

## SECTION 01010

### SUMMARY OF WORK

#### PART 1 – GENERAL

##### 1.01 SUMMARY

- A. General work included in this section:
1. Furnish all labor, materials, and equipment required by the Contract Documents or required to complete the Work.
  2. Coordinate work of all trades.
  3. Furnish and install miscellaneous items incidental to or necessary for completion of the Work, whether these items are specifically indicated in the Contract Documents or not.

##### 1.02 WORK COVERED BY CONTRACT

- A. The Work covered under this Contract will be performed along public right of ways and within easements on private property located within the City of Sausalito. The project location is indicated on the Drawings.
- B. The Work includes, but is not limited to:
1. Reconfiguration and connection of sanitary drain piping at the Spinnaker Restaurant.
  2. Furnish and install grease interceptor.
  3. Furnish and install package lift station, valving, and controls complete and ready for use.
  4. Furnish and install 4-inch HDPE force main piping in existing sewer host pipe.
  5. Replacement of 6-inch Grey Cast Iron sewer with new 6-inch PVC sewer.
  6. Rehabilitation of the Anchor Pump Station piping, valving, and controls
  7. Construction of shored excavations related to the work.
  8. Traffic control.
  9. Pavement repair, grading, and other miscellaneous work needed to restore areas disturbed by the construction back to original condition.

##### Materials Furnished by Sausalito Marin City Sanitary District:

- i. Flow meters
- ii. Level Sensors
- iii. Float Switches
- iv. Programmable logic controller

- v. Radio transceiver, antenna, and remote terminal unit

### 1.03 OTHER CONTRACTS

- A. Construction of portions of the sewer pipeline may coincide with construction activities by other contractors and agencies. Coordination with the contractors undertaking related work or un-related work within the project work areas is the responsibility of the Contractor.

### 1.04 SPECIFICATION LANGUAGE

- A. Specifications may be written in the imperative mood and streamlined form in accordance with practices and principals of the Construction Specifications Institute.
- B. Imperative language is directed to the Contractor unless specifically noted otherwise.
- C. The words “shall be” are included by inference where a colon (:) is used within sentences or phrases.
- D. This project must conform to RWQCB and BCDC permit requirements. A copy of the BCDC permit is provided as Appendix C to Division 0.
  - 1. Contractor to alert Construction Manager if the Contractor believes the permit requirements exceed the contract requirements.

### 1.05 REGULATORY REQUIREMENTS

- A. Comply with all Federal, State, and local laws, regulations, codes, and ordinance applicable to the work.
- B. References in the Contract Documents to local codes shall mean those of Marin County.
- C. Other standards and codes that apply to the work are designated in the Specifications.
- D. The Contractor shall conform to RWQCB and BCDC permit requirements. A copy of the BCDC permit is provided as Appendix C to Division 0.
  - 1. Contractor shall alert the Construction Manager if the Contractor believes the permit requirements exceed the contract requirements.

### 1.06 ACCESS BY GOVERNMENT OFFICIALS

- A. Authorized representatives of governmental agencies shall at all times have access to the work area. Provide proper facilities for access and inspection.

## 1.07 PROTECTION OF PUBLIC AND PRIVATE PROPERTY

- A. Pipeline construction will encounter numerous existing features of various types, such as fences, drain culverts, irrigation facilities, roadside drainage facilities, mailboxes, signs, private and public driveways, curbs, asphalt pavement, buildings, utility poles, guy wires, and other surface structures. Contractor shall protect existing features of this nature and all features affected by construction operations shall be restored to their original condition.
- B. To the greatest extent possible, remove existing features without damaging the materials and re-use the material to place back in the original condition. When existing features are damaged during removal, install new materials of similar type, appearance, and function, at no additional cost to the Owner.
- C. Contractor shall be responsible for all damage to streets, roads, driveways, highways, shoulders, ditches, embankments, culverts, bridges, and other public or private property, regardless of location or character, that may be caused by transporting equipment, materials, or workers to or from the work or any part or site thereof, whether by Contractor or Contractor's subcontractors or suppliers.
- D. Keep fire hydrants and water control valves free from obstruction and available for use at all times.
- E. In areas where the Contractor's operations are adjacent to or near a utility and such operations that may cause damage resulting in expense, loss, and inconvenience, construction operations shall be suspended until all arrangements necessary for the protection thereof have been made by the Contractor.

## 1.08 CONSTRAINTS

- A. Restrict work activities to work limit areas indicated on the Drawings. Equipment and materials shall not be stored on public streets or unapproved storage areas.
- B. Humboldt Drive, Anchor Street, and Bay Street shall remain passable for cars, tourist busses, and emergency vehicles at all times.
- C. No excavation shall be left open overnight. Provide traffic-rated trench plating.
- D. The Contractor is alerted to the fact that the Project is situated in part on fill material of varying quality over Bay mud. Vibration due to construction activities shall be limited at the edge of the southeast work limit lines to attempt to avoid disturbance to business operations and facilities in that location. Contractor shall monitor vibration at said limit lines as work in this area progresses.
- E. No construction requiring excavation shall be allowed until after Labor Day
- F. No open excavations shall be allowed during San Francisco Fleet Week (typically the first two weeks in October).

- G. Construction for the installation of the grease interceptor and upstream, including work under the Spinnaker Restaurant, shall not take place until after October 20
  - a. The restaurant connection shall remain in service at all times except as coordinated with the Restaurant Manager and Construction Manager.
  - b. Tie in of existing restroom drains to the new sanitary drains under the restaurant shall be completed outside of the hours of restaurant operation (11 AM to 11 PM).
- H. The Public Access Overlook at the eastern limits of work is to remain open to the public throughout construction, with the exception of periods when public safety would be jeopardized by the presence of heavy equipment required to perform the Work. Additionally a minimum five foot pedestrian travel way must be maintained along the site fence.
- I. Public Access to the Marine Shop located at 100 Bay St. shall be maintained throughout construction, with the exception of periods when public safety would be jeopardized by the presence of heavy equipment required to perform the Work. Contractor shall coordinate the period(s) when Public Access to the Marine Shop will be closed with the Construction Manager. Marine Shop requires a minimum of 14 calendar day notice of dates and times when it will be required to close in order to maintain public safety. Contractor's failure to notify the Construction Manager at least 14 calendar days in advance of such required period(s) of closure will be a Non-Excusable Delay as defined in Section 00700, 6.03B.
- J. The sewage pump out line and pump station (Sanisailor) are to be protected and remain in service throughout construction for use by the Sausalito Yacht Harbor. This will require relocation of the discharge lines.
- K. A twenty foot ingress/egress travel way to the Sausalito Yacht Harbor Parking Lot is to remain open to tenants and employees throughout construction.
- L. Contractor is allowed to conduct pile driving, or other work that results in negative impacts to fish and marine mammals, only between June 1 and October 31.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

