, Bondo Glazing and Spot Putty, or equal.
- C. Fastener head cover material: 3M Acryl-Green Spot Putty, Bondo Glazing and Spot Putty, or equal.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Do not apply paint in areas where dust is being generated.
- B. Do not begin application of coatings until substrates have been properly prepared.
- C. Verify that surfaces are ready to receive Work as instructed by the product manufacturer.
- D. Examine surfaces scheduled to be finished prior to commencement of Work. Report any condition that may potentially affect proper application.
- E. If substrate preparation is the responsibility of another installer, notify VTA Resident Inspector of unsatisfactory preparation before proceeding.

3.02 PROTECTION OF ITEMS NOT TO BE PAINTED

- A. Remove, mask, or otherwise protect hardware, lighting fixtures, switchplates, aluminum surfaces, nameplates on machinery, and other surfaces not specified elsewhere to be painted.
- B. Furnish sufficient drop cloths, shields and protective equipment to prevent overspray or droppings from marring adjacent surfaces.

- C. Protect mechanical and electrical equipment in the shop building from damage during surface preparation and painting process.

3.03 PREPARATION

- A. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease and incompatible paints.
- B. Comply with manufacturer's written instructions for preparation of substrates.
- C. Steel, Ferrous Metal Substrates, not shop primed:
 - 1. Remove rust, loose mill scale. Clean using methods recommended in writing by paint manufacturer, but not less than the following:
 - a. SSPC-SP 3, "Power Tool Cleaning"
 - 2. Use hand tools to clean areas that cannot be cleaned by power tool cleaning.
 - 3. Follow paint manufacturer's written instructions for additional preparation that may be required.
- D. Steel, Ferrous Metal Substrates, shop primed:
 - 1. Clean field welds, bolted connection, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel" for touching up shop-primed surfaces.
 - 2. Follow paint manufacturer's written instructions for additional preparation that may be required.
- E. Galvanized Metal Substrates:
 - 1. Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
 - 2. Repair damaged surfaces with galvanizing repair material in accordance with ASTM A780.
 - 3. Follow paint manufacturer's recommendations for additional preparation that may be required.
- F. Aluminum Substrates: Remove loose surface oxidation.
- G. Concrete Surface Preparation:
 - 1. Do not begin until 30 days after concrete has been placed.
 - 2. Remove grease, oil, dirt, salts or other chemicals, loose materials, or other foreign matter by solvent, detergent, or other suitable cleaning methods.
 - 3. Follow paint manufacturer's recommendations for additional preparation that may be required.
- H. Existing Painted Surfaces to be Repainted Surface Preparation:
 - 1. Detergent wash and freshwater rinse.

2. Feather into surrounding intact coating.
3. Apply one spot coat of specified primer to bare areas, overlapping prepared existing coating.

3.04 APPLICATION

- A. Apply products in accordance with manufacturer's instructions.
- B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- C. Apply by brush or roller, except for materials specifically required by manufacturer to be applied by spraying. Spray application in existing occupied spaces only upon acceptance by VTA. In existing occupied spaces where paint is applied by spray, mask or enclose with polyethylene, or similar air tight material with edges and seams continuously sealed.
 1. The number of coats and film thickness required is the same regardless of application method.
 2. Apply each coat to uniform appearance.
 3. Use tack cloth to remove dust and particles just prior to applying next coat.
 4. Paint surfaces behind movable equipment same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment with prime coat only.
 5. Primers specified in application schedules may be omitted on items that are factory primed if acceptable to topcoat manufacturers.
 6. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
 7. Apply paints to produce surface films without cloudiness, spotting, laps, brush marks, roller tracking, runs, rags, or other surface imperfections.

3.05 APPLICATION SCHEDULE

- A. Items to be painted:
 - a. All steel and miscellaneous metals furnished and installed in this Contract, such as framing members, plates, angles, brackets and hardware, exposed to view.
 - b. All sheet metal and flashing installed in this contract.
 - c. All metal and plastic piping and conduit furnished and installed in this Contract, exposed to view.
 - d. All conduit fittings and supports furnished and installed in this Contract, such as unistrut, framing channels, threaded rods, and hardware, exposed to view.
 - e. All mechanical, plumbing, electrical equipment furnished and installed in this Contract, such as enclosures, panelboards and switch gear, exposed to view.
 - f. Existing wall surfaces uncovered due to openings required to be cut or removed for installation of new work. Feather into adjacent concrete.

- g. Existing steel uncovered due to cutting or repairing required for installation of new work. Feather into adjacent surfaces.
 - h. Existing surfaces uncovered due to removal of existing items, such as conduit and supports, electrical boxes, lighting fixtures and equipment removal. Feather into adjacent surfaces.
 - i. All items furnished and installed in this Contract having hot-dipped galvanized surfaces.
 - j. All items furnished and installed in this Contract having prime coats applied in shop under other specification Sections. Work shall include touching up of or repairing abraded, damaged or rusted prime coats.
 - k. Prime painting of all unprimed items furnished and installed in this Contract which require prime painting.
 - l. All incidental painting and touch up required to produce proper finish for painted surfaces, including touching up of factory finished items furnished and installed in this Contract.
- B. Do not paint the following:
- 1. Existing items, except as indicated in the application schedule above.
 - 2. Items factory finished.
 - 3. Stainless steel.
 - 4. Anodized aluminum.
 - 5. Equipment nameplates, fire rating labels and operating parts of equipment.
 - 6. Concealed piping.
 - 7. Concealed conduit.
 - 8. Concrete floors.

3.06 CLEAN UP

- A. Collect cloths waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from Jobsite.
- B. Remove paint spots and stains from adjacent surfaces and floors.

3.07 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.
- C. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces.

END OF SECTION 09 91 23

DIVISION 23 – FUELING
SECTION 23 12 00 – FUELING SYSTEM

PART 1 - GENERAL

1.02 SECTION INCLUDES

- A. This Section includes:
 - 1. Underground primary fuel piping
 - 2. Underground fuel piping containment system
 - 3. Flanges, unions and couplings
 - 4. Valves
 - 5. Flexible connections
 - 6. Fuel pumps and controls
 - 7. Specialty fittings
 - 8. Piping sumps
 - 9. Inventory and Leak Monitoring Panel module and sensors

1.03 RELATED SECTIONS

- A. Technical Specifications Section 02 80 00, Hazardous Material Removals, for closure and removal of Aboveground Storage Tanks (boilers and generators) containing hazardous materials.
- B. Technical Specifications Section 26 32 13, Engine Generators

1.04 REFERENCES

- A. American Society of Mechanical Engineers:
 - 1. ASME B16.3 - Malleable Iron Threaded Fittings.
 - 2. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
 - 3. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - 4. ASME B31.4 - Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids.
 - 5. ASME B31.9 - Building Services Piping.
- B. American Society for Testing and Materials (ASTM):
 - 1. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - 2. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
 - 3. ASTM D2310 - Standard Classification for Machine-Made "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.

4. ASTM D2513 - Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.
 5. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
 6. ASTM D2996 - Standard Specification for Filament-Wound Fiberglass (Glass-Fiber-Reinforced Thermosetting Resin) Pipe.
- C. American Water Works Association:
1. AWWA C105 - American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
- D. Manufacturers Standardization Society of the Valve and Fittings Industry:
1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
 2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
 3. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
 4. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
 5. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
 6. MSS SP 85 - Cast Iron Globe & Angle Valves, Flanged and Threaded.
 7. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
 8. MSS SP 110 - Ball Valves Threaded, Socket Welding, Solder Joint, Grooved and Flared Ends.
- E. NACE International:
1. NACE RP-01-69 - Control of External Corrosion on Underground or Submerged Metallic Piping Systems.
- F. Codes:
1. NFPA 30 - Flammable and Combustible Liquids Code.
 2. NFPA 30A – Code for Motor Vehicle Fuel Dispensing Facilities and Repair Garages.
 3. NPFA 70, National Electric Code, with California amendments.
 4. California Health and Safety Code
 5. California Code of Regulations, Title 24, Part 4, “California Mechanical Code”.
 6. California Code of Regulations, Title 24, Part 5, “California Plumbing Code”.
 7. California Code of Regulations, Title 24, Part 9, “California Fire Code”.
 8. California Code of Regulations, Title 8, Industrial Relations.
- G. Underwriters Laboratories Inc.:
1. UL 197 – Standard for Nonmetallic Underground Piping For Flammable Liquids
 2. UL 157 – Gaskets and Seals.

1.05 REGULATORY REQUIREMENTS

A. General Requirements:

1. All Work must be performed in accordance with this Technical Specifications Section and the latest regulations from the U.S. Environmental Protection Agency (EPA), U.S. Department of Transportation (DOT), Occupational Safety and Health Administration (OSHA), State of California Department of Industrial Relations – Division of Occupational Health (DOSH), Bay Area Air Quality Management District (BAQD), and any other applicable federal, state, and regional AHJ.
2. Secure all permits and inspections from the AHJs. Prepare and submit all forms, including those requiring VTA signature, and pay for all plan check application fees and permit fees. Prepare and submit all supporting documentation, including manufacturing drawings, product data sheets, controls and wiring diagrams, piping layout and manufacturers' installation instructions for all proposed equipment.

B. Hazardous Material Storage Tank and Piping System:

1. Generator, fuel tank, and accompanying piping systems require pre-approval from County of Santa Clara Department of Environmental Health – Hazardous Materials Compliance Division (HMCD), prior to installation. HMCD is the Certified Unified Program Agency (CUPA) for Santa Clara County.
2. Comply with all applicable printed documentation issued by HMCD, including:
 - a. "Plan Submittal Requirements for Hazardous Materials Systems"; Form HMCD-004.
 - b. "Guidelines for Installation of Temporary and Permanent Aboveground Diesel Fuel Tanks for Emergency and Standby Power Systems Located Outside of Buildings"; UN-018.
3. Prepare and submit HMCD permit applications to VTA, including those requiring VTA signature, and pay all plan check and permit fees, including:
 - a. "Hazardous Materials Construction Permit Application"
 - b. "Equipment List for Aboveground Storage Tank Systems"
 - c. "Hazardous Materials Clearance Form"
4. Comply with all applicable printed documentation issued by BAAQMD, including:
 - a. "Manual of Procedures"
5. Prepare and submit BAAQMD permit applications, including those requiring VTA signature, and pay all plan check and permit fees, including:
 - a. "Permit to Operate"

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Company specializing in manufacturing products specified in this Technical Specification Section with minimum ten years successful in-service performance,

and with service facilities within 100 miles of Worksite capable of providing training, parts, and emergency maintenance and repairs.

- B. Supplier Qualifications:
 - 1. Manufacturer authorized distributor, with minimum three years documented experience.
- C. Contractor Qualifications:
 - 1. A California licensed General Engineering Contractor having HAZ – Hazardous Substance Removal Certification.
 - 2. Completed within the past five years, at least one commercial aboveground or underground storage tank diesel dispensing facility installation in the State of California, including incidental tank related piping, electrical work, and testing and adjusting of leak detection equipment.

1.07 SUBMITTALS

- A. Submittal procedures must be in accordance with the applicable provisions of:
 - 1. **Section 6.6 Contract Data Requirements**
 - 2. **Section 7.41 Product Options, Supplier Approval and Substitutions**
 - 3. **Section 7.43 Submittal of Shop Drawings, Product Data and Samples**
 - 4. **Section 7.49.1 Certificates of Compliance**
- B. Manufacturer and Supplier Qualifications.
- C. Product Data: For each product specified in this Technical Specification Section and Contract Drawings Fueling Equipment List (Sh. FS-6.0):
 - 1. Product description, dimensions and profiles, rough-in requirements, finishes and rated capacities. Forward all submittals in related groups, as follows:
 - a. Piping, fittings, and accessories.
 - b. Valves and specialty fittings.
 - c. Hangers and supports.
 - d. Fuel Piping Specialties.
 - e. Sumps.
 - f. Pumps: Submit certified pump curve data showing performance characteristics, with pump and system operating point plotted. Include NPSH curve, where applicable. Include electrical characteristics and connection requirements.
 - 2. Organize submittals in same sequence as shown on Contract Drawings, Sh. FS-6.0 "Fueling Equipment List".
- D. Manufacturer's Installation Instructions.

- E. Manufacturer's Certificate: Certify fuel system components and materials are fabricated in accordance with the standards and codes established by UL, NFPA, CARB and Authorities Having Jurisdiction.
- F. Schedule of Test Procedures:
 - 1. Identify component to be tested and test procedure.
 - a. Identify testing required during installation (and before backfilling) and testing prior to start up.
- G. Pre-functional Commissioning and Functional Performance Testing Checklists
 - 1. Submit prior to commencing commissioning and functional performance testing.
- H. Closeout Submittals:
 - 1. Commissioning and functional performance test reports.
 - 2. Field test reports
 - 3. Operations and maintenance manuals.
 - 4. Permits and certificates of inspections from Santa Clara County Department of Environmental Health, Hazardous Materials Compliance Division (HMCD).
 - 5. Sign-in attendance sheet for demonstration and training session, and written training agenda.
 - 6. Contractor's final clearance letter.
 - 7. Manufacturer's warranties.
 - 8. Contractor's special warranty.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Accept materials on-site in shipping containers with labeling in place. Inspect for damage.
- B. Protect piping and fittings from soil and debris with temporary end caps and closures. Maintain in place until installation. Furnish temporary protective coating on cast iron and steel valves.

1.09 WARRANTY

- A. Manufacturer's Warranty: Submit completed manufacturer's warranties.
- B. Contractor's Special Warranty: Provide a warranty signed by Contractor and countersigned by the fueling system installation contractor. Warranty must cover all Work included in this Technical Specifications Section for a period of two years for parts and labor, commencing on the date of Substantial Completion. Any corrective action required for the duration of Contractor's Special Warranty will be paid by Contractor at no cost to VTA.

PART 2 - PRODUCTS

2.01 UNDERGROUND PRIMARY FUEL PIPING

- A. Manufacturers:

1. Smith Fibercast
 2. Ameron
 3. Or equal
- B. FRP: ASTM D2310 and ASTM D2996, UL listed for nonmetallic underground piping for petroleum products, and filament wound fiberglass reinforced epoxy pipe with integral epoxy liner and exterior coating.
1. Fittings: Compression molded, filament wound, fiberglass-reinforced epoxy.
 2. Joints: Tapered bell and spigot adhesive bonded.

2.02 ABOVEGROUND FUEL PIPING

- A. Manufacturers:
1. Perma-Pipe
 2. Rovanco
 3. Insul-Tek
 4. Or equal
- B. Product piping must be constructed using a pre-fabricated secondary containment piping system.
- C. The outer containment casing must be electric fusion welded smooth wall steel conforming to ASTM A-139. Casing must be a minimum 10-gauge wall thickness with an external red mill primer coating. The containment casing must be sized to contain the inner pipe with sufficient clearance for field assembly and thermal expansion or contraction of the inner pipes. All containment casings must be installed on a minimum 1" in 40' slope to provide positive drain points in the casing with no pockets.
- D. The inner pipe must be ASTM A106, Grade B, Schedule 40, electric resistance welded or seamless black steel pipe with beveled ends for field welded joints. All pipe fittings must be welded conforming in physical and chemical properties to ASTM Specification A-234 for the services indicated.
- E. All inner carrier pipes must be concentricity spaced, guided and supported within the outer containment casing. Pipe supports must be constructed from materials compatible with the inner carrier pipe and in such a manner as to permit the unrestricted flow of spilled liquid to drain to the nearest low point leak detection outlet port.
- F. All fittings such as elbows, tees and terminal end seals must be factory prefabricated and furnished with attached pipe tangents. Terminal ends of the containment casing must be equipped with factory installed end seals consisting of a bulk head plate welded to the carrier pipes and the containment casing. End seals must be equipped with 1" diameter vent and drain openings with removable plugs. Field fabrication and/or alternation of the piping is not permitted.
- G. Outer containment casing field joint closures must be furnished with the containment casing at the ratio of one closure kit for each prefabricated item or length. Closures must be of the same wall thickness as the outer containment casing. Closures must be furnished in a smooth wall cylindrical form with a single horizontal split and must be field welded over adjacent unit ends. All field welds must be tested for leaks with soap suds

and re-welded if necessary until air tight at 15 psi internal pressure. Field coat all field joint closure bands with factory supplied coatings.

2.03 UNDERGROUND FUEL PIPING CONTAINMENT SYSTEM

- A. Manufacturers:
 - 1. Ameron
 - 2. Smith Fibercast
 - 3. Or equal
- B. Pipe Material: FRP, ASTM D2310 and ASTM D2996, UL listed filament wound fiberglass reinforced epoxy pipe with integral epoxy liner and exterior coating.
- C. Pipe Diameter: Refer to Contract Drawings.
- D. Fittings: Two piece, compression molded, filament wound, fiberglass-reinforced epoxy, mechanically joined.

2.04 VALVES

- A. Ball Valves
 - 1. Manufacturers:
 - a. Morrison Bros.
 - b. Universal Valve Company
 - c. Or equal
 - 2. MSS SP 110, (Class 150, 400 psi) CWP, bronze, two piece body, chrome plated brass ball, regular port, Teflon seats and stuffing box ring, blow-out proof stem, lever handle threaded ends.

2.05 FLEXIBLE CONNECTORS

- A. Manufacturers:
 - 1. Flex-ing
 - 2. Hosemaster
 - 3. Or equal
- B. Flexible Hose: U.L listed, with integral male swivel fittings, suitable for aboveground and underground fuel systems, compatible with approved secondary containment systems, stainless steel or Teflon corrugated inner hose, stainless steel braided exterior sleeve, suitable for minimum 50 psi, CWP and 250 degrees F.

2.06 SUBMERSIBLE FUEL PUMPS

- A. Manufacturers:
 - 1. FE Petro
 - 2. Red Jacket
 - 3. Or equal
- B. Submersible Pump System:
 - 1. Pump:

- a. 1/3 HP fixed speed submersible pump for diesel generator tank fueling system.
- b. Entire pumping assembly must have UL listing and must meet all requirements of UL Standard 79.
- c. Pump discharge head and manifold assembly must be manufactured from ASTM A48 Class 25 gray iron.
- d. Pump must be furnished with a variable length telescopic feature that allows the length of the pump to be field adjusted during installation, in order to facilitate the specific pump length required.
- e. Pump shall be diesel compatible, have integral check valve with expansion relief valve setting @ 24 PSI relief and 22 PSI reset, siphon capability, separate siphon port, and thermal over-current overload protector with automatic reset.
- f. Pump must facilitate removal and replacement without requiring pump housing removal.

2. Pump Controller:

- a. Compatibility: Controller and pump must be compatible with each other, and be manufactured by the same company. Controller must provide the starting relay and power for the pump.
- b. Controller must be capable of reporting abnormal operating conditions as follows:
 - 1) Dry run warning
 - 2) Low incoming voltage detection
 - 3) Pump motor failure detection
 - 4) Open circuit detection
 - 5) Short circuit detection
 - 6) Relay fault
 - 7) Extended run
- c. Controller must have manual reset button, built-in surge protection, and RS-485 communications port.

3. Controller programming:

- a. Programming of the pump controller must be in standalone mode.

C. Size:

1. Refer to Contract Drawings and Equipment Schedule, Sh. FS-6.0.

2.07 SPECIALTY FITTINGS

A. Manufacturers:

1. OPW
 2. Pomeco
 3. Morrison
 4. Or equal
- B. Vent Cap: Pressure/Vacuum vent must be UL listed, CARB certified for EVR, corrosion resistant, and be installed on top of vent risers from fuel storage tanks. The vent cap must have an internal wire screen designed to protect the tank vent lines against intrusion and blockage from water, debris, and insects.
- C. Manholes: Manholes must be round, rated for H2O loading, raintight with Buna-N gaskets, have recessed handles, and recessed "Roto-Lock" style fasteners. The cover must be composite material; the ring must be cast iron or fabricated steel, and the skirt galvanized steel.

2.08 PIPING SUMPS, DISPENSER PANS AND FLEXIBLE ENTRY BOOTS

- A. Below Ground Sumps:
1. Manufacturers:
 - a. Western Fiberglass
 - b. S. Bravo Systems
 - c. Or equal
 2. Sumps must be double-walled with hydrostatic monitoring system and constructed of fiberglass, and compatible with product.
 3. Sumps must be designed to prevent any external liquids from entering sump, as well as preventing liquids from escaping into the surrounding environment.
 4. Sides and bottom of transition sumps must be designed to withstand internal hydrostatic pressure when sump is completely full of liquid.
 5. Additional Requirements: As shown on Contract Drawings; Refer to Equipment Schedule, Sh. FS-6.0.
- B. Aboveground Transition Sumps:
1. Manufacturers:
 - a. S. Bravo Systems. (B-8700-1PL)
 - b. Or equal
 2. The sump must be for above ground applications, epoxy coated, and with low pint reservoir for fluid sensor.
 3. Sumps must be designed to prevent any external liquids from entering sump, as well as preventing liquids from escaping into the surrounding environment.
 4. Additional Requirements: As shown on Contract Drawings; Refer to Equipment Schedule, Sh. FS-6.0.
- C. Sump Entry Boots:
1. Manufacturers:

- a. S. Bravo Systems.
 - b. Or equal
2. Sump entry boots must accommodate all types of piping and conduits without special modification or Work.
 3. Sump entry boots must be able to accept piping entering at a 15 degree or less angle without undue stress or leaking.
 4. Sump entry boots must be able to withstand a minimum of 6' of liquid head pressure.
- D. Refer to Contract Drawings for size and configuration.

2.09 INVENTORY AND LEAK MONITORING PANEL

- A. The existing inventory and leak monitoring panel is a Veeder Root TLS-350, located at the Cerone Fuel Island mechanical room.
- B. Perform all required modifications to the existing Veeder Root panel, including the following. Add (furnish and install):
1. 6 input PLLD interface modules.
 2. 3 output PLLD interface modules.
 3. Single point mini hydrostatic sensor.
 4. Piping sump sensor (optical).
 5. Pipe Line Leak Detector (PLLD).
- C. Programming:
1. Program the Veeder Root panel to provide leak detection for new fuel piping and to notify the operator of any leaks. The panel must NOT shut down the fuel line.
 2. Perform all necessary modifications, programming and testing of the Veeder Root panel to provide a complete and functional Veeder Root panel.
- D. Additional Requirements: Refer to Contract Drawings and Equipment Schedule, Sh. FS-6.0

2.10 PUMP CONTROLLER

- A. Manufactures:
1. Pneumercator
 2. Incon
 3. Or equal
- B. Pump controller must monitor generator fuel tank level and provide output signal to start/stop submersible fuel supply pump.
- C. Level switch with set point for high level.
- D. Level switch with set point for pump on.
- E. Level switch with set point for pump off.
- F. Additional Requirements: Refer to Contract Drawings and Equipment Schedule, Sh. FS-6.0.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

- A. Perform all labor, including but not limited to installation, programming and testing, for a complete and certifiable functional fuel system installation.
- B. Provide any additional accessories, appurtenances fittings and hardware, not specifically mentioned herein but necessary for a complete and certifiable functional fuel system installation.
- C. Nothing in this Technical Specifications Section and the Contract Drawings will be construed to permit Work not conforming to the applicable codes, regulatory requirements, and manufacturer's printed installation instructions.
- D. Perform field verification of all measurements prior to fabrication and installation.

3.02 EXAMINATION

- A. Verify excavations are to required grade, dry, and not over-excavated.
- B. Install all equipment in strict accordance with manufacturer printed installation instructions.

3.03 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.04 INSTALLATION - ELECTRICAL

- A. Hazardous Area Classifications: All fueling system electrical conduit and wiring must be "intrinsically safe" in accordance with NFPA 70, the National Electrical Code, for Class 1, Division 2 requirements. Refer to Contract Drawings, Sh. FE-2.0.

3.05 INSTALLATION – BURIED PIPING SYSTEMS

- A. Excavate for the installation of piping and appurtenances.
- B. Remove all obstructions, such as broken concrete, tree roots, and other foreign material.
- C. Provide and maintain ample means and devices at all times to remove and dispose of all water entering the trench during the process of pipe laying. Do not install underground piping when bedding is wet or frozen.
- D. Establish elevations of buried piping with not less than the amount of cover, including slab thickness, refer to Contract Drawings.
- E. Establish minimum separation of from other services piping in accordance with local code.
- F. Remove scale and dirt on inside of piping before assembly.
- G. Carefully handle pipe in such a manner as to avoid any physical damage to the pipe.
- H. Inspect each pipe and fitting before the pipe or fitting is lowered into the trench.
- I. Do not drop or dump pipe into trenches under any circumstances.

- J. Install pipe on a bedding of clean pea gravel, as shown on the Contract Drawings.
- K. Level pea gravel and cover with filter fabric.
- L. Slope pipe as shown on the Contract Drawings. Sags are not permitted.
- M. Route pipe in straight line.
- N. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- O. Provide warning tape min 6" over pipe and method of tracing non-metallic pipe.
- P. Pipe Cover and Backfilling:
 - 1. Compact all piping trenches to 95% maximum dry density before backfill material and pipes are installed.
 - 2. Maintain optimum moisture content of fill material to attain required compaction density.
 - 3. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
 - 4. The trench bottom must form a continuous and uniform bearing and support for the pipe at every point.
 - 5. Grade to the bottom of the trench by hand to the line and grade to which the pipe is to be laid, with proper allowance for pipe thickness and for pea gravel.
 - 6. Do not use wheeled or tracked vehicles for tamping.
- Q. Do not backfill piping without prior approval from VTA.
- R. Protect piping systems from entry of water, dust, insects and debris by providing temporary covers, completing sections of the work, and isolating parts of completed system.
- S. Provide a minimum 6" clearance between the fuel pipe and the other utilities.

3.06 TESTING PIPING SYSTEMS

- A. Piping to be wrapped or double-contained shall be tested before wrapping or enclosing.
- B. Do not put water in pumps, tanks, nozzle dispensers or other equipment, which may be contaminated or damaged by pressure or corrosion from water.
- C. Piping which has been hydrostatically tested with water shall be drained and blown dry with air after successful testing. Moisture must not be allowed to remain in piping overnight.
- D. CAUTION: Do not over pressure tanks. Use suitable precaution when testing with air pressure to protect personnel and property in the event of failure.
- E. Except where more stringent tests are required by HMCD or manufacturer's printed installation instructions, perform leak tests as follows:

Service	Material*	Test Pressure (PSI)	Medium	Test Notes (See Article 3.07)
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DF	CS/FRP	50	Air	A
Secondary Piping	CS/FRP	5	Air	A, B
Sumps	FRP/Steel	---	Water	C

*CS – Carbon Steel
FRP – Fiberglass Reinforced Plastic

F. Submit completed test results to VTA.

3.07 TEST NOTES

- A. Hold pressure for 30 minutes, check for leaks, correct deficiencies and retest until no leaks are found.
- B. Hold pressure for 30 minutes. Sealed secondary piping must be pressured and soap tested for leaks.
- C. Fill with water, mark water level and recheck level in 24 hours, check for water leakage or water loss. Correct deficiencies and retest until no leaks are found over a period of one hour.

3.08 OTHER TESTS

- A. Align, lubricate and test run all equipment. Calibrate and test all instrumentation in accordance with the manufacturer’s written installation instructions and Operation and Maintenance manuals.
- B. Purge air in piping using sufficient fuel to completely flush the fueling system. Replace all filters upon completion of testing and flushing of the system.

3.09 FINISHES

- A. Paint all exposed piping, conduits, and metal surfaces that are not factory pre-finished, in accordance with Technical Specifications Section 09 91 23, Painting. Do not paint stainless steel surfaces.
- B. Colors:
 - 1. Pipe Guards: Yellow
 - 2. Aboveground Piping: White
 - 3. Pre-finished Equipment: Touch up factory color as required.

3.10 COMMISSIONING

- A. Perform pre-functional commissioning and functional performance testing as indicated herein. Submit pre-functional commissioning and functional performance testing checklists in a format approved by VTA. Complete checklists in the field concurrently, while commissioning and testing are being performed.
- B. Pre-functional Commissioning
 - 1. Complete Pre-functional commissioning prior to placing any product in the tanks. Pre-functional testing includes the following, at a minimum:

- a. Verification of correct make, model, and voltage of equipment in accordance with approved submittals of this Technical Specification Section.
 - b. Verification that manufacturer's cut sheets, installation and startup manuals, and operation and maintenance manuals have been provided to VTA for all equipment subject to these commissioning requirements.
 - c. Confirmation that applicable installation and startup requirements have been met in accordance with all engineering design drawings and specifications, manufacturer's installation and startup instructions, and current standard industry practices. Such requirements must include, but not be limited to, physical installation of equipment and associated piping and accessories, and electrical wiring and controls applicable to the equipment being commissioned.
- C. Functional Performance Testing
- 1. Complete functional performance testing only after approval is granted by Hazardous Materials Compliance Division (HMCD) to place product in the tank and to operate the generator. HMCD must be present to observe the initial fill of the tank. Functional performance testing includes the following, at a minimum:
 - a. Confirmation that fuel safety systems, including emergency shutdown devices are fully functional.
 - b. Confirmation the Leak and Inventory Panel addition are fully functional.
 - c. Confirmation that submersible pump operation is in accordance with system design requirements and manufacturer's specifications including Pump Control panel.
 - d. Confirmation that fuel supply meets the following design criteria:
 - 1) Diesel flow rate is minimum 12 gallons per minute (GPM) from underground storage tank to generator sub-base fuel tank.

3.11 DEMONSTRATION AND TRAINING

- A. Engage a factory-authorized service representative at Contractor expense, to train VTA maintenance personnel to adjust, operate, and maintain the packaged engine generator:
 - 1. Use the operation and maintenance manual as the basis of instruction.
 - 2. Prepare and insert additional data in the manual when need for such data becomes apparent during instruction.
 - 3. Prepare sign-in attendance sheet for demonstration and training session, and written Agenda.
 - 4. Minimum scheduled training period: Four hours.

3.12 CLOSEOUT DOCUMENTATION

- A. Prepare closeout documentation in accordance with Technical Specifications Section 01 77 00, Closeout Procedures, and Technical Specifications Section 01 78 39, Closeout Record Documents:
1. Commissioning and functional performance test reports.
 2. Field test reports.
 3. Operations and maintenance manuals
 4. Permits and certificates of inspection from Santa Clara County Department of Environmental Health – HMCD.
 5. Provide Contractor’s final clearance letter, certifying that the installation and testing requirements of HMCD have been met, completed, submitted and approved by HMCD.
 6. Sign-In attendance sheet for demonstration and training session, and written training agenda.
 7. Manufacturer’s warranties.
 8. Contractor’s special warranty.

END OF SECTION 23 12 00

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DIVISION 26 – ELECTRICAL

SECTION 26 05 00 – COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Section includes general requirements for electrical work.

1.02 RELATED SECTIONS

- A. Division 26 Technical Specification Sections and Contract Drawings.

1.03 EXECUTION, CORRELATION AND INTENT

- A. The Division 26 Technical Specifications and Contract Drawings are complementary; what is called for by one is binding, as if called for by both. Items shown on the Contract Drawings are not necessarily included in the Technical Specifications and vice versa.
- B. In case of an inconsistency between the Division 26 Technical Specifications Sections and Contract Drawings or within either document not clarified by Addendum, the better quality or greater quantity of Work must be provided in accordance with VTA's interpretation. Notify VTA in writing of any discrepancy before proceeding with the task. VTA will provide written direction.
- C. All Division 26 Technical Specification Sections are interrelated. Use Division 26 in its entirety when interpreting any material, method, or direction listed in any Section.
- D. Contract Drawings depicting electrical work are diagrammatic and are not intended to show all raceway, wiring, exact locations of equipment, terminations, or number or types of fittings required by the electrical system. They do not show every offset, bend, conduit body, elbow or junction box that may be required to install work in the space provided or to avoid conflicts. Follow the Contract Drawings as closely as is practical and provide additional bends, offsets, and elbows where required. Provide all related electrical work which is specified herein, diagrammed or scheduled on the Contract Drawings and as required by code enforcing agencies for complete and operating electrical systems. Field verify all dimensions. Do not scale Contract Drawings.

1.04 PRODUCTS

- A. General: Products are specified by manufacturer name, description, and/or catalog number to show intended function and to establish a quality standard for this project. It is understood such references are used to facilitate the description of the product and is deemed to be followed by the words "or approved equal". Report discrepancies, such as discontinued equipment or catalog numbers, to VTA for resolution.

1.05 SUBMITTALS

- A. Refer to:
 - 1. Appendix B, Contract Data Requirements
 - 2. **Section 7.41 Product Options, Supplier Approval and Substitutions**
 - 3. **Section 7.43 Submittal of Shop Drawings, Product Data and Samples**

4. **Section 7.49.1 Certificates of Compliance**

5. Each Technical Specification Section

1.06 QUALITY ASSURANCE

- A. All materials must be new, unless noted otherwise. Properly store all materials and equipment for protection from physical damage or damage due to corrosion.
- B. Review accessibility of equipment for operation, maintenance and repair prior to installation. Proceed with installation only after unsatisfactory conditions have been corrected
- C. The manufacturer of the electrical equipment or switchgear assembly must be the manufacturer of the major components within the assembly. Applicable electrical equipment and switchgear, and associated major components shall be suitable for and certified to meet all applicable seismic requirements of the California Building Code (CBC).
- D. Contractor Qualifications: Electrical Work must be performed by a California licensed C-10 Electrical Contractor.

1.07 COORDINATION AND SCHEDULING

- A. Coordinate and schedule electrical work with the work of other trades. Every reasonable effort must be made to prevent conflicts as to space requirements, dimensions, locations, code required working spaces, access openings, or other matters tending to obstruct or delay the work of other trades. All changes caused by failure to coordinate will be made at Contractor's expense.

1.08 SAFETY AND PROTECTION

- A. Contractor will be solely and completely responsible for conditions of the Worksite, including safety of all persons and property during performance of the Work. This requirement will apply continuously and not be limited to normal working hours. It is Contractor's responsibility to comply with applicable safety and health regulations for construction.
- B. Protection: Contractor will take whatever measures required to ensure that electrical safety and protection are maintained, including the proper covering, signage, and securing of "live" circuits.
- C. Comply with all applicable Safety Rules and Manuals.
 - 1. General electrical safety rules include, but is not limited to the following:
 - a. Work on Electrical circuits operating at over 50 volts, phase to ground, or greater shall be performed by specially "Qualified Person".
 - b. Electrical circuits will be considered de-energized under the following conditions:
 - (1) Switches connecting subject circuit to the energy supply are observed in the "open" position, with an air break, and locked and tagged.

- (2) Electrically operated switches are visibly “open”, blocked or racked in the “open” position, and locked and tagged out “open”.
 - (3) Use an adequately rated voltage detector to test each phase conductor or circuit part to verify they are de-energized. Test each phase conductor or circuit part both phase-to-phase and phase-to-ground. Before and after each test, determine that the voltage detector is operating satisfactorily.
 - (4) If the supply circuit break is not visible and clearly identified, or where the possibility of induced voltages or stored electrical energy exists, the circuit shall be grounded. If the ground connection is not within sight of the work area, the ground connection shall be locked and tagged out before proceeding with the Work.
 - (5) Oil switches are observed “open” in a sight window and locked and tagged out “open”, or fuse carrier is removed in oil fuse cutouts and locked and tagged out “open”.
- c. Insulated cables, operated at over 250 volts to ground, must be handled when energized only with rubber gloves tested to 22,000 volts by approved testing laboratory.
 - d. Insulated cables that have been in operation must be cut only with grounded cable shears, or must be grounded by driving a grounded sharp tool through the shielding and the conductors before cutting.
 - e. All personnel working around energized electrical equipment operating at over 600 volts or more must wear standard insulated, non-conducting hard hats and shall wear fire retardant garments with no metallic zipper fasteners.
 - f. Ladders used in any electrical work shall be of wood or fiberglass construction.
 - g. All panel boards, junction boxes, electrical devices and other similar equipment which are being worked on and which have exposed live wires, bus bars, or terminals operating above 50 volts must be covered adequately for the voltage with an electrical insulating material and labeled with a “Danger” sign when Contractor personnel are not present. The Danger sign must advise that exposed electrical parts are behind the temporary protective cover.
 - h. Complete lock and tag out once line clearance has been given, and attach locks and tags to any opened switch or equipment.
 - i. Provide effective barriers to prevent others from falling into the open vault. Close and secure vaults when not attended.