**\*\*END OF SECTION\*\***

## SECTION 01025

### MEASUREMENT AND PAYMENT

#### PART 1 - GENERAL

##### 1.01 GENERAL

- A. Measurements of the completed work shall be in accordance with, and by instruments and devices calibrated to United States Standard Measures and the units of measurement for payment, and the limits thereof, shall be made as shown on the Plans, Specifications, General Conditions and Requirements, and Supplementary Conditions.
- B. Units of Measurement
  - 1. Measurements shall be in accordance with U.S. Standard Measures.
  - 2. A pound is an avoirdupois pound.
  - 3. A ton is 2,000 pounds avoirdupois.
  - 4. The unit of liquid measure is the U.S. gallon.
- C. Certified Weights
  - 1. When payment is to be made on the basis of weight, the weighing shall be done on certified platform scales, or when approved by the Construction Manager, on a completely automated weighing and recording system.
  - 2. The Contractor shall furnish the Construction Manager with duplicate licensed weighmaster's certificates showing the actual net weights.
  - 3. The City will accept the certificates as evidence of the weights delivered.
- D. Methods of Measurement
  - 1. Materials and items of work which are to be paid for on the basis of measurement shall be measured in accordance with the method stipulated in the particular sections involved.
  - 2. In determining quantities, all measurements shall be made in a horizontal plane unless otherwise specified.
  - 3. Material not used from a transporting vehicle shall be determined by the Construction Manager and deducted from the certified tag.
  - 4. When material is to be measured and paid for on a volume basis and it would be impractical to determine the volume, or when requested by the Contractor in writing and approved by the Construction Manager in writing, the material will be weighed and converted to volume measurement for payment purposes.

5. Factors for conversion from weight measurement to volume measurement will be determined by the Construction Manager and shall be agreed to by the Contractor before such method of measurement of pay quantities will be adopted.
6. Full compensation for all expense involved in conforming to the above requirements for measuring and weighing materials shall be considered as included in the unit prices paid for the materials being measured or weighed and no additional allowances will be made therefore.
7. Quantities of material wasted or disposed of in a manner not called for under the Contract; or rejected loads of material, including material rejected after it has been placed by reason of failure of the Contractor to conform to the provisions of the Contract; or material not unloaded from the transporting vehicle; or material placed outside the lines indicated on the Plans or given by the Construction Manager; or material remaining on hand after completion of the Contract, will not be paid for and such quantities will be deducted from the final total quantities.
8. No compensation will be allowed for hauling rejected material.

## 1.02 BID ITEMS

- A. The Bid amounts for each Bid Item will be used for comparative bid analysis. The Bid amounts will also form the basis of monthly progress payments. Each Lump Sum bid amount will undergo further breakdown as described later in this Section. Unit prices for any unit price bid items, will be the basis for monthly progress payment determinations and for any changes related to that Work item. Bid Item will also demonstrate the Contractor's compliance with the California Labor Code relating to the price for sheeting, shoring, and bracing of excavations. Bid items are not intended to be exclusive descriptions of work categories and the Contractor shall determine and include in its pricing all materials, labor, and equipment necessary to complete each Bid Item (work phase) as shown and specified. Measurement and payment for each Bid Item is defined in each section of the Special Provisions.
- B. Bid Item 1 – Mobilization and Demobilization
  1. This bid item shall be lump sum. Payment shall be made at seventy five (75%) percent of the bid item amount on the first progress payment following completion of mobilization and the remaining amount on the final progress payment, with retention withheld as allowed by the Contract Documents. The Contractor may apply for the remaining twenty-five (25%) percent of the bid item amount upon completion of the project final punch list items provided by the Construction Manager.
  2. This bid item shall include payment for obtaining all bonds, all Contractor acquired permits, licenses, agreements, certifications, notices of intent, and temporary easements; moving onto the site of all equipment, materials, and staff including obtaining and set up of Contractor's staging area/yard; preparing Storm Water Pollution Prevention Plan; furnishing

and erecting all needed construction facilities; fencing; preparing traffic control plan; project signage; project security; demobilization; preconstruction photographs; video recording of surface features; progress schedules and reports; contract meetings; and record drawings.

3. Final payment for mobilization and demobilization, or any part thereof, will be approved for payment under the Contract when all applicable mobilization and demobilization items listed above have been completed.
4. This amount shall not exceed five percent (5%) of the total bid price for the Work.

C. Bid Item 2 - Bypass Pumping and Control of Sewage Flow

1. This bid item shall be lump sum. Payment for this item will be prorated over the course of the Project based on percentage complete – of all items.
2. This bid item includes all work and materials necessary to maintain uninterrupted sewer service during the project and includes design and preparation of a flow control plan; submittals; personnel; plugging; bypass pumping; piping; temporary pipe trenching and surface restoration; protecting piping from traffic; sound attenuation equipment; temporary flow diversions; handling flow from laterals that are temporarily disconnected; restoration of sewer flow; and all incidentals as required by these Plans and Specifications.

D. Bid Item 3 – Dewatering

1. This bid item shall be lump sum. Payment for this item will be prorated over the course of the Project based on percentage complete- of all items.
2. This bid item includes all work and materials necessary for design and installation of dewatering system necessary to keep sewer trench and other excavations dry at all times. Payment will be "Lump Sum" and will be full compensation for furnishing and operating pumps, power supply; noise control, sediment removal devices; piping; protecting piping from traffic; wells, appurtenances; submittals; and all incidentals including obtaining all permits; abandonment of wells per Marin County requirements and restoration of pavement; sidewalk; or landscaping damaged due to wells and power supply.

E. Bid Item 4 –Shoring

1. This bid item shall be measured in lump sum. Payment for this item will be prorated over the course of the Project based on percentage complete of all items.
2. This bid item includes excavation support measures required including but not limited to: design; submittals; installation and removal of shoring and bracing required to stabilize and prevent movement of existing ground and to protect and provide for the safety of the Contractor's workers due to collapse or movement of the existing ground during excavation and trenching operations, including furnishing all equipment, materials, and personnel

associated therewith, and in accordance with these Specifications and California Labor Code 6700-6708.