1.09 ELECTRICAL SERVICE

- A. Continuity of Service: Refer to Section 6.11 Work Sequence and Constraints, for requirements pertaining to temporary power and cutovers.

1.10 DEMOLITION

- A. Refer to Technical Specifications Section 02 41 19, Selective Demolition, for requirements pertaining to electrical demolition.

1.11 ELECTRICAL EQUIPMENT INSTALLATION

- A. Make electrical connections in accordance with manufacturer's written instructions, with recognized industry practices, and complying with requirements of NFPA 70 (National Fire Protection Association) - National Electrical Code, with California amendments.
- B. Verify all electrical loads (voltage, phase, full load amperes, number and point of connections, minimum circuit capacity, etc.).
- C. Meet with each subcontractor furnishing equipment requiring electrical service to review electrical characteristics for each equipment item before rough in begins. Report any variances from electrical characteristics noted on the electrical drawings to VTA before proceeding with rough-in work.
- D. Comply with applicable provisions of National Electrical Code as to the type of products used and provisions for electrical power connections.
- E. All material and equipment within the scope of the UL Re-examination service shall be approved by Underwriters Laboratories, Inc. for the purpose for which they are used and must bear the UL label. Any variation to this requirement must be approved by VTA.
- F. Cutting and Patching: Provide and coordinate the locations of all openings required in the building construction for installation of the Work:
 - 1. No drilling will be allowed through concrete slabs, beams or walls, unless approval is received from VTA. In no case is any structural member permitted to be cut.
 - 2. Provide sleeves for electrical penetrations through floors, walls and beams. Seal all openings around conduits in sleeves with a material of equal fire rating as the surface penetrated.
- G. Equipment Bases and Fastenings:
 - 1. Comply with seismic anchorage and bracing requirements of applicable section of the California Building Code.
 - 2. Fastenings for securing equipment to walls and floors will be 304 stainless steel. Size must match equipment mounting holes.
 - 3. Stainless steel anchor bolts must be installed for electrical equipment in the front and back of each section at locations recommended by electrical equipment manufacturer.
 - 4. Concrete pad with stainless steel anchor bolts must be provided for all freestanding equipment.

- 5. All wall mounted panels or enclosures must be spaced out from wall by stainless steel unistrut or stainless steel spacers with minimum depth of 1/2".
- H. Equipment Accessibility: Comply with applicable codes and install equipment to be accessible for operation, maintenance or repair. Equipment deemed inaccessible must be relocated as directed by VTA.

1.12 TESTING

- A. Fully test and adjust all equipment installed under Division 26 of the Technical Specifications and demonstrate its proper operation. Refer to Technical Specifications Section 26 08 00, Acceptance Testing.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 26 05 00

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SECTION 26 05 19 - 600 VOLT OR LESS WIRE AND CABLE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Insulated copper stranded conductors and associated connections for general power and control use at voltages below 600 volts, for sizes #14 AWG through 1000 kcmil.

1.02 RELATED SECTIONS

- A. Technical Specifications Section 23 12 00, Fueling System, for fueling system electrical conduit and wiring to be “intrinsically safe”.
- B. Technical Specifications Section 26 05 00, Common Work Results for Electrical, for general electrical requirements.
- C. Technical Specifications Section 26 08 00, Acceptance Testing, for Work performed by an independent testing agency, at Contractor’s expense.

1.03 REFERENCES

- A. ASTM B3, B8.
- B. NECA (National Electrical Contractors Association) National Electrical Installation Standards.
- C. NEMA (National Electrical Manufacturers Association) - WC 70/ICEA S-95-658-1999, Standard for Nonshielded Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy.
- D. NFPA 70 - National Electrical Code, with California amendments.
- E. UL 44, 62, 82, 854.

1.04 QUALITY ASSURANCE

- A. All wire and cable must be new.
- B. Listing and Labeling: Provide wire and cable that are Listed and Labeled as defined in NFPA 70, Article 100 and marked for specific types, sizes, and combinations of conductors and connected items.
- C. Testing Agency Quality Assurance:
 - 1. In accordance with Section 26 08 00, Acceptance Testing.

1.05 SUBMITTALS

- A. Submittal procedures must be in accordance with the applicable provisions of:
 - 1. **Section 6.6 Contract Data Requirements**
 - 2. **Section 7.41 Product Options, Supplier Approval and Substitutions**
 - 3. **Section 7.43 Submittal of Shop Drawings, Product Data, and Samples**
 - 4. **Section 7.49.1 Certificates of Compliance**

- 5. Appendix B, Contract Data Requirements
- B. Cable Testing Record Format.
- C. Product data for all cable and cable termination products:
 - 1. Manufacturer and certificate of compliance.
 - 2. Number and size of strands composing each conductor.
 - 3. Conductor insulation composition type in accordance with California Electrical Code and thickness.
 - 4. Average overall diameter of finished wire and cable.
 - 5. Minimum insulation resistance in megohms per 1000 feet at 30 degrees C ambient.
 - 6. Jacket composition and thickness.
 - 7. Total number of conductors per cable.
 - 8. Shield material (if any) and thickness.
 - 9. Conductor resistance and reactance in ohms per 1000 feet at 25 degrees C ambient.
 - 10. Conductor ampacities at 30 degrees C ambient air temperature and at 20 degrees C ambient earth temperature, and 100 percent load factor for 600V wire and cable.
- D. Field Quality Control Test Reports.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store cables on reels on elevated platforms in a dry location.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect cable from dirt, water, construction debris, and traffic.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers:
 - 1. Southwire Company.
 - 2. General Cable Technologies Corporation.
 - 3. Or equal.

2.02 LOW VOLTAGE CABLES

- A. Provide wire and cable with conductor material and insulation type as specified herein:
 - 1. All conductors must be copper.
 - 2. Use THHN/THWN stranded copper for all wet and dry interior locations.

3. Use XHHW stranded copper for all exterior locations, and underground circuit applications.
4. Grounding conductors: #6 AWG and larger must be stranded copper, bare soft drawn. #8 and smaller shall be solid or stranded copper with green insulation.
5. Comply with NEMA WC 70.
6. Flexible Metal clad (Type MC) wiring must not be used for general wiring purposes.

2.03 CONNECTORS AND SPLICES

- A. UL listed, factory-fabricated wiring connectors of size, ampacity rating, material, type, and class for application and service indicated.
- B. For #14 through #10 AWG wire sizes, provide insulated spring wire connectors or insulated compression connectors.
- C. For #8 wires, use pressure connectors with insulating sleeves.
- D. For #6 AWG and larger cable, use compression connectors using compression dies designed for the exact connector being used. Provide insulating sleeves manufactured specifically for the connector being used. Do not use split-bolt connectors.
- E. Use copper or copper alloy terminals and connectors for copper conductors:
- F. Wire or cable splices are not allowed in new construction.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine raceways and building for installation tolerances and other conditions affecting performance of wire and cable. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install wire and cable as indicated and according to manufacturer's recommendations. Use NECA's "National Electrical Installation Standards" where applicable.
- B. Pull Conductors: Use manufacturer-approved pulling compound or lubricant where necessary. Compound used must not deteriorate conductors or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
 1. Use pulling means including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
- C. For parallel conductors of a single phase, ensure that conductor lengths are equal by actual length comparison before installation.
- D. Minimum conductor size for lighting and power circuits shall be #12 AWG, and for control circuits #14 AWG, or as identified on Contract Drawings.
- E. Provide phase testing for proper rotation of all motors.

- F. All wire and cable must have their ends protected during installation by heat shrinkable end caps. Use 3M Type ICEL or Raychem equivalent.
- G. All wire and cable must be clearly identified at each end using embossed or engraved brass or stainless steel tags attached to the cables in each pull box, handhole or where stubbed into equipment.

3.03 CONNECTIONS

- A. Splices in raceways are not allowed. Splice only in junction or outlet boxes in accessible locations.
- B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use torque values specified in UL 486A and UL 486B:
 - 1. For bolted connections in equipment, mark lugs after torquing with red paint such that paint will be visibly disturbed if lugs are disturbed.

3.04 COLOR CODING AND PHASING

- A. Branch circuit conductors shall be black unless noted otherwise.
- B. Color code conductors for all feeders as indicated in subparagraphs below. Provide a 2" wide minimum band of colored plastic tape, Scotch No.35 all-weather vinyl, at terminations when colored insulation is not available:
 - 1. 480Y/277-Volt, 3-phase, 4-wire systems:

a.	Phase A (left or top)	Brown
b.	Phase B (center)	Orange
c.	Phase C (right or bottom)	Yellow
d.	Neutral	Gray
e.	Ground	Green
f.	Travelers	Pink
 - 2. 208Y/120-Volt, 3-phase, 4-wire systems:

a.	Phase A (left or top)	Black
b.	Phase B (center)	Red
c.	Phase C (right or bottom)	Blue
d.	Neutral	White
e.	Ground	Green
f.	Isolated ground	Green with yellow or orange stripe
g.	Travelers	Pink
 - 3. 120/240-Volt, 1-phase, 3-wire systems (non-standard):

a.	Phase A	Black
b.	Phase B	Red
c.	Neutral	White
d.	Ground	Green
- C. Control system color coding:

- | | | |
|----|-------------------------|------------|
| 1. | 120 VAC Control | Red |
| 2. | 120 VAC Control Neutral | White |
| 3. | DC Control (+) | Blue |
| 4. | DC Control (-) | Blue/White |
| 5. | Ground | Green |

3.05 IDENTIFICATION

- A. Identify wires and cables in accordance with Technical Specifications Section 26 05 53, Electrical Identification.
- B. Provide wire markers on each conductor in pull boxes, junction boxes and at all load connections.

3.06 FIELD QUALITY CONTROL

- A. Testing: Engage an independent electrical testing agency, at Contractor's expense, to perform field quality-control testing, in accordance with Technical Specifications Section 26 08 00 – Acceptance Testing, and as specified herein.
- B. Wire and Cable Tests: Test feeder and control circuits before they are placed in service:
 - 1. 600-Volt Power Cable: Megger testing for one half minute is required for all 600-volt insulated wire #2 AWG and larger using a 500-volt megger for 208- and 240-volt systems, and a 1000-volt megger for 480-volt systems. Test between phase conductors and from each conductor to ground before energizing service equipment, switchgear, switchboards, MCCs (including all connected motors) and panelboards. Determine the values with cable disconnected at both ends. Megger wire and cable only after installation, not on the cable reel. Replace cables that do not meet cable manufacturer's insulation resistance requirements.
 - a. Provide phasing tests:
 - (1) Test and make all changes necessary to assure proper rotation of all motors.
 - (2) Correct phasing and phase sequence of all circuits susceptible to being paralleled.
 - (3) Perform other such phasing tests as may be required for the equipment being connected under this Contract.
 - b. Using a volt/ohm meter, test all power conductors below #2 AWG for possible continuity to ground.
 - c. Measure insulation resistance between each conductor and ground.
 - (1) Minimum acceptable insulation resistance: (2) two Megaohms.
 - 2. Check all control wiring for tightness of terminal contacts and continuity (especially current transformer leads) through each "run" of control circuiting. Thoroughly verify all wiring by means of battery-powered lights, buzzers, bells, or telephones. After completing these continuity checks and tests on a given control circuit, attach a temporary cardboard tag on each end of cable tested which bears

the date and name of Contractor's representative responsible for checking. Follow this procedure for each control circuit cable.

3. Test all control circuits per NETA 7.3 requirements, including functional tests. Functional tests shall require complete written procedures to be submitted and approved prior to testing.
4. Correct deficiencies and retest to demonstrate compliance.

3.07 CLOSEOUT DOCUMENTATION

- A. Prepare closeout documentation in accordance with Technical Specifications Section 01 77 00, Closeout Procedures, and Technical Specifications Section 01 78 39, Project Record Documents, to include the following:
 1. Field Quality Control Tests.

END OF SECTION 26 05 19

SECTION 26 05 26 – GROUNDING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Grounding of electrical systems and equipment.
 - 1. Grounding requirements specified in this Technical Specifications Section may be supplemented by special requirements of systems described in other Technical Specifications Sections.

1.02 RELATED SECTIONS

- A. Technical Specifications Section 23 12 00, Fueling System, for fueling system electrical conduit and wiring to be “intrinsically safe”.
- B. Technical Specifications Section 26 05 00, Common Work Results for Electrical Work, for general electrical requirements.
- C. Technical Specifications Section 26 08 00, Acceptance Testing, for Work performed by an independent testing agency, at Contractor’s expense.

1.03 REFERENCES

- A. ASTM B8.
- B. NFPA 70 – National Electrical Code, with California amendments.
- C. ANSI/UL 467 - Grounding and Bonding Equipment.

1.04 QUALITY ASSURANCE

- A. Listing and Labeling: Provide electrical components, devices, and accessories that are Listed and Labeled in accordance with NFPA 70, Article 100, and marked for specific types, sizes, and combinations of conductors and connected items.
- B. Comply with IEEE 837 and UL 467.
- C. Comply with IEEE Std. 142 (Green Book).
- D. Comply with IEEE C2 for overhead-line construction and medium-voltage underground construction.
- E. Testing Agency Quality Assurance:
 - 1. In accordance with Technical Specifications Section 26 08 00 – Acceptance Testing.

1.05 SUBMITTALS

- A. Submittal procedures must be in accordance with the applicable provisions of:
 - 1. **Section 6.6 Contract Data Requirements**
 - 2. **Section 7.41 Product Options, Supplier Approval and Substitutions**
 - 3. **Section 7.43 Submittal of Shop Drawings, Product Data, and Samples**
 - 4. **Section 7.49.1 Certificates of Compliance**

5. Appendix B, Contract Data Requirements
- B. Product Data:
 1. Grounding conductors and cables.
 2. Grounding connectors.
 3. Grounding electrodes.
 4. Ground bus.
- C. Shop Drawings: Indicate electrical equipment grounding and bonding connections.
- D. Field quality control test reports.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers:
 1. Grounding Conductor Fittings:
 - a. Burndy.
 - b. O-Z/Gedney.
 - c. Raco, Inc.; Division of Hubbell.
 - d. Or equal.
 - e. Only copper/copper alloy fittings will be accepted.
 2. Grounding Connectors and Rods:
 - a. Burndy.
 - b. O-Z/Gedney.
 - c. Raco, Inc.; Division of Hubbell.
 - d. Or equal.

2.02 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Section 26 05 19, 600 Volt or Less Wire and Cable.
- B. Material: Copper.
- C. Equipment Grounding Conductors: Insulated with green-colored insulation.
- D. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.
- E. Grounding Electrode Conductors: Stranded cable.
- F. Bare Copper Conductors: Assembly of stranded conductors, ASTM B 8.
- G. Copper Bonding Conductors:
 1. Bonding Conductor: Stranded copper conductor, sized per drawings.
 2. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- H. Bonding Straps: Soft copper.

- I. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.

2.03 CONNECTORS

- A. Pressure Connectors: High-conductivity-plated units, copper or copper alloy. Dual-rated aluminum connectors are not allowed unless specified on the Contract Drawings.
- B. Bolted Connectors: Heavy-duty, bolted-pressure-type, copper or copper alloy. Dual-rated aluminum connectors are not allowed unless specified on the Contract Drawings.
- C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturers written instructions.
- D. Grounding Conductor Fittings: Copper/copper alloy.

2.04 GROUNDING ELECTRODES

- A. Ground Rods: Solid copper clad steel, 3/4-inch diameter by 10-foot length.
- B. Plate Electrodes: Minimum 0.10-inch thick copper.

2.05 GROUND BUS

- A. Ground Bus: 1/4 inch x 2-inch copper mounted on standoff insulators. Size and location as shown on Contract Drawings.

PART 3 - EXECUTION

3.01 APPLICATION

- A. Use copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone and similar materials.
- B. In raceways, use insulated equipment grounding conductors.
- C. Exothermic-Welded Connections: Use for connections to structural steel or as shown on the Drawings.
- D. Equipment Grounding Conductor Terminations: Use copper alloy Burndy Hyground compression connections or approved equal. Exothermic and split bolt connections are not allowed.
- E. Ground Rod Clamps at Manholes: Use bolted pressure clamps with at least two bolts.
- F. Grounding Bus: Install in locations as indicated:
 - 1. Use insulated spacer; space 1 inch from wall and support from wall 6 inches above finished floor, unless otherwise indicated.
 - 2. At doors, route the bus up to the top of the doorframe, across the top of the doorway, and down to the specified height above the floor.
- G. Ground Rod Connections: Use copper alloy Burndy Hyground compression connections or approved equal. Exothermic and split bolt connections are not allowed.

3.02 EQUIPMENT GROUNDING CONDUCTORS

- A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
- B. Install equipment grounding conductors in all feeders and branch circuits unless otherwise noted:
 - 1. Provide insulated equipment grounding conductors from the ground bus in all switchgear, switchboards, motor control centers and panel boards to all electrical equipment and devices.
- C. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.
- D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate equipment grounding conductor to each electric water heater, heat-tracing, and antifrost heating cable. Bond conductor to heater units, piping, connected equipment, and components.
- E. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide #4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location:
 - 1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4 inch x 2 inch x 12 inch grounding bus.
 - 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.03 IDENTIFICATION

- A. Identify grounding system components as required by the AHJ and as specified in Section 26 05 33, Electrical Identification.

3.04 FIELD QUALITY CONTROL

- A. Testing: Engage an independent electrical testing agency, at Contractor's expense, to perform field quality-control testing, in accordance with Technical Specifications Section 26 08 00, Acceptance Testing, and as follows:
 - 1. After installing grounding system but before permanent electrical circuitry has been energized, perform testing as follows:
 - a. Measure ground resistance without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Ground System Continuity: Test equipment enclosures, metallic conduits, metallic raceway supports.
 - c. Test resistance measurement:
 - (1) Perform the three-point method test per IEEE No.81 Section 9.03 to determine the ground resistance between the main grounding

system and all major electrical equipment frames, system neutral and/or derived neutral points.

- d. Test Requirements:
 - (1) 5 ohms or less.
 - e. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify VTA promptly and include recommendations to reduce ground resistance.
- B. Accompany the independent testing firm field service technician and assist as required during field tests.
- C. Provide as-built drawings locating each ground rod and ground rod assembly and other grounding electrodes:
- 1. Identify each ground rod by letter in alphabetical order, and key to the record of tests and observations.
 - 2. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results.

3.05 CLOSEOUT DOCUMENTATION

- A. Prepare closeout documentation in accordance with Technical Specifications Section 01 77 00, Closeout Procedures, and Technical Specifications Section 01 78 39, Project Record Documents, to include the following:
- 1. Field quality control tests.
 - 2. Ground rod assembly as-built drawings.

END OF SECTION 26 05 26

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SECTION 26 05 29 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Conduit fittings and supports.
- B. Formed steel channel.
- C. Spring steel clips.
- D. Sleeves.
- E. Mechanical sleeve seals.
- F. Equipment bases and supports.
- G. Seismic restraint system.

1.02 RELATED SECTIONS

- A. Technical Specifications Section 26 05 00, Common Work Results for Electrical, for general electrical requirements.

1.03 REFERENCES

- A. American Society of Testing Materials (ASTM):
 - 1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
 - 3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
- B. NFPA 70 - National Electrical Code, with California amendments.
- C. National Electrical Contractors Association (NECA):
 - 1. NECA 1 – Standard for Good Workmanship in Electrical Construction.
 - 2. NECA 101 – Standard for Installing Steel Conduit.
- D. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
 - 1. SMACNA R0010 - Guidelines for Seismic Restraints of Mechanical System and Plumbing Piping Systems.
 - 2. SMACNA R0003 - Superstrut Seismic Restraint System.
 - 3. SMACNA R0071 - Kin-Line Seismic Restraint System.
- E. Metal Framing Manufacturers Association (MFMA).

1.04 SUBMITTALS

- A. Submittal procedures must be in accordance with the applicable provisions of:
 - 1. **Section 6.6 Contract Data Requirements**

2. **Section 7.41 Product Options, Supplier Approval and Substitutions**
 3. **Section 7.43 Submittal of Shop Drawings, Product Data, and Samples**
 4. **Section 7.49.1 Certificates of Compliance**
 5. Appendix B, Contract Data Requirements
- B. Shop Drawings: Signed and sealed by a qualified California Professional Engineer (PE). Indicate system layout and installation details.
- C. Product Data:
- a. Hangers and Supports: Manufacturers catalog data including load capacity.
- D. Manufacturer's Installation Instructions:

1.05 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

1.06 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Channel Supports
1. Unistrut
 2. Superstrut
 3. Or equal
- B. Fasteners
1. Steel City
 2. T&B
 3. Or equal
- C. Expansion Bolts
1. Hilti Red Head
 2. Or equal

2.02 CONDUIT SUPPORTS

- A. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.
- B. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.
- C. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.
- D. Conduit clamps - general purpose: One hole malleable iron for surface mounted conduits.
- E. Cable Ties: High strength nylon temperature rated to 185 °F. Self-locking type.

2.03 SLEEVES

- A. Sleeves for conduit through walls: Prefabricated sleeves including seals, UL listed.

2.04 MECHANICAL SLEEVE SEALS

- A. Manufacturers:
 - 1. Thunderline Link-Seal, Inc.
 - 2. NMP Corporation
 - 3. Or equal
- B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.05 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA, metal framing standards publication.
 - 1. Manufacturers:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. Unistrut; Tyco International, Ltd.
 - d. Or equal.
 - 2. Metallic Coatings: Hot-dip galvanized after fabrication.
 - 3. Channel Dimensions: Select for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs must have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body must be malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Use 304 stainless steel for all applications.
 - b. Manufacturers:
 - (1) Hilti Inc.
 - (2) ITW Ramset/Red Head.
 - (3) Simpson Strong-Tie.
 - (4) Or equal.
 - 2. Mechanical-Expansion Anchors: Insert-wedge-type expansion anchor for use in hardened Portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Use 304 Stainless Steel for all applications.
 - b. Manufacturers:
 - (1) Cooper B-Line, Inc.
 - (2) Hilti Inc.
 - (3) ITW Ramset/Red Head.
 - (4) Or equal.
 - 3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 - 4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A325.
 - 5. Toggle Bolts: All-steel springhead type.
 - 6. Hanger Rods: Threaded steel.

2.06 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of fire stopping material.
- B. Remove incompatible materials affecting bond.
- C. Install backing or damming materials to arrest liquid material leakage.
- D. Do not cut structural members.

3.02 INSTALLATION - HANGERS AND SUPPORTS

- A. Anchors and Fasteners:
 - 1. Concrete Structural Elements: Provide precast inserts, expansion anchors.
 - 2. Steel Structural Elements: Provide beam clamps, steel ramset fasteners, and welded fasteners.
 - 3. Concrete Surfaces: Provide expansion anchors.
 - 4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide toggle bolts and hollow wall fasteners.
 - 5. Solid Masonry Walls: Provide expansion anchors and preset inserts.
 - 6. Sheet Metal: Provide sheet metal screws.
- B. Inserts:
 - 1. Install inserts for placement in concrete forms.
 - 2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
 - 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 - 5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut.
- C. Install conduit and raceway support and spacing in accordance with NFPA 70 .
- D. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
- E. Install multiple conduit runs on common hangers.
- F. Supports:
 - 1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength

and rigidity. Install spring lock washers under nuts.

2. Install surface mounted cabinets and panel boards with minimum of four anchors.
3. In wet and damp locations install steel channel supports to stand cabinets and panel boards 1 inch off wall.
4. Support vertical conduit at every floor.

3.03 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

- A. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.
- B. Install surface-mounted cabinets and panel boards with minimum of four anchors.
- C. Construct supports of structural steel or formed steel channel. Brace and fasten with flanges bolted to structure.
- D. Support Installation:
 1. Comply with NECA 1 and NECA 101.
 2. Strength of Support Assemblies: Select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
 3. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods:
 - a. To New Concrete: Anchor bolt to concrete inserts.
 - (1) Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - (2) Install anchor bolts to elevations required for proper attachment to Supported equipment.
 - (3) Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - b. To Masonry: Toggle-type bolts on hollow masonry units; Expansion anchor fasteners on solid masonry units.
 - c. To Existing Concrete: Expansion anchor fasteners.
 - (1) Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.

- d. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
 - e. To Light Steel: Sheet metal screws.
 - 4. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.
- E. Installation of Fabricated Metal Supports
 - 1. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- F. Painting
 - 1. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting.
 - 2. Paint all new exposed hangers and supports for electrical system in accordance with Technical Specifications Section 09 91 23, Painting.

3.04 INSTALLATION – SLEEVES

- A. Exterior watertight entries: Seal with adjustable interlocking rubber links.
- B. Conduit penetrations not required to be watertight: Sleeve and fill with silicon foam.
- C. Set sleeves in position in forms. Provide reinforcing around sleeves.
- D. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- E. Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with fire stopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- F. Install escutcheons at finished surfaces.

END OF SECTION 26 05 29

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SECTION 26 05 33 – RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Rigid galvanized steel conduit and fittings.
- B. Liquid-tight flexible metal conduit and fittings.
- C. Boxes, enclosures and cabinets.

1.02 RELATED SECTIONS

- A. Technical Specifications Section 23 12 00, Fueling System, for fueling system electrical conduit and wiring to be “intrinsically safe”.
- B. Technical Specifications Section 26 05 00, Common Work Results for Electrical, for general electrical requirements.
- C. Technical Specifications Section 26 08 00, Acceptance Testing, for Work performed by an independent testing agency, at Contractor’s expense.

1.03 REFERENCES

- A. ANSI C80.1 – Rigid Steel Conduit, Zinc Coated.
- B. ANSI C80.3 – Electrical Metallic Tubing, Zinc Coated.
- C. NECA – National Electrical Installation Standards.
- D. NEMA FB 1 – Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
- E. NEMA TC 3 – PVC Fittings for Use with Rigid PVC Conduit and Tubing.
- F. NFPA 70 – National Electrical Code, with California amendments.

1.04 QUALITY ASSURANCE

- A. Listing and Labeling: Provide raceways that are listed and labeled by a testing agency, for the locations and environment the raceways are being installed, in accordance with NFPA 70, Article 100, and acceptable to the Authority Having Jurisdiction.
- B. Comply with NECA’s “National Electrical Installation Standards”.

1.05 SUBMITTALS

- A. Submittal procedures must be in accordance with the applicable provisions of:
 - 1. **Section 6.6 Contract Data Requirements**
 - 2. **Section 7.41 Product Options, Supplier Approval and Substitutions**
 - 3. **Section 7.43 Submittal of Shop Drawings, Product Data, and Samples**
 - 4. **Section 7.49.1 Certificates of Compliance**
 - 5. Appendix B, Contract Data Requirements

- B. Product Data:
 - 1. Raceways and associated fittings.
 - 2. Boxes and enclosures.

1.06 COORDINATION

- A. Raceway locations shown on the Contract Drawings are diagrammatic representations only, unless such locations are specifically dimensioned on the Contract Drawings. Raceway locations may be adjusted in the field to avoid conflicts. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, access, and regulatory compliance.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Provide conduit systems in conformance with the definition given in Article 100 of the NEC, and in accordance with UL and applicable NEC articles.
- B. Provide conduit as shown on the "Conduit Schedule" in the Contract Drawings.
- C. Provide all necessary conduit for splices, taps, wire pulling, equipment connections, and as required for a complete wiring system.

2.02 RIGID GALVANIZED STEEL CONDUIT

- A. Type: ANSI C80.1 hot-dip galvanized inside and outside after factory threading.
- B. Minimum size: ¾-inch, unless otherwise specified in the Contract Drawings.
- C. Fittings: Standard as manufactured for conduit, either self-sealing type or sealed with sealing compounds.

2.03 ELECTRICAL METALLIC TUBING

- A. Not Used.

2.04 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

- A. Type: Formed from spirally wound galvanized steel strip with successive convolutions securely interlocked, jacketed with liquid tight plastic cover.
- B. Minimum Size: ¾ inch, unless otherwise required in order to connect to new or existing equipment.
- C. Fittings: Cadmium-plated malleable iron body and gland nut, brass grounding ferrule threaded to engage conduit spiral and O-ring seals around the conduit and box connection and insulated throat. Furnish 450 and 900 fittings where applicable.
- D. Maximum Length: 24 inches or as noted in the Contract Drawings.

2.05 FITTINGS

- A. Unions:
 - 1. PVC coated galvanized steel.

- B. Locknuts:
 - 1. For 3/4-Inch Through 1-1/2-Inch Conduit: Extra heavy galvanized steel.
 - 2. For Conduit Greater Than 1-1/2 Inches: Galvanized malleable iron.
- C. Bushings:
 - 1. Type: Galvanized steel or galvanized malleable iron with a molded phenolic or nylon insulating collar.
 - 2. Furnish grounding bushings with separate lugs for ground conductor attachment and set screw for securely locking the bushing to the conduit.
- D. Bushed Openings:
 - 1. Provide bushed openings for protection of cables passing through metal barriers.
 - 2. Type: All-phenolic.
- E. Conduit Bodies:
 - 1. Type: Oblong, round or rectangular PVC coated, galvanized steel.
 - 2. Fittings: Galvanized steel, integrally cast threaded hubs with a minimum of 4-thread contact on securing.
 - 3. Covers: Material similar to the body and secured to the body by stainless steel machine screws. Provide full body neoprene gaskets with the cover.
- F. Weathertight Connectors:
 - 1. Furnish weathertight connectors (hubs) for conduit attachment to NEMA 12 or NEMA 3R enclosures.
 - 2. Type: Galvanized steel, galvanized malleable iron or stainless steel with an O-ring gasket and grounding face.
- G. Liquidtight Connectors:
 - 1. Provide liquidtight connectors for attachment of liquidtight flexible conduit to enclosures and fixtures.
 - 2. Type: PVC coated galvanized steel or galvanized malleable iron with O-ring gasket and approved grounding insert.
 - 3. Use angle connectors where required.
- H. Expansion Fittings:
 - 1. Exposed Runs:
 - a. Type: Weatherproof and provided with an external bonding jumper.
 - b. Movement: 4 inches longitudinal.
 - c. Provide bushings on each end of the conduit entering the fitting.
 - 2. Embedded Runs:

- a. Type: Watertight, furnished with an internal bonding jumper.
- b. Expansion Material: Neoprene.
- c. Movement: 3/4-inch in any direction.

2.06 PULL BOXES AND ENCLOSURES

- A. Rating: NEMA 250, Type 4X.
 - 1. Pull Box and Enclosure Material: 304 Stainless steel.
 - 2. Dimensions: Refer to Contract Drawings.
- B. Provide each box with a grounding terminal of either a green colored washer in head machine screw not smaller than No. 10-32 in a drilled, tapped and threaded hole in the back of the box, or a grounding bushing with a green colored machine screw attached to one of the conduits. Provide grounding jumpers as specified in Technical Specifications 26 05 26 - Grounding.
- C. Gaskets: Cellular neoprene gasket, 1/8 inch thickness. If box or enclosure is preassembled with foam or similar gasket, remove original gasket and replace with neoprene gasket kit according to instructions provided with the neoprene gasket kit.

2.07 JUNCTION BOXES

- A. Junction Box Material: Hot-dip galvanized steel.
- B. Dimensions: Refer to Contract Drawings.
- C. Provide each box with a grounding terminal of either a green colored washer in head machine screw not smaller than No. 10-32 in a drilled, tapped and threaded hole in the back of the box, or a grounding bushing with a green colored machine screw attached to one of the conduits. Provide grounding jumpers as specified in Technical Specifications 26 05 26 - Grounding.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Exposed Conduit:
 - 1. Welding, brazing or otherwise heating of the conduit is not allowed. Do not use plumber's perforated hanger iron for securing or bonding of conduit, devices or equipment.
 - 2. Surface Run:
 - a. Type: GRS unless otherwise indicated.
 - b. Run exposed conduit on supports spaced not more than 8-feet apart. Install with runs parallel or perpendicular to walls, structural members or intersections of vertical planes and ceiling.
 - c. Install no closer than 6 inches to any object operating above the rated temperature of the insulation of the conductor within the conduit.

- d. Provide support within 3-feet of each outlet box, junction box, device box, cabinet, conduit body, or other conduit termination.
3. Supported directly from a flat surface:
 - a. Spacing: At least 3/4-inch from the surface using framing channel.
 - b. Support vertically-suspended conduit with galvanized wrought steel pipe rings.
 - c. Where three or more conduits are vertically suspended, provide suitable steel racks designed; subject to loading approval by VTA.
4. Secure racks and individual conduit supports to concrete surfaces by means of two-unit stainless steel expansion anchors. Do not use wooden plugs, plastic inserts or gunpowder-driven inserts as a base to secure conduit supports.
5. Do not use the same pull box for two or more conduit runs of different systems. Install cast pull boxes where required for ease of pulling, even though not shown on the Drawings.
6. Avoid bends and offsets where possible, but where necessary, make with an approved hickey or suitable conduit bending machine.
7. Provide cast-metal fittings or symmetrical bends for turns.
8. Except as otherwise shown on the Drawings, terminate conduit in junction boxes, outlet boxes or panels with proper fittings. Terminate conduit feeding free-standing panels and cabinets from below in clear wiring space within the panel interior wiring space and terminate with a grounding bushing.
9. Ground all conduits in accordance with Technical Specifications Section 26 05 26, Grounding.
10. Secure entrances to NEMA 1 sheet-steel boxes or cabinets by locknuts on both the interior and exterior of the device and provide an insulating bushing installed over the conduit end.
11. Terminate conduit entering NEMA 12 or JIC boxes with a rain tight hub having an insulating liner.
12. Provide five full threads of contact for conduit terminated in NEMA 4 or other cast boxes.
13. Make joints with standard couplings or specified unions. Do not use running threads in lieu of conduit nipples. Do not use excessive thread on any conduit.
14. Field cuts: Square, reamed and threaded with straight threads.
15. Make up conduit joints with a conductive corrosion inhibitor such as T&B Kopr Shield to the male threads only.
16. Flexible Conduit:

- a. Where flexibility is required for electrical raceways on equipment, furnish and install liquid-tight conduit in accordance with JIC standards and these Contract Documents.
 - b. Maximum length: 24 inches unless otherwise shown on the Drawings.
17. Apply end caps to conduit to prevent the lodging of dirt, concrete or trash in the conduit, fittings and boxes during the course of installation.
18. Paint all new conduit, tubing, fittings and supports in accordance with Technical Specifications Section 09 91 23, Painting.
- B. Wall Penetrating:
- 1. Core drill individual conduit wall penetrations. Obtain approval for penetration locations and sizes from VTA prior to drilling.
 - 2. Penetrations at Fire Rated Construction: Seal all penetrations of fire rated walls using firestopping material in compliance with an applicable UL-listed assembly, to full thickness of the penetrated elements.

3.02 INSPECTION AND TESTING

- A. Clean completed conduit runs with plug or mandrel swab before installation of cable, and inspect for completeness including hangers. Perform inspection after cable is installed to verify that covers, gaskets and screws are in place and properly tightened. Verify ground connections as applicable.

END OF SECTION 26 05 33

SECTION 26 05 43 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Conduit, ducts, and duct accessories for direct-buried, concrete-encased duct banks, hand holes, and boxes.

1.02 RELATED SECTIONS

- A. Technical Specifications Section 23 12 00, Fueling System, for fueling system electrical conduit and wiring to be “intrinsically safe”.
- B. Technical Specifications Section 26 05 00, Common Work Results for Electrical, for general electrical requirements.
- C. Technical Specifications Section 26 05 19, 600 Volt or Less Wire and Cable.
- D. Technical Specifications Section 26 08 00, Acceptance Testing, for Work performed by an independent testing agency, at Contractor’s expense.

1.03 DEFINITIONS

- A. RNC: Rigid nonmetallic conduit.

1.04 REFERENCES

- A. Comply with the following Standards:
 - 1. ASTM
 - 2. ANSI
 - 3. NFPA
 - 4. NEMA
 - 5. Society of Cable Telecommunications Engineers (SCTE)
 - 6. International Organization for Standardization (ISO)
 - 7. National Institute of Standards and Technology (NIST)
 - 8. American Association of state Highway and Transportation Officials (AASHTO)

1.05 SUBMITTALS

- A. Submittal procedures must be in accordance with the applicable provisions of:
 - 1. **Section 6.6 Contract Data Requirements**
 - 2. **Section 7.41 Product Options, Supplier Approval and Substitutions**
 - 3. **Section 7.43 Submittal of Shop Drawings, Product Data, and Samples**
 - 4. **Section 7.49.1 Certificates of Compliance**
 - 5. Appendix B, Contract Data Requirements
- B. Product Data:

1. Ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
 2. Accessories for hand holes, boxes, and other utility structures.
 3. Warning tape.
- C. Field quality control test reports.