F. Bid Item 5 – 4-inch Force Main

1. This bid item shall be measured in linear feet. Measurement for unit price work will be based on the actual number of linear feet complete and in place as determined by the Construction Manager and the unit price bid as approved by the Construction Manager
2. This bid item includes; submittals; traffic control; SWPPP pollution prevention measures; locating/potholing and protecting existing utilities; surveying; saw cutting; grinding; surface demolition; excavation of launch pit and trench; spoil removal and proper disposal; pipe bedding; non-shrink grout; grout pipe; lightweight annulus grout; chemical grout soaked in oakum; trench; HPDE welding; backfill; drain rock; filter fabric; compaction; force main pipe; pressure testing; CCTV camera and video inspection; surface restoration including sidewalks, concrete paving, asphalt paving, curbs, gutters, fences, and other surface features disturbed by the Work; dust control; cleaning; record drawings; furnishing all equipment, materials and personnel associated therewith; and all incidentals in accordance with these Plans and Specifications.

G. Bid Item 6 – 6-inch Sanitary Sewer

1. This bid item shall be measured in linear feet. Measurement for unit price work will be based on the actual number of linear feet complete and in place as determined by the Construction Manager and the unit price bid as approved by the Construction Manager
2. This bid item includes submittals; traffic control; SWPPP pollution prevention measures; locating/potholing and protecting existing utilities; surveying; saw cutting, grinding, surface demolition; concrete plugs, excavation of trench; spoil removal and proper disposal; pipe bedding; trench backfill, drain rock; filter fabric; compaction; sanitary sewer pipe; Mission Rubber stainless steel bands; CCTV camera and video inspecting; surface restoration including sidewalks, concrete paving, asphalt paving, curbs, gutters, fences, and other surface features disturbed by the Work; dust control; cleaning; record drawings; furnishing all equipment, materials, and personnel associated therewith, and all incidentals in accordance with these Plans and Specifications.

H. Bid Item 7–Lateral Replacement and Connection to Manhole or Sewer

1. This bid item shall be for "Each" lateral replacement and connection installed as directed in the field by the Construction Manager. Measurement for unit price work will be based on the actual number of laterals complete and in place as determined by the Construction Manager and the unit price bid as approved by the Construction Manager.



2. This bid item includes furnishing all equipment, materials, and personnel associated therewith, and in accordance with these Specifications; submittals; traffic control; SWPPP pollution prevention measures; dust control; collection and legal disposal of all coupons; locating/potholing and protecting existing utilities; surveying; locating/potholing the lateral; surface demolition; saw cutting; grinding; trenching; excavation; removal and proper disposal of concrete; spoil handling and proper disposal; cutting and sealing sewer service laterals; removal and disposal of existing laterals; preparing and compacting pipe sub base; placing and compacting pipe bedding; furnishing, installing, and compacting trench backfill; installation of lateral wye connection or connection to manhole as appropriate, up to 100 feet of lateral piping and connection couplings; wyes; furnish and install two-way cleanout and backwater valve; backwater check valve; B9 concrete box with concrete covers; PVC riser; connection to existing lateral; encasement in low strength concrete, if necessary; backfill; compaction; testing; video inspection; surface restoration including fences, curb and gutter, sidewalks, concrete paving, asphalt paving, irrigation system components and landscaping; cleaning; record drawings, and all incidentals as required by these Specifications and Drawings.

I. Bid Item 8 - Grease Interceptor

1. This bid item shall be lump sum. Measurement for lump sum work will be based on the completed and in place grease interceptor as determined by the Construction Manager and the lump sum bid as approved by the Construction Manager.
2. This bid item includes all labor, equipment and materials necessary for the complete, tested and operational installation of a grease interceptor as indicated on the Drawings and in accordance with these Specifications; submittals; traffic control plan and traffic control; SWPPP pollution prevention measures; locating/potholing and protecting existing utilities; demolition of existing facilities; dust control; excavation; spoil removal and proper disposal; structure bedding; furnish and install grease interceptor, ballast slab, anchor straps, anchors, bearing slab, piping, two-way cleanout, riser pipe, heavy duty manhole frames and cover, concrete collars and couplings; backfill; geotextile fabric; test; surface restoration including sidewalks, concrete paving, asphalt paving, curbs, gutters, fences, and other surface features disturbed by the Work; cleaning; record drawings; and all incidentals in accordance with these Plans and Specifications. Grease interceptor may be precast concrete or fiberglass.

J. Bid Item 9 - Manholes

1. This bid item will be for "Each" Manhole including frame and cover, installed regardless of depth. Payment will be based on the actual number of manholes and manhole frames and covers completed and in place as determined by the Construction Manager and the unit price bid as approved by the Construction Manager.

2. This bid item includes all labor, equipment, and materials necessary to furnish precast concrete manholes including bases, barrel sections, frames and covers; submittals; traffic control; SWPPP pollution prevention measures; saw cutting; excavation; dust control; soil stockpiling and spoils handling and disposal; structure bedding; chemical grouting; non-shrink grout; backfilling; compaction; routing of new flow channels within manholes; testing; surface restoration including sidewalks, concrete paving, asphalt paving, curbs, gutters, fences, and other surface features disturbed by the Work; cleaning; record drawings and all incidentals required for a complete installation.

K. Bid Item 10- Existing Manholes

1. This bid item will be for “Each” existing manhole with new work connecting to it. Payment will be based on the actual number of existing manholes included in the work as determined by the Construction Manager and the unit price bid as approved by the Construction Manager.
2. This bid item includes all labor, equipment, and materials necessary to connect new work to existing manholes including, submittals; cleaning and pressure washing; traffic control; cutting or chipping existing bench and openings; Mission Rubber concrete manhole adapter; concrete manhole adaptor water stop; dust control; chemical grouting; non-shrink grout; lightweight annulus grout; grout pipe; oakum; saw cutting; excavation, within existing manholes; and all incidentals required for a complete installation.

L. Bid Item 11 – Package Lift Station

1. This bid item will be lump sum. Payment will be based on the furnished and installed, completed and in place packaged lift stations as determined by the Construction Manager and the unit price bid as approved by the Construction Manager.
2. This bid item includes furnishing and installing all labor, equipment, and materials necessary for the complete, tested, and operational installation of a package lift station including: pumps, valves, piping, wet well, valve box, concrete structures, hatches, fittings, and miscellaneous items as indicated on the Drawings in accordance with these Specifications; submittals; traffic control; SWPPP pollution prevention measures; locating/potholing and protecting existing utilities; demolition existing facilities; dust control; excavation; spoil removal and proper disposal; concrete slabs, structure bedding, backfill; electrical power distribution and controls; coordination with the electrical utility company including initial connection fee (usage will be paid by the City separately); startup and test; troubleshoot, provide installation certifications and train City personnel; surface restoration including sidewalks, concrete paving, asphalt paving, curbs, gutters, fences, and other surface features disturbed by the Work; cleaning; record drawings; and all incidentals required for a complete installation.