1.06 QUALITY ASSURANCE

- A. Comply with ANSI C2.
- B. Comply with NFPA 70, National Electrical Code, with California amendments.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver ducts to Worksite with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.
- B. Store precast concrete and other factory-fabricated underground utility structures at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.
- C. Lift and support precast concrete units only at designated lifting or supporting points.

1.08 COORDINATION

- A. Coordinate layout and installation of ducts, hand holes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field.
- B. Coordinate elevations of ducts and duct-bank entrances into hand holes, and boxes with final locations and profiles of ducts and duct banks as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to hand holes, and as approved by Architect.

PART 2 - PRODUCTS

2.01 CONDUIT

- A. PVC coated rigid galvanized steel, in accordance with NEMA Standards Publication RN 1.
 1. PVC coated rigid galvanized steel conduit must be used for all direct burial in earth installations. Galvanizing must be achieved by the hot dip method.
- B. Manufacturers:
 1. Calbond Coated Conduit and Fittings, Inc.
 2. Thomas & Betts; ABB Group.
 3. Or equal.

2.02 NONMETALLIC DUCTS AND DUCT ACCESSORIES

- A. Manufacturers:
 1. Beck - Anvil International.

2. Cantex, Inc.
 3. IPEX Inc.
 4. Or equal.
- B. Duct Accessories:
1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, and selected to provide minimum duct spacings indicated while supporting ducts during concreting or backfilling.
 2. Warning Tape: Underground-line warning tape specified in Technical Specifications Section 26 05 53, Electrical Identification.

2.03 PRECAST CONCRETE HANDHOLES AND BOXES

- A. Manufacturers:
1. Christy Concrete Products.
 2. Oldcastle Infrastructure.
 3. Riverton Concrete Products; a division of Cretex Companies, Inc.
 4. Or equal.
- B. Comply with ASTM C 858 for design and manufacturing processes.
- C. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated on Contract Drawings. Frame and cover must form top of enclosure and must have load rating consistent with that of hand hole or box.
1. Frame and Cover: Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
 2. Frame and Cover: Weatherproof steel frame, with steel cover with recessed cover Hook eyes and tamper-resistant, captive, cover-securing bolts.
 3. Frame and Cover: Weatherproof steel frame, with hinged steel access door assembly with tamper-resistant, captive, cover-securing bolts.
 - a. Cover Hinges: Concealed, with hold-open ratchet assembly.
 - b. Cover Handle: Recessed.
 4. Frame and Cover: Weatherproof aluminum frame with hinged aluminum access door assembly with tamper-resistant, captive, cover-securing bolts.
 - a. Cover Hinges: Concealed, with hold-open ratchet assembly.
 - b. Cover Handle: Recessed.
 5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 6. Cover Legend: Molded lettering, "ELECTRIC."
 7. Configuration: Units must be designed for flush burial and have open bottom, unless otherwise indicated.

8. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.
 - a. Extension must provide increased depth of 12 inches.
 - b. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.
9. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks plus an additional 12 inches vertically and horizontally to accommodate alignment variations.
 - a. Windows must be located no less than 6 inches from interior surfaces of walls, floors, or frames and covers of hand holes, but close enough to corners to facilitate racking of cables on walls.
 - b. Window opening must have cast-in-place, welded wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
 - c. Window openings must be framed with at least two additional No. 4 steel reinforcing bars in concrete around each opening.
10. Duct Entrances in Hand Hole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
 - a. Type and size must match fittings to duct or conduit to be terminated.
 - b. Fittings must align with elevations of approaching ducts and be located near interior corners of hand holes to facilitate racking of cable.
11. Hand holes 12 inches wide by 24 inches long and larger must have inserts for cable racks and pulling-in irons installed before concrete is poured.

PART 3 - EXECUTION

3.01 UNDERGROUND DUCT APPLICATION

- A. Ducts for Electrical Feeders 600 V and Less: PVC Coated GRS, NEMA Type, in protective slurry backfill, unless otherwise indicated on Contract Drawings.
- B. Ducts for Electrical Branch Circuits: PVC Coated GRS, NEMA Type, in protective slurry backfill, unless otherwise indicated on Contract Drawings.

3.02 UNDERGROUND ENCLOSURE APPLICATION

- A. Hand holes and Boxes for 600 V and Less, Including Telephone, Communications, and Data Wiring:
 1. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Non-deliberate Loading by Heavy Vehicles: Precast concrete, AASHTO HB 17, H- 20 structural load rating.
 2. Units in Sidewalk and Similar Applications with a Safety Factor for Non-deliberate Loading by Vehicles: Precast concrete, AASHTO HB 17, H-10 structural load rating. Resin, structurally tested according to SCTE 77 with 3000-lbf vertical loading.

3.03 EARTHWORK

- A. Excavation and Backfill: Do not use heavy-duty, hydraulic-operated, compaction equipment.
- B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated.
- C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other Work.
- D. Cut and patch existing pavement in the path of underground ducts and utility structures.

3.04 DUCT INSTALLATION

- A. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and hand holes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes to drain in both directions.
- B. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius 5 times the conduit diameter or 48 inches whichever is greater, both horizontally and vertically, at other locations, unless otherwise indicated.
- C. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.
- D. Duct Entrances to Concrete and Polymer Concrete Hand holes: Use end bells, spaced approximately 10 inches on center for 5-inch ducts, and vary proportionately for other duct sizes.
 - 1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line.
 - 2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to hand hole.
 - 3. Grout end bells into structure walls from both sides to provide watertight entrances.
- E. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.
- F. Pulling Cord: Install 100-lbf- test nylon cord in ducts, including spares.
- G. Minimum Space between Ducts: 3 inches between ducts and exterior envelope wall, 2 inches between ducts for like services, and 4 inches between power and signal ducts.
- H. Depth: Install top of duct bank at least 36 inches below finished grade, unless otherwise indicated. Duct Banks must be laid so as to slope towards manholes with a drop of at least 3 inches per one hundred feet unless otherwise noted in the Contract Drawings.
- I. Stub-Ups: Use manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Extend concrete encasement throughout the length of the elbow.

- J. Warning Tape: Provide 6" wide red polyethylene with wording "Caution Electrical Lines Below" warning tape. Bury warning tape approximately 12 inches above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches of the centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

3.05 INSTALLATION OF CONCRETE HANDHOLES, AND BOXES

- A. Precast Concrete Hand hole Installation:
 - 1. Comply with ASTM C 891, unless otherwise indicated.
 - 2. Install units level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.
 - 3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- B. Elevations:
 - 1. Hand Hole Covers: In paved areas and traffic ways, set surface flush with finished grade. Set covers of other hand holes 1 inch above finished grade.
 - 2. Where indicated, cast hand hole cover frame integrally with hand hole structure.
- C. Hardware: Install removable hardware, including pulling eyes, cable stanchions, and cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.
- D. Field-Installed Bolting Anchors in Concrete Hand holes: Do not drill deeper than 2 inches for hand holes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

3.06 GROUNDING

- A. Ground underground ducts and utility structures in accordance with Technical Specifications Section 26 05 26, Grounding.

3.07 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections and prepare test reports:
 - 1. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out- of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
 - 2. Test hand hole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 26 05 26, Grounding and Bonding for Electrical Systems.
- B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.08 CLEANING

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- B. Clean internal surfaces of manholes, including sump. Remove foreign material.

3.01 CLOSEOUT DOCUMENTATION

- A. Prepare closeout documentation in accordance with Technical Specifications Section 01 77 00, Closeout Procedures, and Technical Specifications Section 01 78 39, Project Record Documents, to include the following:
 - 1. Field Quality Control Tests.

END OF SECTION 26 05 43

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SECTION 26 05 53 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Identification of electrical materials, equipment, and installations.

1.02 RELATED SECTIONS

- A. Technical Specifications Section 26 05 00, Common Work Results for Electrical, for general electrical requirements.
- B. Technical Specifications Section 26 08 00, Acceptance Testing, for labeling to be attached upon satisfactory completion of testing.

1.03 REFERENCES

- A. ANSI/IEEE C2 National Electrical Safety Code.
- B. NFPA 70 – National Electrical Code, with California amendments.

1.04 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Comply with ANSI C2.

1.05 SUBMITTALS

- A. Submittal procedures must be in accordance with the applicable provisions of:
 - 1. **Section 6.6 Contract Data Requirements**
 - 2. **Section 7.41 Product Options, Supplier Approval and Substitutions**
 - 3. **Section 7.43 Submittal of Shop Drawings, Product Data, and Samples**
 - 4. **Section 7.49.1 Certificates of Compliance**
 - 5. Appendix B, Contract Data Requirements
- B. Product Data:
 - 1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of label.
- C. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions.
- D. Identification Schedule: For each piece of electrical equipment and electrical system components.

PART 2 - PRODUCTS

2.01 LABELS

- A. Manufacturer's standard products with colors prescribed by ANSI A13.1, NFPA 70, and this Technical Specification Section. Refer to table and descriptions in subparagraphs below for acceptable labeling methods:

Cerone Division Emergency Generator Replacement
Contract C19010

TITLE	LABEL TYPES														
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Grounding						X									
600-Volt or Less Wire & Cable		X													
Medium-Voltage Cables							X								
Raceway and Boxes	X			X											
Wiring Devices				1/4											
Enclosed Switches & Circuit Breaker		5/8													
Enclosures, Pull Boxes, Motor-Control Centers		5/8													
Motor Controllers		3/8													
Low-Voltage Busway												X	X		

* Refer to nameplate schedules on contract documents for nameplate sizes. Unless indicated otherwise on the contract drawings or specifications, these nameplates shall be provided by the equipment supplier.

Label Type	Description
A	Black felt-tip permanent marker in dry unfinished locations.
B	Flexible, preprinted pre-tensioned wraparound plastic sleeves sized to suit the diameter of the wire it identifies and arranged to stay in place by pre-tensioned gripping action when placed in position.
C	Engraved melamine plastic laminate flat stock, 1/16 inch minimum thickness for sizes up to 15 square inches. Use 1/8-inch minimum for sizes larger than 20 square inches. Black with white letters for normal power systems and red with white letters for emergency power systems, with height as shown in table above unless specified otherwise. UV-inhibited when used outdoors. Secure with stainless steel drive screws, stainless steel self-tapping screws or stainless steel oval-head 6-32 screws tapped into enclosure, or with stainless steel bolts with elastic stopnut.
D	Same as 'C', except engraved metal flat stock, riveted in place.
E	Adhesive-backed plastic machine-printed labels, white with black letters in finished areas.
F	Plain-colored vinyl adhesive tape, 3-mil minimum by 1 inch wide minimum. Apply 1/2-inch minimum over-wrap through 2-inch minimum length.
G	Melamine plastic laminate flat stock, 1/16" minimum thickness. All corners shall be rounded off. White background with black letters. Text shall be 60 pt. Arial font.
H	Not used.
I	Warning signs: Baked Enamel on aluminum plate, 0.040-inch minimum thickness. OSHA standard wording where approved. Custom wording if required. Secure with non-corrosive fasteners.

- J** Stainless-steel machine or hand-stamped wire marker plates with one hole at Neach end for attachment with non-corrosive fasteners that do 0.010-inch minimum thickness. (Reference Panduit MMP350-C series).
- K** Adhesive-backed metal labels manufactured with testing agency logo. Punched or engraved with actual settings and date.
- L** Stainless steel machine or hand-stamped wire marker plates with one hole at each end for attachment with non-corrosive fasteners that do 0.010-inch minimum thickness. (Reference Panduit MMP350-C series).
- M** Adhesive machine-printed plastic tape, cut to length, black with white letters unless specified otherwise. 3/8 inch minimum width of tape in unfinished areas only. (Reference Dymo System).

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install identification labels in accordance with manufacturer's written installation instructions.
- B. Install labels where indicated. Locate for optimum viewing and without interference with the operation and maintenance of equipment.
- C. Coordinate names, abbreviations, colors, graphics and other designations used for electrical identification with corresponding designations used in the Contract Documents. Use consistent designations throughout the project. Labeling abbreviations is not allowed.
- D. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work.
- E. Clean surfaces of dust, loose material, and oily films before applying painted or self-adhesive identification products.
- F. Affix permanent type nameplate or tag on all field-mounted instruments, transmitters, pressure gauges, and control valves with proper identification number and service description:
 - 1. Provide 3"x 1" aluminum or stainless steel tag stamped with the instrument loop number designation and the calibrated range.
- G. Conductor Identification:
 - 1. Conductors to Be Extended in the Future: Indicate source and circuit numbers.
 - 2. Multiple Power or Lighting Circuits in the Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color coding for voltage and phase indication of secondary circuit.
 - 3. Multiple Control and Communications Circuits in the Same Enclosure: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color coding, or cable marking tape.
- H. Warning, Caution, and Instruction Signs:

1. Install warning, caution, and instruction signs to ensure safe operation and maintenance of electrical systems and of items to which they connect.
 2. Provide arc-flash warning labeling, including a description of the personal protective equipment (PPE) required for maintenance worker protection at electrical enclosures.
 3. Emergency-Operating Signs: Install engraved laminate signs with white legend on red background with minimum 3/8-inch high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.
- I. Except as indicated in the Label Types table in Part 2 of this Technical Specifications Section, apply equipment identification labels of engraved plastic laminate on each major unit of equipment, including central or master unit of each system. This includes communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification. Except as otherwise indicated, provide a single line of text with 1/4-inch high lettering on 1-inch high label. Use white lettering on black field. Apply labels parallel to equipment lines.
 - J. Apply instrument labels on all field-mounted instruments, transmitters, pressure gauges and control valves.
 - K. Apply short circuit and other marking labels to all industrial control panels per NEC Article 409.

END OF SECTION 26 05 53

SECTION 26 08 00 - ACCEPTANCE TESTING

PART 1 - GENERAL

1.01 WORK INCLUDES

- A. This Section includes requirements for acceptance testing by a NETA certified independent testing agency, at Contractor expense.

1.02 RELATED SECTIONS

- A. Technical Specifications Section 26 05 00, Common Work Results for Electrical, for general electrical requirements.

1.03 APPLICABLE PUBLICATIONS

- A. All inspections and tests must be in accordance with the following applicable standards and codes. These publications form a part of this specification to the extent referenced.
 1. National Electrical Code – NEC.
 2. American National Standards Institute – ANSI.
 3. National Fire Protection Association – NFPA.
 4. Occupational Safety and Health - OSHA 29CFR Part 1910.269.
 5. International Electrical Testing Association – NETA.
 6. State and Local Codes and Ordinances.
 7. National Electrical Safety Code (NESC).

1.04 TESTING FIRM QUALITY ASSURANCE

- A. Except where otherwise specified for certain power equipment the testing firm must be an independent testing organization which can function as an unbiased testing authority, professionally independent of the project design, equipment manufacturer, supplier and installer of equipment or system, and regularly engaged in the testing of electrical equipment, devices, installations and systems. The testing firm shall:
 1. Be a full-service electrical testing company in business for a minimum of 10 years.
 2. Meet OSHA criteria for accreditation of testing laboratories, Title 29, Part 1907, or be a full member company of the International Electrical Testing Association (NETA).
 3. Have at least one full-time registered Professional Engineer (PE) on its staff.
- B. Testing Firm's Field Supervisor Qualifications: A person, regularly employed by the firm for testing services and currently certified by the NETA to supervise on-site testing specified.

1.05 GENERAL REQUIREMENTS

- A. General Scope: Testing firm shall perform quality control inspections and tests as specified herein:

1. Testing firm shall provide all material, equipment, labor and technical supervision to perform all tests and inspections to determine suitability of equipment for energization and continued reliable operation.
2. The purpose of these tests is to assure that all tested electrical equipment is operational within industry and manufacturer's tolerances and that equipment is installed and functioning in the system in accordance with the Contract Documents.
3. Testing firm shall inspect and test the following equipment:
 - a. Refer to each Division 26 Technical Specifications section.

1.06 SUBMITTALS

- A. Submittal procedures must be in accordance with the applicable provisions of:
 1. **Section 6.6 Contract Data Requirements**
 2. **Section 7.41 Product Options, Supplier Approval and Substitutions**
 3. **Section 7.43 Submittal of Shop Drawings, Product Data, and Samples**
 4. **Section 7.49.1 Certificates of Compliance**
 5. Appendix B, Contract Data Requirements
- B. Independent Testing Agency Qualifications, NETA certified.

1.07 DIVISION OF RESPONSIBILITY

- A. Contractor will perform routine insulation-resistance, continuity, and rotation tests for all distribution and utilization equipment prior to, and in addition to tests performed by the independent testing firm.
- B. Contractor will supply a suitable and stable source of electrical power to each test site. The testing firm shall determine the specific power requirements.
- C. Contractor will notify the testing firm when equipment becomes available for acceptance tests. Coordinate work to expedite project scheduling.
- D. Testing firm will notify VTA prior to commencement of any testing.

1.08 SAFETY

- A. Adhere to safety procedures as required by the following:
 1. Occupational Safety and Health Act.
 2. Accident Prevention Manual for Industrial Operations, National Safety Council.
 3. ANSI/NFPA 70E, Electrical Safety Requirements for Employee Workplaces.
 4. American National Standards for Personnel Protection: Lockout/Tagout.
 5. Applicable state and local safety operating procedures.
- B. Perform all tests with apparatus de-energized, except where specifically required.
- C. Designate a project safety representative to supervise operations with respect to safety.

PART 2 - PRODUCTS

2.01 TEST EQUIPMENT

- A. Utilize test equipment in good mechanical and electrical condition with shape and frequency output waveforms appropriate for the test and the tested equipment:
 - 1. Accuracy must be appropriate for the test being performed, but not in excess of 2% of the scale being used.
- B. Field test meters used to check installed power system instrument calibration must have accuracy higher than that of the instrument being checked.

2.02 TEST INSTRUMENTS AND CALIBRATION

- A. Testing firm must have a calibration program which assures that all applicable test instruments are maintained within rated accuracy as dictated by the National Institute of Standards and Technology (NIST):
 - 1. Instruments calibration schedule:
 - a. Field instruments: Analog, 6 months maximum; Digital, 12 months maximum.
 - b. Laboratory instruments - 12 months.
 - c. Leased specialty equipment - 12 months (where lessor guarantees accuracy).
 - 2. Provide visible dated calibration labels on all test equipment.
 - 3. Maintain up-to-date instrument calibration instructions and procedures for each test instrument.
- B. Testing firm must provide all testing equipment required including, but not limited to, the following:
 - 1. Wet and dry-bulb thermometer.
 - 2. 500V, 1000V, meggers.
 - 3. Battery-powered portable telephone sets.
 - 4. Multimeter (Volts-Ohms-Millimeter) rated 20k ohms per volt or higher.
 - 5. Three-phase rotation meter, 60-Hz.
 - 6. Miscellaneous cable, test leads, jumpers, test lights, buzzers, bells, switches, plugs, receptacles, and other test equipment as required.
 - 7. Insulation Tester (Megger): 2,000 Megohms for 600V and below. Use appropriate rated megger for tests on MV systems prior to Hi- Pot.
 - 8. Dranetz, BMI Model 355, Fluke 41 or equivalent recording type harmonic analyzer to display individual and total harmonic currents and voltages.
 - 9. Clamp-on ammeter.
 - 10. Circuit breaker current injections test set.

2.03 TEST REPORT

- A. Include the following:
 - 1. Refer to Technical Specifications Section 01 78 39, Project Record Documents, Part 3.02, Reports and Documents.

PART 3 - EXECUTION

3.01 TESTING

- A. General Requirements: Testing firm must test all wire, cable, and electrical equipment installed and connected by Contractor to assure proper installation, setting, connection, and function as indicated or to conform to the Contract Documents and manufacturer's instructions. After the installation has been completed, conduct an operating test demonstrating that all equipment and devices operate in accordance with the requirements of the plans and specifications:
 - 1. Perform tests recommended by the equipment manufacturer.
 - 2. Verify phase sequence and rotation for all connections.
 - 3. Be responsible for all damage to equipment or material due to improper test procedures or test apparatus handling.
- B. Grounding:
 - 1. Field/Design Evaluation and Report: Perform a field/design evaluation for grounding systems per published NETA acceptance standard:
 - a. Test Labeling: Upon satisfactory completion of testing for each transformer, attach a dated and signed "Satisfactory Test" label to each tested component.
 - b. Submit above referenced field/design evaluation test report to VTA.
- C. Control Scheme Tests: Test all electrical controls via trial operation of control equipment after all wiring is completed. Check to see that each interlock and control function operates to conform to the sequence of operation, as indicated in the schematic diagrams and the manufacturer's operating instructions.
- D. Submit testing results in accordance with Technical Specifications Section 01 77 00, Closeout Procedures, and Section 01 78 39, Contract Record Documents.
 - 1. Submit the forms used in the field to perform the testing, including the original hand-written test results that were recorded and signed by the individual(s) who performed the testing.

3.02 IDENTIFICATION

- A. Upon completion of the tests and inspections noted in these specifications, attach a label to all serviced devices indicating the date serviced and the testing company responsible.

END OF SECTION 26 08 00

SECTION 26 27 00 MINI-POWER CENTERS

PART 1 - GENERAL

1.01 WORK INCLUDES

- A. Single-phase and three-phase general purpose individually mounted mini-power centers of the two-winding type, self-cooled.

1.02 RELATED SECTIONS

- A. Technical Specifications Section 26 05 00, Common Work Results for Electrical, for general electrical requirements.
- B. Technical Specifications Section 26 08 00, Acceptance Testing, for Work performed by an independent testing agency, at Contractor expense.

1.03 REFERENCES

- A. The mini-power center and all components must be designed, manufactured and tested in accordance with the latest applicable standards of UL, ANSI and NEMA.

1.04 SUBMITTALS

- A. Submittal procedures must be in accordance with the applicable provisions of:
 - 1. **Section 6.6 Contract Data Requirements**
 - 2. **Section 7.41 Product Options, Supplier Approval and Substitutions**
 - 3. **Section 7.43 Submittal of Shop Drawings, Product Data, and Samples**
 - 4. **Section 7.49.1 Certificates of Compliance**
 - 5. Appendix B, Contract Data Requirements
- B. Product data sheets, connection diagrams, and installation instructions.
- C. Closeout submittals:
 - 1. Field quality control test reports.
 - 2. Operations and maintenance manuals.
 - 3. Manufacturer's warranty.

1.05 QUALIFICATIONS

- A. The manufacturer of the assembly must be the manufacturer of the secondary distribution equipment.
- B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.
- C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years.

1.06 REGULATORY REQUIREMENTS

- A. The assembly and all components must be U.L. listed.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Equipment must be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions must be included with the equipment at time of shipment.

1.08 OPERATION AND MAINTENANCE MANUALS

- A. Equipment operation and maintenance manuals must be provided with each assembly shipped, and must include instruction leaflets and instruction bulletins for the complete assembly and each major component.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Square D
 - 1. Model #: See Contract Drawings.
- B. Or Equal

2.02 RATINGS

- A. 10 kVA and voltage ratings as shown in the Contract Drawings.
- B. Units must be designed for continuous operation at rated kVA, for 24 hours a day, 365 days a year operation, with normal life expectancy as defined in ANSI C57.96.
- C. Transformer sound levels must not exceed the following ANSI and NEMA levels for self-cooled ratings:
 - Up to 9 kVA 40 db
 - 10 to 30 kVA 45 db

2.03 CONSTRUCTION

- A. Each mini-power center must include a primary main breaker, an encapsulated dry-type transformer and a load center with secondary main breaker.
- B. Primary main, secondary main, and feeder breakers must be enclosed with a padlockable hinged door.
- C. Mini-power centers must be suitable for service entrance application and labeled as such.
- D. Insulation Systems:
 - 1. Transformers must be insulated with a 180 degrees C insulation system and rated at 115 degrees C temperature rise.
 - 2. Required performance must be obtained without exceeding the above-indicated temperature rise in a 40 degrees C maximum ambient, with a 30 degrees C average over 24 hours.
 - 3. All insulation materials must be flame-retardant and must not support combustion as defined in ASTM Standard Test Method D635.
- E. Core and Coil Assemblies

1. Transformer core must be constructed with high-grade, non-aging, silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Maximum magnetic flux densities must be substantially below the saturation point. The transformer core volume must allow efficient transformer operation at 10% above the nominal tap voltage. The core laminations must be tightly clamped and compressed. Coils must be wound of electrical grade aluminum [copper optional] with continuous wound construction.
2. The core and coil assembly must be completely encapsulated in a proportioned mixture of resin and aggregate to provide a moisture proof, shock-resistant seal. The core and coil encapsulation system must minimize the sound level.
3. The core of the transformer must be grounded to the enclosure.
4. Provide two (2) 5% FCBN taps.

2.04 BUS

- A. Secondary bus shall be copper.

2.05 WIRING/TERMINATIONS

- A. All interconnecting wiring between the primary breaker and transformer, secondary main breaker and transformer and distribution section must be factory installed.
- B. All transformers must be equipped with a wiring compartment suitable for conduit entry and large enough to allow convenient wiring.

2.06 MAIN DEVICES

- A. Each mini-power center must include a primary main breaker with an interrupting rating of 65kA at 277/480 volts; and a secondary main breaker with an interrupting rating of 10kA at 120/240 volts, and a loadcenter.

2.07 FEEDER DEVICES

- A. The secondary distribution section must accommodate one-inch plug-in breakers with 10 kA interrupting capacity.

2.08 ENCLOSURE

- A. The enclosure must be made of heavy-gauge steel and the maximum temperature of the enclosure must not exceed 90 degrees C.
- B. The enclosure must be totally enclosed, nonventilated, NEMA 3R, with lifting provisions.

PART 3 - EXECUTION

3.01 FACTORY TESTING

- A. The following standard factory tests must be performed on the equipment provided under this section. All tests must be in accordance with the latest version of ANSI and NEMA.
 1. Ratio tests at the rated voltage connection and at all tap connections
 2. Polarity and phase-relation tests on the rated voltage connection

3. Applied potential tests
4. Induced potential test
5. No-load and excitation current at rated voltage on the rated voltage connection

3.02 INSTALLATION

- A. Install all equipment in accordance with the manufacturer's written installation instruction and Contract Drawings.

3.03 FIELD ADJUSTMENTS

- A. Adjust taps to deliver appropriate secondary voltage.

3.04 FIELD QUALITY CONTROL

- A. Testing: Engage a qualified independent testing agency to perform field quality-control testing.
 1. Measure primary and secondary voltages for proper tap settings.
 2. Perform insulation-resistance test winding-to-winding and each winding to ground. Apply voltage in accordance with Table 100.5 of the NETA standard.

3.05 CLOSEOUT DOCUMENTATION

- A. Prepare closeout documentation in accordance with Technical Specifications Section 01 77 00, Closeout Procedures, and Technical Specifications Section 01 78 39, Project Record Documents, to include the following:
 1. Field quality control tests.
 2. Operations and maintenance manuals.
 3. Manufacturer's warranty.

END OF SECTION 26 27 00

SECTION 26 32 13 - ENGINE GENERATOR

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Package engine generator set, exhaust silencer and fittings, fuel fittings and sub-base tank, sound enclosure, remote control panel, battery, and charger.

1.02 RELATED SECTIONS

- A. Technical Specifications Section 23 12 00, Fueling System.
- B. Technical Specifications Section 26 05 00, Common Work Results for Electrical, for general electrical requirements.
- C. Technical Specifications Section 26 08 00, Acceptance Testing, for Work performed by an independent testing agency, at Contractor expense.
- D. Technical Specifications Section 26 36 23, Transfer Switches.

1.03 REFERENCES

- A. NEMA AB 1 - Molded Case Circuit Breakers.
- B. NEMA ICS 10 - Industrial Control and Systems: AC Transfer Switch Equipment.
- C. NEMA MG 1 - Motors and Generators.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- E. NFPA 30 - Flammable and Combustible Liquids Code.
- F. NFPA 37 - Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines
- G. NFPA 70 -- National Electrical Code, with California amendments.
- H. NFPA 110 - Emergency and Standby Power Systems.
- I. NETA - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- J. California Code of Regulations, Title 24, Part 4, "California Mechanical Code".
- K. California Code of Regulations, Title 24, Part 9, "California Fire Code".

1.04 REGULATORY REQUIREMENTS

- A. General Requirements:
 - 1. All work must be in accordance with this Technical Specifications Section, and the latest regulations from the U.S. Environmental Protection Agency (EPA), U.S. Department of Transportation (DOT), Occupational Safety and Health Administration (OSHA), State of California Department of Industrial Relations – Division of Occupational Health (DOSH), Bay Area Air Quality Management District (BAAQMD), and any other applicable federal, state and regional Authority Having Jurisdiction (AHJ).

2. Secure all permits and inspections from the authorities having jurisdiction (AHJ). Prepare and submit all forms to VTA, including those requiring VTA signature, and pay for all plan check application fees and permit fees. Prepare and submit all supporting documentation, including manufacturing drawings, product data sheets, controls and wiring diagrams, piping layout and manufacturers' installation instructions for all proposed equipment.
- B. Hazardous Material Storage Tank and Piping System:
1. Generator, fuel tank and accompanying piping systems require pre-approval from County of Santa Clara Department of Environmental Health – Hazardous Materials Compliance Division (HMCD), prior to installation. HMCD is the Certified Unified Program Agency (CUPA) for Santa Clara County.
 2. Comply with all applicable printed documentation issued by HMCD, including:
 - a. "Plan Submittal Requirements for Hazardous Materials Systems"; Form HMCD-004.
 - b. "Guidelines for Installation of Temporary and Permanent Aboveground Diesel Fuel Tanks for Emergency and Standby Power Systems Located Outside of Buildings"; UN-018.
 3. Prepare and submit HMCD permit applications, including those requiring VTA signature, and pay all plan check and permit fees, including:
 - a. "Hazardous Materials Construction Permit Application".
 - b. "Equipment List for Aboveground Storage Tank Systems".
 - c. "Hazardous Materials Clearance Form".
 4. Comply with all applicable printed documentation issued by BAAQMD for emission limitations. Emission documentation shall be provided to BAAQMD for air permitting purposes.
 5. Prepare and submit BAAQMD permit applications, including those requiring VTA signature, and pay all plan check and permit fees, including:
 - a. "Permit to Construct" and "Permit to Operate".

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
1. Company specializing in manufacturing products specified in this Technical Specifications Section with minimum ten years successful in-service performance, and with service facilities within 100 miles of Worksite capable of providing training, parts, and emergency maintenance and repairs.
- B. Supplier Qualifications:
1. Manufacturer authorized distributor, with minimum three years documented experience.
- C. Contractor Qualifications:

1. A California licensed General Engineering Contractor or C-10 Electrical Contractor.
 2. Completed within the past five years, at least one standby generator installation for a public agency or commercial owner located in the State of California.
- D. Listing and Labeling: Provide components, devices and accessories that are Listed and Labeled in accordance with NFPA 70, Article 100, and marked for intended use for the location and environment in which they are installed.
- E. Comply with applicable NEMA, ISO, UL provisions and NFPA 70.
- F. Testing Agency Quality Assurance:
1. In accordance with Technical Specifications Section 26 08 00, Acceptance Testing

1.06 MANUFACTURER'S FIELD SERVICES

- A. Engage the services of a factory authorized service representative, at Contractor's expense, to inspect field assembled components and equipment installation, including piping and electrical connections, and to assist in onsite testing, and instruct VTA personnel as to the operational and maintenance features of the equipment. Submit a letter listing the qualifications and experience of the manufacturer's field representative. The field representative must have attended the manufacturer's training courses on installation and operation and maintenance of engine generator sets.

1.07 SUBMITTALS

- A. Submittal procedures must be in accordance with the applicable provisions of:
1. **Section 6.6 Contract Data Requirements**
 2. **Section 7.41, Product Options Supplier Approval and Substitutions**
 3. **Section 7.43 Submittal of Shop Drawings, Product Data, and Samples**
 4. **Section 7.49.1 Certificates of Compliance**
 5. Appendix B, Contract Data Requirements
- B. Manufacturer and Supplier Qualifications.
- C. Generator Manufacturer's Field Service Representative Qualifications.
- D. Generator Manufacturer's Field Quality Control Testing Plan.
- E. Product Data: Submit data showing dimensions, weights, rating capacities, operating characteristics, interconnection points, and internal wiring diagrams for equipment, including but not limited to engine generator, control panel, battery, battery rack, battery charger, exhaust silencer, vibration isolators, outdoor enclosure, sub-base fuel tank and furnished specialties and accessories.
1. Include each product manufacturer's statement of compliance with regulatory labeling requirements.
 2. Include manufacturer's installation instructions.

- F. Shop Drawings: Submit for engine generator, generator enclosure, access stair landing, all equipment assemblies, including electrical assemblies.
1. General requirements: Prepare project-specific shop drawings, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Drawings or standard printed data. Include the following information, as applicable:
 - a. Dimensions, including required clearances.
 - b. Identification of products.
 - c. Fabrication and installation drawings.
 - d. Roughing-in and setting diagrams
 - e. Shopwork manufacturing instructions.
 - f. Templates and patterns.
 - g. Compliance with specified standards.
 - h. Notation of coordination requirements.
 - i. Notation of dimensions established by field measurement.
 2. Design Calculations: Design Calculations and Certification: Submit certification and engineering calculations, signed and sealed by a registered Professional Civil or Structural Engineer, licensed in the State of California, stating that engine generator, control panel, battery rack and sub-base fuel tank, will withstand seismic forces. Include the following:
 - a. Basis of Certification: Indicate whether certification is based on actual test of assembled components or on calculation.
 - b. 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”.
 - c. Dimensioned Outline Drawings of Equipment Units: Identify center of gravity. Locate and describe mounting and anchorage provisions.
 - d. Describe in detail the equipment anchorage devices on which the certification is based, and installation requirements.
 - e. Component certification documentation provided by equipment manufacturer for all emergency and life safety equipment, as required by ASCE 7-05 13.2.2.
 - f. Generator Enclosure and Access Stair and Landing System: Submit engineering calculations signed and sealed by a registered Professional Civil or Structural Engineer.
 3. Wiring Diagrams: Diagrams of power, signal and control wiring. Identify interconnection point dimensions, fuel consumption rate curves at various loads, ventilation and combustion air requirements.

- a. Differentiate between manufacturer-installed and field-installed wiring.
- G. Manufacturer's Source Quality Control Factory Test Reports.
- H. Closeout Submittals:
 - 1. Commissioning test reports.
 - 2. Field test reports.
 - 3. Operations and maintenance manuals.
 - 4. Permits and certificates of inspection from Santa Clara County of Environmental Health – HMCD (the CUPA).
 - 5. Sign-in attendance sheet for demonstration and training session, and written training agenda.
 - 6. Tools for preventative maintenance.
 - 7. Manufacturer's warranties.
 - 8. Contractor's special warranty.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Cover engine generator and ancillaries to protect them from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers. Provide electric heating of sufficient wattage to prevent condensation.
- B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to engine generator internal components, enclosure, and finish.

1.09 EXTRA MATERIALS

- A. Supply one set of tools required for preventative maintenance of the engine generator system. Package tools in adequately sized metal toolbox

1.10 WARRANTY

- A. Manufacturer's Warranty: Submit completed manufacturer's warranties.
- B. Contractor's Special Warranty: Provide a warranty signed by Contractor and countersigned by the generator installation contractor. Warranty shall cover all work included in this Technical Specifications Section for a period of two years parts and labor, commencing on the date of Substantial Completion. Any corrective action required for the duration of Contractor's special warranty will be paid by Contractor at no cost to VTA.

PART 2 - PRODUCTS

2.01 ENGINE GENERATOR SET

- A. General: The engine generator set must be comprised of a diesel prime mover and a generator mounted to a structural steel base with lifting and pulling eyes, furnished complete with sub-base fuel tank with ancillaries and ready to run.
- B. Standards of Manufacturers: References to manufacturer's name and model number are used to establish a quality standard for this Project. It is understood that such references

are used to facilitate the description of the product, and is deemed to be followed by the words "or equal".