M. Bid Item 12- Restaurant Plumbing Changes

1. This bid item shall be lump sum. Payment will be based on the percentage of work completed as determined by the Construction Manager, and the detailed schedule or breakdown of lump sum items as approved by the Construction Manager.
2. This bid item includes all labor, equipment and material necessary for the separation of sanitary sewer lines within Spinnaker Restaurant as indicated on the Drawings and in accordance with these Specifications, including: coordination with restaurant operations; submittals; SWPPP pollution prevention measures; locating and protecting existing utilities; excavation; dust control; spoil removal and proper disposal; demolish existing facilities, remove and dispose of existing parts, piping, vaults, and mechanisms as shown on the Drawings; drain piping and fittings; bedding; backfill; surface restoration including sidewalks, paving, curbs, gutters, and other surface features disturbed by the Work; cleaning; record drawings; and all incidentals in accordance with these Plans and Specifications. Work at night may be required and shall be provided at no additional cost to the City.

N. Bid Item 13- Anchor Pump Station Rehabilitation

1. This bid item shall be lump sum. Payment will be based on the percentage of work completed as determined by the Construction Manager, and the detailed schedule or breakdown of lump sum items as approved by the Construction Manager.
2. This bid item includes all labor, equipment and material necessary for the complete rehabilitation of Anchor Pump Station as indicated on the Drawings and in accordance with these Specifications; including precast vaults, grout, drains, fittings, high solids epoxy, wetwell slab, vents, clamps, hatches, pipe supports, and all miscellaneous items; submittals; traffic control; SWPPP pollution prevention measures; locating/potholing and protecting existing utilities; excavation; spoil removal and proper disposal; demolish existing facilities; existing pipe plugs; dust control; remove and dispose of existing parts, piping, vaults, and mechanisms as shown on the Drawings; wet well coating; structure bedding; backfill; electrical power distribution equipment; concrete base coordinate with SMCS D or District furnished equipment; coordinate with utility company; startup and test; troubleshoot; provide installation certifications and train City personnel; surface restoration including asphalt paving, striping and lettering, AC curbs, gutters, fences, hedges, and other surface features disturbed by the Work; cleaning; record drawings; and all incidentals in accordance with these Plans and Specifications.

O. Bid Item 14- Portable Restroom Modifications

1. This bid item shall be lump sum. Payment will be based on the percentage of work completed as determined by the Construction Manager, and the detailed schedule or breakdown of lump sum items as approved by the Construction Manager.
2. This bid item includes all labor, equipment, and material necessary for the relocation of the portable restroom as indicated on the Drawings and in accordance with these Specifications, including: coordination with City; submittals; coordination with the restroom trailer company; disconnection of existing water supply and sewer; installation of wheels; moving trailer and jack stands to location approved by Construction Manager; relocation of access ramp; connection of water supply to temporary location; waste storage tank and pump out service; moving the restroom trailer to original location following acceptance by the Construction Manager of the sewer and trench AC repair; and incidentals as needed for a complete and operable restroom facility.

P. Alternate Bid Item A – Demolition of Existing Parking Attendant Kiosk

1. This bid item will be for all labor, equipment, and materials necessary to remove the existing parking attendant kiosk. Payment will be based on a lump sum basis based on the percentage of work for this item completed and in place as determined by the Construction Manager.
2. This bid item includes furnish and install all labor, equipment, and materials necessary to demolish and remove the parking attendant kiosk including traffic control; SWPPP pollution prevention measures; locating/potholing and protecting existing utilities; coordinating with the electrical utility company to turn off power; demolition of existing facilities wood framed structure and concrete slab on grade foundation; dust control; excavation; spoil removal and proper disposal; refilling the resulting void with compacted Class 2 AB; record drawings, and all incidentals in accordance with these Plans and Specifications.

Q. Alternate Bid Item B.1 – Curb and Gutter

1. This bid item shall be measured in linear feet. Measurement for unit price work will be based on the actual number of linear feet complete and in place as determined by the Construction Manager and the unit price bid as approved by the Construction Manager.
2. This bid item includes all labor, equipment, and materials necessary to remove and replace approximately 400 linear feet of curb and gutter, as indicated on the Plans.
3. This bid item includes demolition and disposal of existing concrete; excavation and spoils disposal; furnish, place, and compact aggregate base material; furnish, form, place, consolidate, and finish Portland cement concrete; SWPPP pollution prevention measures; establish and maintain

reference elevations, cleaning, record drawings; and all incidentals in accordance with these Plans and Specifications.

R. Alternate Bid Item B.2 – Sidewalk and Driveway

1. This bid item shall be measured in square feet. Measurement for unit price work will be based on the actual number of square feet complete and in place as determined by the Construction Manager and the unit price bid as approved by the Construction Manager.
2. This bid item includes all labor, equipment, and materials necessary to remove approximately 2,800 square feet of sidewalk and construct approximately 6,200 square feet of sidewalk and driveway, as indicated on the Plans.
3. This bid item includes demolition and disposal of existing concrete; excavation and spoils disposal; furnish, place, and compact aggregate base material; furnish, form, place, consolidate, and finish Portland cement concrete; SWPPP pollution prevention measures; establish and maintain reference elevations, cleaning, record drawings; and all incidentals in accordance with these Plans and Specifications.

S. Alternate Bid Item B.3 – Electrical Box

1. This bid item shall be lump sum. Measurement for lump sum work will be based on the completed and in place electrical box as determined by the Construction Manager and the lump sum bid as approved by the Construction Manager.
2. This bid item includes demolish and disposal of existing electrical box; subgrade preparation, coordination with sidewalk installation, replacement with new electrical box; establish and maintain reference elevations, cleaning, record drawings; and all incidentals in accordance with these Plans and Specifications.

T. Alternate Bid Item B.4 – AC Paving

1. This bid item shall be measured in square feet. Measurement for unit price work will be based on the actual number of square feet complete and in place as determined by the Construction Manager and the unit price bid as approved by the Construction Manager.
2. This bid item includes all labor, equipment, and materials necessary to remove and replace approximately 9,300 square feet of AC paving, and installation of similar quantity of thermoplastic striping as existing, as indicated on the Plans.
3. This bid item includes demolish and disposal of existing asphalt concrete pavement; excavation and spoils disposal; furnish, place, and compact aggregate base material; furnish, form, place, consolidate, and finish asphaltic concrete pavement; furnish and install thermoplastic striping; SWPPP pollution prevention measures; establish and maintain reference elevations, cleaning, record drawings; and all incidentals in accordance with these Plans and Specifications.

### 1.03 LUMP SUM PAYMENT ITEMS

- A. Payment items for the Project for which Contract lump sum payments will be made are as listed in the Bid Schedule.
- B. Payment for each lump sum item provides full compensation for furnishing the labor, materials, tools, and equipment and doing all the work involved to complete the work covered by each item and included in the Contract Documents. Costs for items of Work, not specifically mentioned to be included in a particular lump sum or unit price payment item, but deemed incidental to the Work to be considered complete, shall be included in the listed lump sum item most closely associated with the Work involved.
- C. The lump sum price and payment made for each item listed shall be for performing all work required to complete the item and for which separate payment is not otherwise provided.
- D. Contractor shall submit a Schedule of Values for lump sum items. Provide itemized costs of lump sum items to facilitate progress payments of lump sum items that will take longer than one month to complete and are not tied to overall project completion.

### 1.04 UNIT PRICE PAYMENT ITEMS

- A. Payment items for the Project on which the Contract unit price payments will be made are as listed in the approved Bid Schedule.
- B. Each unit price item provides full compensation for furnishing the labor, materials, tools, and equipment and doing all the work involved to complete the work covered by each item and included in the Contract Documents. Measurement and payment stipulations are as detailed in the Specifications.

### 1.05 BID SCHEDULE QUANTITIES

- A. Contract quantities are those quantities that have been calculated from the neat lines shown on the Plans and Specifications with no allowance for so-called shrinkage, swelling or settlement.
- B. When the Plans and Specifications have been altered or when disagreement exists between the Contractor and the Construction Manager as to the accuracy of the Plan and Specification quantities, either party shall, before any work is started that would affect the measurement, have the right to request in writing a change to the noted quantity.

### 1.06 SCHEDULE OF VALUES

- A. In addition to the requirements stated in Contract Documents, the Schedule of Values shall be in the form of an Excel hardcopy spreadsheet along with the electronic file on a floppy disk. A Schedule of Values shall be submitted for each bid item as directed by the Construction Manager. Each component of work shall be consistent with the Contractor's Construction Schedule as defined in Section 01310 PROGRESS SCHEDULES. Construction Manager will use the approved Schedule

of Values to assist in determining monthly progress payments for associated bid items, but will pay for work in terms of percentages actually completed.

- B. Lump Sum bid items as listed in the Bid Schedule submitted by the Contractor with the accepted bid shall be included in a separate detailed Schedule of Values addendum. Each lump sum item shall be as included on the Bid Schedule and shall indicate the portion of the lump sum expected to be requested for each month for the period of the Project. Construction Manager will use this information for reviewing and approving partial payments for these items.
- C. Construction Manager will review the Schedule of Values to assure that item breakdowns are reasonable and balanced. Before any work associated with Schedule of Value items can commence, Construction Manager must approve the Schedule of Values. When approved, they will be used in reviewing and approving the associated bid items to be included in the monthly partial payment requests.
- D. Updates and proposed changes to cash flow and Schedule of Values shall be submitted with the monthly partial payment request. Construction Manager will review the updates and proposed changes and advise the Contractor as to their acceptance, modification or rejection.

#### 1.07 CHANGES AND EXTRA WORK

- A. Measurement and payment of changes and extra work shall be as detailed in the Contract Documents.

#### **PART 2 - PRODUCTS (NOT USED)**

#### **PART 3 - EXECUTION (NOT USED)**

**\*\*END OF SECTION\*\***

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## SECTION 01035

### MODIFICATION PROCEDURES

#### PART 1 - GENERAL

##### 1.01 CHANGES IN CONTRACT PRICE

This section provides supplementary procedures for the administration of changes to the Contract as specified in Section 00700-Article 7, **CHANGES IN THE WORK**. Whenever corrections, alterations, or modifications of the Work under this Contract are ordered by the Construction Manager and approved by the City and increase the amount of work to be done, such added work shall be known as extra work; and when such corrections, alterations, or modifications decrease the amount of work to be done, such subtracted work shall be known as omitted work.

The difference in cost of the work affected by such change will be added to or deducted from the amount of said Contract price, as the case may be, by a fair and reasonable valuation, which shall be determined in one or more of the following ways as directed by the Construction Manager:

- A. Where applicable, by unit prices accepted by the City and stated in the Contract Documents;
- B. By unit prices subsequently fixed by agreement between the parties;
- C. By an acceptable lump sum proposal from the Contractor; or
- D. By Force Account (as described in Section 01035-1.03, **FORCE ACCOUNT PAYMENT**), when directed in writing and administered by the City through its agents or representatives.

The prices agreed upon and any agreed upon adjustment in Contract Time shall be incorporated in the written order issued by the City, which shall be written so as to indicate an acceptance on the part of the Contractor as evidenced by its signature. By signature of the Change Order, the Contractor acknowledges that the adjustments to cost and time contained in the Change Order are in full satisfaction and accord, payment in full, and so waives any right to claim any further cost and time impacts at any time during and after completion of the Contract for the changes encompassed by the Change Order.

##### 1.02 NEGOTIATED CHANGE ORDERS

Under the methods described in Sections 01035-1.01B and 01035-1.01C, the Contractor shall submit substantiating documentation with an itemized breakdown of Contractor and subcontractor direct costs, including labor, material, equipment rentals, and approved services, pertaining to such ordered work in the form and detail acceptable to the

Construction Manager. The direct costs shall include only costs as described in Section 01035-1.04, **DIRECT COST CATEGORIES**.

The Construction Manager will review the Contractor's proposal for the change and negotiate an equitable adjustment with the Contractor. After there is an agreement the Construction Manager will prepare and process the Change Order and make a recommendation for action by the City. All Change Orders must be approved by the City in writing before the work can be authorized and the Change Order executed.

### 1.03 FORCE ACCOUNT PAYMENT

If either the amount of work or payment for a Change Order cannot be determined or agreed upon beforehand, the City may direct by written Change Order or Field Order that the work be done on a force account basis. The term "force account" shall be understood to mean that payment for the work will be done on a time and expense basis, that is, on an accounting of the Contractor's forces, materials, equipment, and other items of cost as required and used to do the work. For the work performed, payment will be made for the documented actual cost of the work as described in Section 01035-1.04, **DIRECT COST CATEGORIES**.