1. Caterpillar Model C18 ACERT, 600KW/750KVA, 60 HZ, 1800 RPM, 480VAC, 0.8 Power Factor shall establish the performance and quality standard for this Project. Engine generator set and sub-base fuel tank must be furnished as a complete package from the generator manufacturer. Refer to the Contract Drawings and approved Shop Drawings for complete requirements.
 - a. Genset pad layout and dimensions shown on the Contract Drawings are based on the Caterpillar Model C18 ACERT and sub-base fuel tank by Fidelity Manufacturing.
 - b. Any suggested genset and sub-base fuel tank substitution from an acceptable manufacturer must fit within the current design of Work, meaning no changes to the current design will be necessary in order to accommodate the substitution.
 2. Acceptable manufacturers:
 - a. Caterpillar.
 - b. Onan.
 - c. Kohler.
 - d. Or equal.
- C. Ratings:
1. Voltage: 480Y/277 VAC, 3-phase, 4-wire.
 2. Standby Power Rating: 600kW.
 3. Power Factor: 0.8.
 4. Speed: 1800 rpm.
- D. Performance:
1. Steady-State Voltage Operational Bandwidth: 4 percent of rated output voltage from no load to full load.
 2. Steady-State Voltage Modulation Frequency: Less than 1 Hz.
 3. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage recovery to remain within the steady-state operating band within three seconds.
 4. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
 5. Steady-State Frequency Stability: When system is operating at any constant load within rated load, there are no random speed variations outside the steady-state operational band and no hunting or surging of speed.
 6. Transient Frequency Performance: Less than 5 percent variation for a 50 percent step-load increase or decrease. Frequency recovers to remain within the steady-state operating band within five seconds.

7. Output Waveform: At no load, harmonic content measured line to line or line to neutral does not exceed 5 percent total and 3 percent for single harmonics. The telephone influence factor, determined according to NEMA MG 1, must not exceed 50.
8. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, the system will supply a minimum of 300 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to any generator system component.
9. Start Time: system requirements to start, come up to speed and voltage, and to connect to load within 60 seconds.

2.02 ENGINE

- A. Description:
 1. Rated for standby power duty per applicable standards.
 2. Water cooled, inline or V type, cast iron.
 3. Four-stroke cycle.
 4. Compression ignition (Diesel) internal combustion.
- B. Piston Speed: 2250 feet per minute maximum (4 cycle).
- C. Fuel: Diesel, No.2 fuel oil.
- D. Engine Fuel System:
 1. Main fuel pump: engine driven, adequate for starting and load conditions.
 2. Pressure regulating valve: Maintains design pressure in fuel rail and returns excess to tank.
- E. Lubrication System:
 1. Pressurized, positive displacement pump, crankshaft driven.
 2. Full-flow filter.
- F. Cooling System:
 1. Closed loop, liquid cooled.
 2. Integral engine-driven coolant pump.
 3. Self-contained, thermostatic temperature control valve.
 4. Engine Jacket Heater, sized to maintain 32°C.
- G. Radiator: Non-ferrous metal, no aluminum. Sized to maintain safe engine temperature in ambient up to 50°C:
 1. Integral radiator:
 - a. Factory mounted on engine generator base.
 - b. Integral belt-driven engine fan.
- H. Exhaust System:
 1. Critical type muffler/silencer.

2. Stainless steel flex and expansion connections.
 3. Sound level at 10-foot distance: 85 dBA or less.
 4. Provide CARB and BAAQMD approved diesel particulate filters and oxidation catalysts as required by regulations for emission control.
- I. Combustion Air Intake System:
1. Heavy-duty filter factory-mounted on generator in an accessible location.
- J. Mounting and Base:
1. Spring type vibration isolators.
 2. Structural steel skid-type base with rigging diagram.
 3. Lifting lugs, pulling eyes and jacking pads.
 4. Designed to withstand site seismic event per CBC and site seismic criteria.
- K. Starting System:
1. 24VDC, negative ground.
 2. 3 cranking cycles (75 seconds).
 3. Engine-driven alternator, 35 amp minimum.
 4. Equalizing battery charger, 10 amp minimum.

2.03 GENERATOR

- A. Description:
1. NEMA MG1.
 2. Synchronous.
 3. Three phase, four pole.
- B. Insulation Class:
1. 480 VAC: Class F or Class H.
- C. Temperature Rise: 105° C rise above 40°C ambient at standby power rating.
- D. Construction:
1. Single bearing rotor direct coupled to engine by flexible disc.
 2. Amortisseur winding, integral fan.
 3. 2/3 pitch stator windings.
 4. Open drip-proof enclosure.
- E. Design Conditions:
1. 125% overspeed.
 2. 110% overload.
- F. Exciter/voltage regulator:
1. Rotating brushless exciter.
 2. Permanent magnet generator excitation power source.
 3. Solid state regulator with 3-phase sensing and volts-per-hertz compensation.
 4. Capable of supplying 300% rated current into a fault for 10 seconds.
 5. Voltage regulation of plus or minus 1% from no load to full load.

6. Adjustable voltage drop, voltage level and voltage gain.

2.04 GOVERNOR

- A. Description:
 1. Electronic governor, adjustable 0% (isochronous) to 10% speed droop.
 2. Provision for parallel generator operation.
- B. Performance:
 1. Maintain engine speed within 0.5 percent, steady state.
 2. Recover to steady state within 2 seconds following sudden load changes.

2.05 FUEL OIL STORAGE

- A. Sub-base Fuel Tank: Custom engineered, UL 142 listed assembly for use with the generator, covering all aspects of its construction and operations.
- B. Fuel tank must be supplied by the generator manufacturer as part of the complete genset package.
- C. Features include the following:
 1. Tank level indicator.
 2. Capacity: 600 gallons base tank.
 3. Vandal – Resistance fill cap.
 4. Double-walled, steel.
 5. Integral rupture, prime wall, with leak detector and level alarms.
 6. Fuel Containment Provisions: Comply with HMCD requirements.
 7. Exterior Finish: Factory prefinished.
 8. Refer to Contract Drawings for genset footprint extension, and additional requirements.

2.06 GENERATOR PROTECTION

- A. Generator circuit breaker: rating over 500 kVA (480 VAC): Insulated-case, adjustable electronic trip, 100% rated generator breaker with shunt trip, complying with UL 489:
 1. Tripping Characteristics: Adjustable long-time and short-time delay and instantaneous.
 2. Trip Settings: Selected to coordinate with generator thermal damage curves.
 3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
 4. Mounting: Adjacent to or integrated with control and monitoring panel.
- B. Generator Protector: Microprocessor-based unit must continuously monitor current level in each phase of generator output, integrate generator heating effect over time, and predict when thermal damage of alternator will occur. When signaled by generator protector or other generator-set protective devices, a shunt-trip device in the generator

disconnect switch must open the switch to disconnect the generator from load circuits. Protector must perform the following functions:

1. Initiates a generator overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other generator-set malfunction alarms.
 2. Under single or three-phase fault conditions, regulates generator to 300 percent of rated full-load current for up to 10 seconds.
 3. As overcurrent heating effect on the generator approaches the thermal damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the generator set.
 4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.
- C. Ground-Fault Indication: Comply with NFPA 70, "Emergency System" signals for ground-fault. Integrate ground-fault alarm indication with other generator-set alarm indications.

2.07 ENGINE GENERATOR CONTROL MODULE

- A. Description:
1. Microprocessor based.
 2. Communications Interface port compatible with ISG Power Monitoring and Data Gathering System.
 3. Interactive control panel for unit control, diagnostics and data inquiry.
 4. Environmentally hardened enclosure.
- B. Indicating, Protecting devices, Controls and displays: As required by NFPA 110 for level 1 system, and the following:
1. "RUN/OFF/AUTO" switch (key operated).
 2. "EMERGENCY STOP" push button.
 3. Generator Volts.
 4. Generator Amps.
 5. Generator Kilowatts.
 6. Generator Frequency.
 7. Generator kVARs.
 8. Generator Power Factor.
 9. Engine Oil Pressure, Temperature, RPM, Running Hours and DC (battery) voltage.
 10. Fuel Level.
- C. Standard alarms:
1. Low Oil Pressure.
 2. High Coolant Temperature.
 3. Low Fuel Level.
- D. Standard shutdowns:
1. Low-Low Oil Pressure.

2. High-High Coolant Temperature.
 3. Overcrank.
 4. Overspeed.
 5. Emergency Shutdown.
- E. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.
- F. Connection to Data Link: A separate terminal block, factory wired to Form C dry contacts, for each alarm and status indication is reserved for connections for data-link transmission of indications to remote data terminals.
- G. Common Remote Audible Alarm (Remote Alarm Annunciator): Include necessary contacts and terminals in control and monitoring panel:
1. Overcrank shutdown.
 2. Coolant low-temperature alarm.
 3. Control switch not in auto position.
 4. Battery-charger malfunction alarm.
 5. Battery low-voltage alarm.
 6. Engine high-temperature shutdown.
 7. Lube-oil, low-pressure shutdown.
 8. Overspeed shutdown.
 9. Remote emergency-stop shutdown.
 10. Engine high-temperature pre-alarm.
 11. Lube-oil, low-pressure pre-alarm.
 12. Fuel tank, low-fuel level.
 13. Low coolant level.
 14. Engine running.
- H. Remote Alarm Annunciator: An LED display with proper alarm conditions shall identify each alarm event and a common audible signal must sound for each alarm condition. Silencing switch in face of panel must silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated. Display panel must include spare lamps to allow future addition of other alarm and status functions to the annunciator. Provide media converter for connectivity and integration to VTA's existing fiber network.

2.08 SOURCE QUALITY CONTROL

- A. Factory tests:
1. Transient and steady-state governing.
 2. Single-step load pickup.
 3. Functional test of safety and protective shutdowns.
- B. Make completed engine-generator assembly available for inspection at manufacturer's factory prior to packaging for shipment. Notify VTA at least seven days before inspection is allowed.

- C. Allow witnessing of factory inspections and tests at manufacturer's test facility. Notify VTA at least seven days before factory inspections and tests are performed.
- D. Report test results within ten days of completion of tests.
- E. Provide UL nameplate providing verification of inspection and listing of assembly.

2.09 OUTDOOR GENERATOR-SET ENCLOSURE

- A. Description: Vandal-resistant, sound-attenuated, weatherproof steel housing, wind resistant up to 100 mph (160 km/h). Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable. Instruments and control shall be mounted within enclosure. Prefabricated or pre-engineered walk-in enclosure, pre-assembled, pre-integrated and delivered as part of the entire power system, with the following features:
 - 1. Construction: Galvanized-steel, metal-clad, integral structural-steel-framed building, 12 gauge steel for framework and 14 gauge steel for panels-minimum erected on concrete foundation. All hardware and hinges shall be stainless steel.
 - 2. Structural Design and Anchorage: Comply with ASCE 7 for wind loads, 100 mph minimum.
 - 3. Space Heater: Thermostatically controlled and sized to prevent condensation.
 - 4. Louvers: Equipped with bird screen and filter arranged to permit air circulation when engine is not running while excluding exterior dust, birds, and rodents.
 - 5. Hinged Doors: With padlocking provisions.
 - 6. Ventilation: Louvers equipped with bird screen and filter arranged to permit air circulation while excluding exterior dust, birds, and rodents.
 - 7. Thermal Insulation: Manufacturer's standard materials and thickness selected in coordination with space heater to maintain winter interior temperature within operating limits required by engine-generator-set components.
 - 8. Muffler Location: Within enclosure.
 - 9. The enclosure shall be insulated with non-hydroscopic materials.
 - 10. Mount at pre-arranged location external generator emergency stop switch, protected from accidental activation.
 - 11. Provide access door, sized as required, for Load Bank testing connection cables. Verify and coordinate with generator unit supplier location of access door so that connection to second circuit breaker inside the enclosure is easily accessible.
 - 12. Generator space and access area is limited. Dimensions shown in the Contract Drawings identify the maximum size for the enclosure.
- B. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions:
 - 1. Louvers: Fixed-engine, cooling-air inlet and discharge. Storm-proof and drainable louvers to prevent entry of rain and snow.

2. Automatic Dampers: At engine cooling-air inlet and discharge. Dampers must be closed to reduce enclosure heat loss in cold weather when unit is not operating.
- C. The provisions required include:
1. Two duplex GFI receptacles.

2.10 STAIR SYSTEM ACCESS

- A. General description:
1. Aluminum ramp, landing and stair sections shall be rigid, free-span design, and shall be double configuration (provided on both sides of the generator) to allow access to all generator doors.
- B. Material and details:
1. All aluminum construction shall use 6000 series aluminum alloys and have standard mill finish.
 2. Fasteners: 304 stainless steel.
 3. Landing, ramp and stair sections must be engineered for a 100psf live load.
 4. Stairs: 38 inch wide.
 5. Landing and ramp walking surface: 48 inch wide.
 6. Landing and ramp walking surface must be designed for a minimum concentrated vertical load of 300lbs applied evenly over a 12"x12" area. Stair treads must be designed to withstand a minimum concentrated load of 300lbs over a 4 square inch area.
 7. Ramp and landing guardrails: 42 inch minimum height.
 8. Handrail assemblies and guardrails must be designed to resist a load of 50plf applied in any direction at the top of the rail.
 9. Handrail assemblies and guardrails must resist a single concentrated load of 200lbs, applied in any direction at any point along the top of the rail. This load need not to be assumed to act concurrently with the loads specified in the preceding paragraph.
 10. Intermediate rails, balusters and panel fillers must be designed to withstand a horizontally applied normal load of 50lbs on an area equal to 1 square foot, including openings and space between rails.
 11. Guardrail system must be designed so that a 4 inch sphere cannot pass through any opening.
 12. Deck surface must be slip resistant, extruded aluminum decking with a triple I-beam self-mating design.
 13. All surfaces, members and their welded joints must be smooth and free from sharp or jagged edges.
- C. Acceptable Manufacturers:

1. Sapa Extrusion, LLC, REDD Team.
2. Or equal.

2.11 VIBRATION ISOLATION DEVICES

- A. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint:
1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
 2. Outside Spring Diameter: Not less than 80 percent of compressed height of the spring at rated load.
 3. Minimum Additional Travel: 50 percent of required deflection at rated load.
 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.12 FINISHES

- A. Indoor and Outdoor Enclosures and Components: Factory pre-finished.
1. Manufacturer's standard finish over corrosion-resistant pre-treatment and compatible primer.
- B. Paint all exposed piping, conduits, and metal surfaces that are not factory pre-finished, in accordance with Technical Specifications Section 09 91 23, Painting. Do not paint stainless steel surfaces.
- C. Expansion anchors, anchor bolts, hardware and fastenings, etc., installed outdoors must be stainless steel.

2.13 LOAD TESTING

- A. Provide necessary connections, breakers, conductors and switching to allow for 100% full-load testing of generator by mobile load bank.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

- A. Perform all labor, including but not limited to installation, programming and testing, for a complete and certifiable functional generator system installation.
- B. Provide any additional accessories, appurtenances fittings and hardware, not specifically mentioned herein but necessary, for a complete and certifiable functional generator system installation.
- C. Perform field verification of all measurements prior to fabrication and installation.

3.02 EXAMINATION

- A. Examine work area, including equipment foundations, with Installer present, for compliance with approved shop drawings, installation requirements and other conditions affecting packaged engine generator performance:
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Examine roughing-in of cooling-system piping systems, exhaust systems and electrical connections. Verify actual locations of connections before packaged engine generator installation.

3.03 INSTALLATION

- A. Comply with engine generator manufacturers' written installation and alignment instructions.
- B. Emissions Permit: Obtain BAAQMD approval, and forward original copy of the BAAQMD "Permit to Construct" to VTA prior to delivery of the engine-generator set to work site.
- C. Engine-generator set shall be pre-assembled and pre-wired by manufacturer, prior to shipment to work site.
- D. Set packaged engine generator and sub-base fuel tank on concrete base:
 - 1. Support generator-set mounting feet on rectangular metal blocks and shims or on metal wedges having small taper, at points near foundation bolts to provide 3/4- to 1-1/2-inch gap between pump base and foundation for grouting.
 - 2. Adjust metal supports or wedges until generator is level.
 - 3. Seismic Anchoring: Install and seismically anchor generator on concrete base in accordance with approved shop drawings.
- E. Install engine-generator set in compliance with conditions set forth in BAAQMD and HMCD permits. Pay fees and obtain field approval of BAAQMD and HMCD inspectors.
- F. Install engine-generator set to provide access for periodic maintenance, including removal of drivers and accessories. Generator space and access area is limited. Manufacturer must identify enclosure dimensions and required access clearances around enclosure.
- G. Connect exhaust-system piping within enclosure to point of termination on enclosure, in accordance with manufacturer's written instructions.
- H. Provide grounding and bonding as shown on the Contract Drawings, and in accordance with Article 250 of the National Electrical Code.
- I. Provide feeder and alarm wiring connections as shown in the Contract Drawings.
- J. Perform field quality control testing in accordance with the approved field quality control testing plan, under the supervision of the engine-generator set manufacturer's factory authorized service representative.

3.04 CONNECTIONS

- A. Connect exhaust-system piping to diesel engines, per manufacturer's requirements.
- B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B:
 - 1. Mark lugs after torquing with red paint such that paint will be visibly disturbed if lugs are disturbed.

3.05 IDENTIFICATION

- A. Identify system components in accordance with Technical Specifications Section 26 05 53, Electrical Identification.
- B. Label generator with equipment designation, kW rating and voltage.
- C. Label ancillary equipment with equipment designation, power source and circuit numbers, and power source location.
- D. Label voltage rating of batteries on battery rack.
- E. Apply instrument labels on all field-mounted instruments, transmitters, pressure gauges and control valves.
- F. Equipment used in emergency systems shall be labeled "Suitable for use on emergency systems" per NEC 700-3.
- G. Instructional signs: Install approved legend where instructions or explanations are required for system or equipment operation.

3.06 COMMISSIONING

- A. Coordinate commissioning requirements of this Technical Specifications Section with pre-functional commissioning and functional performance testing specified in Technical Specifications Section 23 12 00, Fueling System, and testing specified in Technical Specifications Section 26 36 23, Transfer Switches. Complete functional performance testing only after approval is granted by HMCD to place product in the tank and to operate the generator. HMCD must be present to observe the initial fill of the tank.
- B. Independent Testing Agency: Engage an independent testing agency, at Contractor expense, to perform field quality-control testing, in accordance with Technical Specifications Section 26 08 00, Acceptance Testing, and as follows:
 - 1. All tests recommended by manufacturer.
 - 2. NETA Tests: Perform each visual and mechanical inspection and electrical and mechanical test stated in NETA ATS for engine generator sets, except omit vibration baseline test. Certify compliance with test parameters for tests performed.
 - 3. Perform tests as stipulated in the NETA ATS, and as follows:
 - a. Full load (100%) test must be 3-hour continuous duration.