Prior to the commencement of force account work, the Contractor shall notify the Construction Manager of its intent to begin work. Labor, equipment and materials furnished on force account work shall be recorded daily by the Contractor upon report sheets acceptable to the Construction Manager. The reports, if found to be correct, shall be signed by both the Contractor and Construction Manager, or inspector, and a copy of which shall be furnished to the Construction Manager no later than the working day following the performance of said work. The daily report sheet shall thereafter be considered the true record of force account work provided. If the Construction Manager, or inspector, do not agree with the labor, equipment and/or materials listed on the Contractor's daily force account report, the Contractor and Construction Manager, or inspector, shall sign-off on the items on which they are in agreement. The Construction Manager shall then review the items of disagreement and will advise the Contractor, in writing, of its determination. If the Contractor disagrees with this determination, it shall have the right to file a claim notice as provided in Section 00700-7.03A, **Notice**.

The Contractor shall maintain its records in such a manner as to provide a clear distinction between the direct costs of work paid for on a force account basis and the costs of other operations.

To receive partial payments and final payment for force account work, the Contractor shall submit, in a manner approved by the Construction Manager, detailed and complete documented verification of the Contractor's and any of its subcontractor's actual costs involved in the force account pursuant to the pertinent Change Order or Field Order. Such costs shall be submitted within thirty (30) days after said work has been performed. No payments will be made for work billed and submitted to the Construction Manager after the thirty (30) day period has expired.

The force account invoice shall itemize the materials used and shall cover the direct costs of labor and the charges for equipment rental, whether furnished by the Contractor, subcontractor, or other forces. The invoice shall be in a form acceptable to the Construction Manager and shall provide names or identifications and classifications of workers, the hourly rate of pay and hours worked, and also the size, type, and identification number of equipment and hours operated. Material charges shall be substantiated by valid copies of vendor's invoices.

#### 1.04 DIRECT COST CATEGORIES

The categories described below are defined to be direct costs. No other type of costs will be allowable as direct costs. Direct costs shall not include any labor costs pertaining to the Contractor's and subcontractors' managers or superintendents, their office and engineering staffs, the cost of their offices, facilities, vehicles, or anyone not directly employed on such work, nor small tools, and supplies. All such items are considered indirect costs which form a part of the Contractor's and subcontractors' overhead expenses.

The City reserves the right to furnish such labor, materials, and equipment as it deems expedient, and the Contractor shall have no claim for profit or added fees on the cost of such items.

##### A. Direct Labor

The Contractor will be paid the cost of direct craft labor for the workers and foremen (when authorized by the Construction Manager) used or proposed to be utilized in the actual and direct performance of the work.

The direct labor cost will be the actual payroll cost, including wages, subsistence and travel payments, and fringe benefits as established by negotiated labor agreements or state prevailing wages. To these actual wages, a labor surcharge in the amount of 11% of the direct labor cost will be added for all workers including Pile Drivers and Longshoremen and Harbor Workers. The labor surcharge compensates Contractor for the following statutory payroll-related costs: Workers Compensation, Social Security, Medicare, Federal Unemployment, State Unemployment, and State Training taxes. No other fixed labor burdens will be considered, unless approved in writing by the Construction Manager. Except as otherwise provided, the Contractor shall receive no additional compensation for wage premiums resulting from overtime work performed under change conditions without the prior written authorization of the Construction Manager.

##### B. Materials

The Contractor will be paid the cost of the materials to the purchaser, including tax and delivery if paid. If the Contractor does not furnish satisfactory evidence of the cost of such materials, it shall be deemed to be the lowest current price for the materials delivered to the job site for the applicable quantities of the materials.

No payment for small tools and supplies will be made for modifications. The Contractor's base compensation shall be deemed as full compensation for all tools and materials which are incidental to performing work including safety equipment provided by the Contractor to its employees.

C. Construction Equipment

The cost of construction machinery and equipment for changes shall be based on fair rental cost or equivalent rental cost of owned equipment. Such costs will be allowed for only those days or hours during which the equipment is in actual use. Payment shall be based on actual rental and transportation invoices but shall not exceed the rental rates listed for such equipment in the State of California Department of Transportation publication entitled "Labor Surcharge and Equipment Rental Rates" which is in effect on the date upon which the work is performed. Owner-operated equipment rates shall not exceed the rates in the aforesaid Rental Rate publication plus the labor costs as provided in Section 01035-1.04A, **Direct Labor**. The rental cost allowed for equipment will, in all cases, be understood to cover all fuel, supplies, repairs, ownership, and incidental costs and no further allowances will be made for those items, unless specific written agreement to that effect is made. Compensation for idle time of equipment through delays caused by the City will be made consistent with Section 8-1.09, **Right-of-Way Delays**, of the Caltrans Standard Specifications.

Individual items of construction equipment or small tools which have a replacement value of five hundred dollars (\$500) or less shall not be charged to the Change Order work unless it can be demonstrated that the particular item is needed solely for the completion of the Change Order work.

1.05 MARK-UP ALLOWANCES

To the total of the direct costs of labor, materials, and equipment computed as described above, Contractor may add the following markups to the direct cost of the Change Order work, as further described below. The maximum markups allowed are:

- A. For work by its own organization, the Contractor may add up to the following percentages:
  - 1. Direct Labor
    - a. Negotiated Change Orders (Section 01035-1.02): 25 percent
    - b. Force Account Payment (Section 01035-1.03): 15 percent
  - 2. Materials 10 percent
  - 3. Equipment (owned or rented) 15 percent
- B. For all such work performed by subcontractors, such subcontractor may add the same percentages as the Contractor as listed in Section 01035-1.05A above to its actual net increase in costs for combined overhead and profit. The Contractor may add up to five (5) percent of the subcontractor's total for its combined overhead and profit. No further compensation will be allowed for the Contractor's administration of the work performed by the subcontractor.

- C. For all such work done by sub-tier subcontractors, such sub-subcontractors may add the same percentages as the Contractor as listed in Section 01035-1.05A above to its actual net increase in costs for combined overhead and profit. The subcontractor may add up to five (5) percent of the sub-subcontractor's total for its combined overhead and profit. The Contractor may add up to five (5) percent of the subcontractor's total for its combined overhead and profit. No further compensation will be allowed for the Contractor's administration of the work performed by the subcontractor.
- D. For all such work performed by consultants, engineers, surveyors, etc. the combined total allowable markup for the Contractor and all subcontractors shall be five (5) percent of the fee total.
- E. To the total of the direct costs and markups allowed herein under, not more than two (2) percent shall be added for any and all additional Contractor bond and insurance, other than workers compensation insurance. (Cost for workers compensation insurance is included in the labor surcharge.) The compensable percentage for additional bonds and insurance shall be based on actual costs for the Contractor's bonds and insurance, as substantiated through documentation submitted to the Construction Manager.

When both additional and deleted work are involved in any one change, the markup allowances of this Section shall be applied to the net extra cost of the work, if any, after subtraction of the costs for the deleted work. For Change Order work which results in a net decrease in cost a minimum of five (5) percent markup shall be added to the sum of the direct labor, materials and equipment as a deduction for profit, indirect and overhead costs, and reduction in bond and insurance. The Contractor shall not be entitled to nor claim for anticipated profits on work that may be omitted.

The added mark ups shall be considered to be full compensation covering the cost of general supervision, field and home office overhead, profit, delay costs, small tools, safety equipment, incidentals, and any other items of expense not specifically designated as cost for labor, materials, and equipment, above. The above mark ups represent the maximum limits which will be allowed, and they include the Contractor's and all subcontractors' indirect field and home office expenses and all other costs for cost proposal preparation, schedule analysis and preparation, operation and maintenance manual documentation, and record documents and change order administration.

#### 1.06 INCREASED OR DECREASED QUANTITIES

Increases or decreases in the quantity of a Contract unit price bid item of work will be determined by comparing the total pay quantity of such item of work with the Bid Schedule quantity.

If the total pay quantity of any item of work required under the Contract varies from the Bid Schedule quantity by twenty five (25) percent or less, payment will be made for the quantity of work of said item performed at the Contract unit prices therefore, unless eligible for adjustment pursuant to Section 01035-1.06D, **Changes in Character of Work**.

If the total pay quantity of any item of work required under the Contract varies from the Bid Schedule quantity by more than twenty five (25) percent in the absence of an executed Contract Change Order specifying the compensation to be paid, the compensation payable to the Contractor will be determined in accordance with Sections 01035-1.06A, 1.06B or 1.06C, as the case may be.

A. Increases of more than twenty five (25) percent

Should the total pay quantity of any item of work required under the Contract exceed the Bid Schedule quantity by more than twenty five (25) percent, the work in excess of one hundred twenty five (125) percent of the Bid Schedule quantity will be paid for by adjusting the Contract unit price, as hereinafter provided. At the option of the Construction Manager, payment for the work involved in such excess will be made on the basis of force account as provided by Section 01035-1.03, **FORCE ACCOUNT PAYMENT**.

Such adjustment of the Contract unit price will be the difference between the Contract unit prices and the actual unit costs, which will be determined as hereinafter provided, of the total pay quantity of the item. If the costs applicable to such item of work include fixed costs, such fixed costs will be deemed to have been recovered by the Contractor by the payments made for one hundred twenty five (125) percent of the Bid Schedule quantity for such item, and in computing the actual unit cost, such fixed costs will be excluded. Subject to the above provisions, such actual unit cost will be determined by the Construction Manager in the same manner as if the work were to be paid for on a force account basis as provided in Section 01035-1.03, **FORCE ACCOUNT PAYMENT** or such adjustment will be as agreed to by the Contractor and the Construction Manager.

When the compensation payable for the number of units of an item of work performed in excess of one hundred twenty five (125) percent of the Bid Schedule quantity is less than \$5,000 at the applicable Contract unit price, the Construction Manager reserves the right to make no adjustment in said price if it so elects, except that an adjustment will be further considered if requested in writing by the Contractor.

B. Decreases of more than twenty five (25) percent

Should the total pay quantity of any item of work required under the Contract be less than seventy five (75) percent of the Bid Schedule quantity, an adjustment in compensation pursuant to this Section will not be made unless the Contractor so requests in writing. If the Contractor so requests, the revised quantity will be paid for by adjusting the Contract unit price as hereinafter provided. At the option of the Construction Manager, payment for the quantity of the work of such item performed will be made on the basis of force account as provided in Section 01035-1.03, **FORCE ACCOUNT PAYMENT**. However, in no case shall the payment for such work be less than that which would be made at the Contract unit price.

Such adjustment of the Contract unit price will be the difference between the Contract unit price and the actual unit cost of the total pay quantity of the item, including fixed costs. Such actual unit cost will be determined by the Construction Manager in the same manner as if the work were to be paid for on a force account basis as provided in Section 01035-1.03, **FORCE ACCOUNT PAYMENT**; or such adjustment will be as agreed to by the Contractor and the Construction Manager.

The payment for the total pay quantity of such item of work will in no case exceed the payment which would have been made for the performance of seventy five (75) percent of the Bid Schedule of the quantity for such item at the original Contract unit price.

C. Eliminated Items

In the event that a part of the Work is to be eliminated in its entirety and such Work is covered by unit price(s) contained in the Bid and/or Contract Documents, the price of the eliminated Work item shall be based on the applicable unit price(s). The Contractor shall be paid five (5) percent of the total extended amount (bid price times the Bid Schedule quantity) for the eliminated Work item in consideration of the applicable Contractor's overhead costs.

Should any Contract item of the Work be eliminated in its entirety, in the absence of an executed Contract Change Order covering such elimination, payment will be made to the Contractor for actual costs incurred in connection with such eliminated Contract item if incurred prior to the date of notification in writing by the Construction Manager of such elimination.

If acceptable material is ordered by the Contractor for the eliminated item prior to the date of notification of such elimination by the Construction Manager, and if orders for such material cannot be canceled, it will be paid for at the actual cost, including a five (5) percent mark-up, to the Contractor. In such case, the material paid for shall become the property of the City and the actual cost of any further handling will be paid for. If the material is returnable to the vendor, and if the Construction Manager so directs, the material shall be returned and the Contractor will be paid for the actual costs of charges made by the vendor for returning the material. The actual cost of handling returned material will be paid for by the City.

D. Changes in Character of Work

If an ordered change in the Plans and Specifications materially changes the character of work of a Contract unit price bid item from that on which the Contractor based its Bid price, and if the change increases or decreases the actual unit cost of such changed item as compared to the actual or estimated actual unit cost of performing the work of said item in accordance with the Plans and Specifications originally applicable thereto, in the absence of an executed

Contract Change Order specifying the compensation payable, an adjustment in compensation therefore will be made in accordance with the following:

The basis of such adjustment in compensation will be the difference between the actual unit cost to perform the work of said item or portion thereof involved in the change as originally planned and the actual unit cost of performing the work of said item or portion thereof involved in the change, as changed. Actual unit costs will be determined by the Construction Manager in the same manner as if the work were to be paid for on a force account basis as provided in Section 01035-1.03, **FORCE ACCOUNT PAYMENT**; or such adjustment will be agreed to by the Contractor and the Construction Manager. Any such adjustment will apply only to the portion of the work of said item actually changed in character. At the option of the Construction Manager, the work of said item or portion of item which is changed in character will be paid for by force account as provided in Section 01035-1.03, **FORCE ACCOUNT PAYMENT**.