- b. Arrangements for simulating primary power loss must be coordinated with VTA.
- 4. Battery Tests: Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery. Verify acceptance of charge for each element of battery after discharge. Verify measurements are within manufacturer's specifications.
- 5. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
- 6. System Integrity Tests: Verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.
- 7. Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding 40 inches. Connect to exhaust line close to engine exhaust manifold. Verify that back-pressure at full-rated load is within manufacturer's written allowable limits for the engine. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
- 8. Harmonic-Content Tests: Measure harmonic content of output voltage under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.
- C. Provide sufficient fuel for testing and leave the tank full at the conclusion of the tests. Provide all lubricants as recommended by the engine manufacturer.
- D. Coordinate tests with tests for transfer switches where applicable and run them concurrently.
- E. Electrical contractor shall accompany and assist as required during all onsite field tests.
- F. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.
- G. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- H. Test instruments must have been calibrated within the last 12 months. Make calibration records available for examination on request.
- I. Battery Equalization: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
- J. Adjust generator output voltage and engine speed to meet specified ratings.
- K. Clean engine and generator surfaces. Replace oil and fuel filters after completion of testing.

- L. Provide full load test utilizing portable test bank, if required, for four hours minimum. Simulate power failure including operation of transfer switch, automatic starting cycle, and automatic shutdown, and return to normal.
- M. During test, record the following at 20 minute intervals: kilowatts, amperes, voltage, coolant temperature, ambient temperature, frequency, oil pressure.
- N. Test all alarm and shutdown circuits.
- O. Verify that engine system, in conjunction with the automatic transfer switch picks up the emergency loads within 60 seconds of the loss of utility power.

3.07 DEMONSTRATION AND TRAINING

- A. Engage a factory-authorized service representative, at Contractor's expense, to train VTA maintenance personnel to adjust, operate, and maintain the packaged engine generator:
 - 1. Use the operation and maintenance manual as the basis of instruction.
 - 2. Prepare and insert additional data in the manual when need for such data becomes apparent during instruction.
 - 3. Prepare sign-in attendance sheet for demonstration and training session, and written agenda.
 - 4. Minimum scheduled training period: Four hours

3.08 CLOSEOUT DOCUMENTATION

- A. Prepare closeout documentation in accordance with Technical Specifications Section 01 77 00, Closeout Procedures, and Technical Specifications Section 01 78 39, Project Record Documents, to include the following:
 - 1. Commissioning test reports.
 - 2. Field test reports.
 - 3. Operations and maintenance manuals.
 - 4. Permits and certificates of inspection from BAAQMD and HMCD.
 - a. Provide certification that the installation and testing requirements of BAAQMD and HMCD have been met, and all required test results have been submitted and accepted by BAAQMD and HMCD.
 - 5. Sign-in attendance sheet for demonstration and training session, and written agenda.
 - 6. Manufacturer's warranties.
 - 7. Contractor's special warranty.

END OF SECTION 26 32 13

SECTION 26 36 23 - TRANSFER SWITCHES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Transfer switches in individual enclosures for systems rated 600 volts and less.

1.02 RELATED SECTIONS

- A. Technical Specifications Section 26 05 00, Common Work Results for Electrical, for general electrical requirements.
- B. Technical Specifications Section 26 05 53, Electrical Identification
- C. Technical Specifications Section 26 08 00, Acceptance Testing, for Work performed by an independent testing agency, at Contractor's expense.
- D. Technical Specifications Section 26 32 13, Engine Generators

1.03 REFERENCES

- A. ANSI/NEMA ICS 10 - AC Transfer Switch Equipment.
- B. ANSI/UL 1008 - Automatic Transfer Switches.
- C. NETA - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum 10 years documented experience, and with service facilities within 100 miles of Worksite capable of providing training, parts, and emergency maintenance and repairs.
- B. Supplier: Authorized distributor of specified manufacturer with minimum 10 years documented experience.
- C. Listing and Labeling: Provide components, devices and accessories that are Listed and Labeled as defined in NFPA 70, Article 100 and marked for intended use for the location and environment in which they are installed.
- D. Comply with NFPA 70.
- E. Testing Agency Quality Assurance:
 - 1. In accordance with Technical Specifications Section 26 08 00 – Acceptance Testing.

1.05 SUBMITTALS

- A. Submittal procedures must be in accordance with the applicable provisions of:
 - 1. **Section 6.6 Contract Data Requirements**
 - 2. **Section 7.41 Product Options, Supplier Approval and Substitutions**
 - 3. **Section 7.43 Submittal of Shop Drawings, Product Data, and Samples**

4. **Section 7.49.1 Certificates of Compliance**
5. Appendix B, Contract Data Requirements
- B. Manufacturer and Distributor Qualifications.
- C. Product Data:
 1. Catalog sheets showing voltage, switch size, ratings and size of switching and overcurrent protective devices, operating logic, short circuit ratings, dimensions, and enclosure details.
 2. Indicate compliance with seismic rating and labeling requirements.
- D. Shop Drawings: For each transfer switch and related equipment:
 1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details.
 - b. Bus configuration, current, and voltage ratings.
 - c. Short-circuit current rating of overcurrent protective devices.
 - d. Operating logic.
- E. Manufacturer Seismic Qualification Certification: Submit certification and calculations, signed and stamped by a registered Professional Structural Engineer, licensed in the State of California, stating that equipment will withstand seismic forces. Include the following:
 1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation:
 - a. The term “withstand” means the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event.
 2. Dimensioned Outline Drawings of Equipment Units: 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.
 4. Component certification documentation provided by equipment manufacturer for all emergency and life safety equipment as required by ASCE 7-05 13.2.2.
- F. Closeout Submittals:
 1. Field quality control test reports.
 2. Operations and maintenance manuals:
 - a. Manufacturer’s written instructions for configuration, operation and testing.
 - b. Listing of all parameters and settings for transfer switch controller.

3. Manufacturer's warranty.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to internal components, enclosure, and finish.

1.07 COORDINATION

- A. Coordinate layout and installation of transfer switches with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access panels.

PART 2 - PRODUCTS

2.01 TRANSFER SWITCH

- A. Standards of manufacturers: References to manufacturer name and model number are used to establish a quality standard for this Project. It is understood that such references are used to facilitate the description of the product and is deemed to be followed by the words "or equal".
 1. ASCO Power Technologies, Part # G3ADTS-A33000N-GX-C will establish the quality standard for this project.
 2. Approval of a substitute "or equal" product will be subject to compatibility with the generator manufacturer & main switchgear. Any suggested substitution from an acceptable manufacturer must fit within the current design of Work, meaning no changes to the current design will be necessary in order to accommodate the substitution.
- B. Acceptable manufacturers:
 1. Eaton Electrical (Cutler-Hammer).
 2. GE Zenith.
 3. RusselElectric.
 4. Or equal.
- C. Service Conditions:
 1. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding 50°C.
 - b. Altitude: Not exceeding 1000 feet.
- D. Compliance: Comply with NEMA ICS 10 and UL 1008.
- E. Ratings:

1. Voltage: 480Y/277 Volts AC, 60 hertz, 3-phase, 4-wire.
 2. Continuous current: As shown on the plans.
 3. Neutral Current: 100% of nominal bus rating.
 4. Operating Temperature: Continuous current rating shall apply at 50° C ambient.
 5. Minimum Withstand Rating: 100 kA, or as noted on drawing.
 6. Poles: 3-pole, delayed transition.
 7. 30 seconds backup power, Accessory 1UP.
 8. Power Meter, Accessory 135L.
 9. Connectivity Module and Programmable Engine Exerciser with RS485 port, Accessory 72EE and 11BE.
 10. Strip Heater, Accessory 44G.
- F. Type: Automatic without bypass/isolation switch.
- G. Enclosure: Indoor: NEMA 1.

2.02 AUTOMATIC TRANSFER SWITCH

- A. Description:
1. Monitor all three phases of both normal and alternate sources and initiate appropriate transfer as governed by the switch control settings.
 2. Electrically operated, mechanically held with a constant contact pressure independent of voltage variations.
 3. Inherently double-throw type, incapable of intermediate position stops between poles.
- B. Field adjustable controls:
1. Differential voltage sensing on the normal source.
 2. Voltage sensing of alternate source.
 3. Frequency sensing of alternate source.
 4. Time delay to override normal source voltage dips before initiating start.
 5. Re-transfer to normal time delay.
 6. Unloaded run time delay.
- C. Control devices:
1. Test switch.
 2. Switch position indicating lights.
 3. Source available indicating lights.
 4. Engine start and shutdown contacts.
 5. Auxiliary contacts.

6. The transfer switch shall be equipped with optional accessories as required for the specific application and as shown on plans.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine surfaces to receive transfer switches for compliance with installation tolerances, ventilation requirements and other conditions affecting performance:
 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Verify mounting supports are properly sized and located.

3.02 INSTALLATION

- A. Install transfer switch on a concrete base of dimensions indicated on the Contract Drawings.
- B. Comply with manufacturer's recommendations, drawings and mounting and anchoring requirements.
- C. Ground all equipment.
- D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values:
 1. If manufacturer's torque values are not indicated, use torque values specified in UL 486A and UL 486B.
 2. Mark lugs after torquing with red paint such that paint will be visibly disturbed if lugs are disturbed.

3.03 IDENTIFICATION

- A. Identify transfer switch, transfer switch components, and control wiring in accordance with Technical Specifications Section 26 05 53 – Electrical Identification.
- B. Identify transfer switch name, designation, power sources, source locations, voltage, load served and load location.
- C. Equipment used in emergency systems must be labeled "Suitable for use on emergency systems" per NEC 700.3.
- D. Operating Instructions: Frame printed operating instructions for transfer switch, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of transfer switch.

3.04 ADJUSTING

- A. Adjust control and sensing devices to achieve specified sequence of operation.

3.05 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative, at Contractor expense, to observe and inspect field-assembled components and equipment

installation, including piping and electrical connections, and to observe all testing performed by the independent testing agency.

- B. Testing: Engage a qualified independent testing agency to perform field quality-control testing.
 - 1. Perform inspections and tests listed in NETA ATS, Section 7.22.3.
 - 2. Certify compliance with test parameters.
 - 3. Test insulation resistance for each transfer switch bus, component, connecting supply, and feeder. Use 1000V megger for 480V and 500V megger for 208V.
 - 4. Check for proper phase rotation: Phase A, B, C from left to right and front to back.
- C. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Electrical contractor shall accompany the independent testing agency field service technician and assist as required during field tests.

3.06 CLEANING

- A. Clean transfer switch internally, on completion of installation, according to manufacturer's written instructions. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

3.07 COMMISSIONING

- A. Demonstrate operation of transfer switch in normal, and emergency modes.

3.08 TRAINING

- A. Training: Provide a factory-authorized service representative, at Contractor's expense, to demonstrate transfer switch operation and maintenance and provide training for VTA staff. Training must include instructions on the following:
 - 1. Safety precautions.
 - 2. Features and construction of transfer switches and accessories.
 - 3. Transfer switch controller parameters and programming.
 - 4. Demonstrate operation of transfer switch in normal, and emergency modes.
 - 5. Routine inspection, test, and maintenance procedures.
 - 6. Routine cleaning.
 - 7. Interpretation of readings of indicating and alarm devices.
 - 8. Review data in maintenance manuals.
- B. Schedule training with the VTA with at least ten days advance notice.

3.09 WARRANTY

- A. Manufacturer's Warranty: Submit completed manufacturer's warranty.

3.10 CLOSEOUT DOCUMENTATION

- A. Prepare closeout documentation in accordance with Technical Specifications Section 01 77 00, Closeout Procedures, and Technical Specifications Section 01 78 39, Project Record Documents, to include the following:
1. Field quality control tests.
 2. Operations and maintenance manuals.
 3. Manufacturer's warranty.

END OF SECTION 26 36 23

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DIVISION 31 – EARTHWORK
SECTION 31 10 00 – SITE CLEARING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Removing existing vegetation.
- B. Clearing and grubbing.
- C. Removing above and below grade site improvements.
- D. Disconnecting, capping or sealing, and removing or abandoning site utilities in place.

1.02 RELATED SECTIONS

- A. Technical Specifications Section 02 32 19, Potholing
- B. Technical Specifications Section 02 41 19, Selective Demolition

1.03 MATERIALS OWNERSHIP

- A. Except for materials indicated to be stockpiled or otherwise remain VTA property, cleared materials must become Contractor's property and must be removed from Worksite in an appropriate and legal manner.

1.04 SAFETY REQUIREMENTS

- A. General: Maintain neat, orderly, and hazard-free on-site operations until final acceptance of the Work in conformance with CAL OSHA requirements.

1.05 PROJECT CONDITIONS

- A. Minimize interference with adjoining driveways, walks, and other adjacent occupied or used facilities during site-clearing operations.
- B. Do not close or obstruct walks and driveways or other occupied or used facilities without written permission from VTA.
- C. Provide alternate routes around closed or obstructed driveways if required by VTA.
- D. Potholing: Perform potholing before commencing site clearing. Refer to Technical Specifications Section 02 32 19, Potholing.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to remain from damage during construction.
- C. Temporary Facilities:

1. Provide temporary barricades, warning signs, lights, delineators, shields, and other provisions necessary to protect passerby from injury or discomfort around the demolition area.

3.02 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion and sedimentation control measure to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent areas. Refer to Appendix G, Environmental Coordination and Cooperation.

3.03 CLEARING AND GRUBBING

- A. Remove obstructions, tree roots, and other vegetation as required for new construction.
- B. Fill and compact all voids caused by the removal of pipe, structures, etc., and clearing and grubbing operations with satisfactory fill material. Provide for positive drainage of the disturbed area to drain run-off in a direction consistent with the surrounding area. Provide all fill materials to the site as needed. Compaction of fill must match the compaction of adjacent undisturbed material.

3.04 SITE IMPROVEMENTS

- A. Remove existing above and below grade improvements as indicated and necessary to facilitate new construction.
 1. Remove pavements, sidewalks, curbs and gutters and other existing features where necessitated by the installation of new utility trenches.
- B. Piped Utility Demolition
 1. Disconnect, demolish, excavate and remove piped utility systems, equipment, and components indicated to be removed.
 - a. Removed Piping: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Abandoned in Place Piping: Drain piping. Fill abandoned piping with flowable fill, and cap or plug piping with same or compatible piping material.
 - c. Removed Equipment: Disconnect and cap services and equipment indicated to be removed.
- C. Provide additional site clearing as indicated in other Technical Specifications Sections and the Contract Drawings, and as required for new construction.

3.05 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off VTA property.

END OF SECTION 31 10 00

SECTION 31 23 16 – STRUCTURAL EXCAVATION / EARTHWORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Excavating for building volume below grade, footings, pile caps, slabs-on-grade, and site structures.

1.02 RELATED REQUIREMENTS

- A. Technical Specifications Section 31 23 23, Structural Fill.

1.03 QUALITY ASSURANCE

- A. Codes and Standards: Comply with all Federal, State and Local Codes and Safety Regulations. In addition, comply with the provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified.
 - 1. City of San Jose, Standard Specifications for Public Works Construction, current governing edition.
 - 2. CAL-OSHA the Division of Occupational Safety and Health.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.
- B. Locate, identify, and protect utilities that remain and protect from damage. Excavation for underground facilities is not permitted prior to Contractor's identification of existing utilities.
- C. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- D. Adjoining property shall be protected from damage during demolition and construction work.

3.02 EXCAVATING

- A. Underpin adjacent structures that could be damaged by excavating work.
- B. Excavate to accommodate new structures and construction operations.
- C. Notify VTA of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- D. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.
- E. Do not interfere with 45 degree bearing splay of foundations.
- F. Cut utility trenches wide enough to allow inspection of installed utilities.

- G. Hand trim excavations. Remove tree roots and loose matter.
- H. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- I. Due to the expansive nature of onsite soils, material obtained during structure excavation shall not be used for structure backfill. The excavated material must be removed from the site and disposed of by Contractor.

END OF SECTION 31 23 16

SECTION 31 23 23 – STRUCTURAL FILL

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Filling, backfilling for building volume below grade, footings, pile caps, slabs-on-grade, site structures and utilities.

1.02 RELATED REQUIREMENTS

- A. Technical Specifications Section 03 30 00 – Cast-in-Place Concrete

1.03 SUBMITTALS

- A. Submittal procedures must be in accordance with the applicable provisions of:
 - 1. **Section 6.6 Contract Data Requirements**
 - 2. **Section 7.41 Product Options, Supplier Approval, and Substitutions**
 - 3. **Section 7.43 Submittal of Shop Drawings, Product Data, and Samples**
 - 4. **Section 7.49.1 Certificates of Compliance**
 - 5. Appendix B, Contract Data Requirements
- B. Site location for earthwork materials: Submit list of sites and location of each, proposed to be used by Contractor to provide each of the following materials:
 - 1. Structure Backfill

1.04 QUALITY ASSURANCE

- A. Codes and Standards: Comply with all Federal, State, and Local codes and safety regulations. In addition, comply with the provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified.
 - 1. City of San Jose, Standard Specifications for Public Works Construction, current governing edition.
- B. Testing and Inspection
 - 1. Contractor:
 - a. Cooperate with and notify VTA at least 48 hours in advance of inspections required.
 - b. Should the materials at the site proposed by Contractor fail to meet the specified requirements, Contractor shall propose another site to provide required material and pay for any subsequent inspections and testing necessary to verify compliance of proposed materials to those specified.
 - c. At least 20 days before any backfill work is to be done, clear the site proposed to provide imported borrow, structure backfill, or pervious backfill. Take samples as required to test materials for conformance to these technical specifications.

PART 2 - PRODUCTS

2.01 FILL MATERIALS

- A. Structural Fill: Conforming to the gradation and quality requirements of the project geotechnical investigation.
- B. Concrete for Fill: Lean concrete as defined in Technical Specifications Section 03 30 00, "Cast-In-Place Concrete".
- C. Granular Fill: Conforming to the gradation and quality requirements of the project geotechnical investigation.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Identify required lines, levels, contours, and datum locations.

3.02 PREPARATION

- A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.
- B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- C. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.03 FILLING

- A. Maintain optimum moisture content of fill materials to attain required compaction density.
- B. Correct areas that are over-excavated.

END OF SECTION 31 23 23