If the compensation for an item of work is adjusted under this Section, the costs recognized in determining such adjustment shall be excluded from consideration in making an adjustment for such item of work under the provisions in Sections 01035-1.06A, **Increases of More Than Twenty five (25) percent** and 1.06B, **Decreases of More Than Twenty five (25) percent**.

#### 1.07 COST PRICING DATA AND ACCESS TO RECORDS

All cost and pricing data submitted by the Contractor with respect to any change, prospective or executed, or any claim for extra compensation shall be a true, complete, accurate, and current representation of actual cost and pricing of the work. The Construction Manager may require a formal certification as to cost and pricing data submitted by the Contractor.

The City, its Construction Manager or other designated representative shall have access, upon reasonable notice during normal business hours, to any books, documents, accounting records, papers, project correspondence, project files, scheduling information, and other relevant records of the Contractor and all subcontractors directly or indirectly pertinent to the work, original as well as changes and claimed extra work, and the Contract for the purpose of making audit, examination, excerpts, and transcriptions and in order to verify or evaluate any change, prospective or executed, or any claim for which compensation has been requested or notice of potential claim has been tendered.

Such books, documents, and other records mentioned above shall include, but are not limited to all those reasonably necessary to determine the accurate amount of direct and indirect costs, job site, and delay and impact costs, however characterized, and shall include the original Bid and all documents related to the Bid and its preparation, as well as, the as-planned construction schedule and all related documents.

Such access shall include the right to examine and audit such records and make excerpts, transcriptions, and photocopies at the City's cost.



1.08 TIME EXTENSIONS FOR CHANGE ORDERS

If the Contractor requests a time extension for the extra work necessitated by a proposed Change Order, the request must comply with the applicable requirements of Section 01310-1.06, **TIME IMPACT ANALYSES**.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

**\*\*END OF SECTION\*\***

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## SECTION 01050

### FIELD ENGINEERING

#### PART 1 - GENERAL

##### 1.01 DATUM

Vertical and horizontal datum is based on the coordinates and elevations shown on the Drawings. The Contractor shall establish other control and reference points from these City-furnished reference points as required to properly layout the Work and to document as-built location. The control will be tied to not less than two retraceable permanent monuments that are further tied to NAD 83 HARN, GRS Spheroid for horizontal location and NAVD 88 for vertical location. HT1072 (FEMA-2009 FIRM), HT1074 (FEMA-2009 FIRM), M223 (Sausalito), M 224(Sausalito), RM13 (Sausalito) are suggested. Other benchmarks and monuments may be used subject to approval by the Owner. The Contractor shall confirm all relative elevations identified on the Plans prior to start of construction. All connections shall be installed based on actual elevations of existing structures to which connections are made.

Contractor shall protect control points and preserve permanent reference points during construction. Any control points or monuments lost, disturbed or destroyed by the Work shall be replaced by the Contractor's surveyor.

##### 1.02 QUALITY ASSURANCE

The Contractor's surveyor or engineer responsible for surveying specified herein shall be a registered land surveyor in the State of California.

##### 1.03 LINES AND GRADES

The Contractor shall lay out all work, including but not limited to boardwalk, structures, parking lot, pipelines, and utilities, and shall be responsible for any errors resulting therefrom. In all questions arising as to proper location of lines and grades, the Construction Manager's decision will be final.

As part of the bid price for the construction of the improvements, the Contractor shall provide and be responsible for the layout of all work. The Contractor shall provide all necessary surveys, field staking, and positioning for the construction of all components at the proper alignment, elevations, grades, and positions, as indicated on the Drawings and as required for the proper operation and function. The Contractor shall stake its work limits.

The Contractor's layout shall be based on existing structures, survey control and bench marks established by the City.

The Contractor shall supply such labor as required, at no extra charge, to aid and assist the Construction Manager in checking location and grades of the Work as set by the Contractor if the Construction Manager desires to perform this checking. This shall include moving materials and equipment located between monuments and the construction work.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

**\*\*END OF SECTION\*\***

## SECTION 01060

### REGULATORY REQUIREMENTS AND PERMITS

#### PART 1 - GENERAL

##### 1.01 APPLICABLE CODES

Contractor shall comply with all codes applicable to the Project; see Technical Specifications for applicable codes as well Division 0 and Division 1 Specifications and Drawings. The omission of a code shall not excuse nor relieve the Contractor's obligation to comply with any such code applicable to the Work.

##### 1.02 FEES AND PERMITS

The Contractor shall obtain necessary encroachment permits from the County of Marin, Marin Municipal Water District (MMWD), PG&E, or other agency having jurisdiction over the construction area, and shall be responsible for satisfying all requirements, calling for inspections, and obtaining final approvals. The Contractor shall notify the Construction Manager of the need and the readiness of all required inspections. All inspections are to be coordinated with the Construction Manager. The Contractor shall comply with all construction conditions stipulated in the permits. Permits obtained by the City are provided in Appendix C to Division 0:

###### A. Appendix C – BCDC Permit

The Contractor shall initially pay for all permits, fees and inspections required for local agency and code requirements. The Contractor shall submit invoice to the Construction Manager for the City's reimbursement of such costs.

The Contractor shall be responsible for and the City shall not provide reimbursement for any costs required for the reinspection of defective work or additional costs due to the Contractor's failure to properly schedule the inspections.

##### 1.03 STORM WATER QUALITY CONTROLS

A. On Sept. 2, 2009, the State Water Resources Control Board (State Water Board) adopted a revised General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (Order No. 2009-0009-DWQ) for all categories of construction storm water discharges. This permit is a statewide general construction storm water permit for construction activity that results in a land disturbance of one (1) acre or more. Contractor shall be responsible for compliance with the State of California Construction General Permit Order 2009-0009-DWQ adopted on September 2, 2009, as well as compliance for construction of this Project with the City's Permit Coverage as a Small MS4s under Phase II NPDES General Permit, and existing City storm water regulations.

- B. Since the City is responsible to the State for the preparation of and compliance with the various management plans called for in the permit, the City requires the Contractor to provide the detail planning and compliance activities required insofar as they would potentially affect Contractor's methods and means of performing the Work. The conditions of the permit applicable to the Contractor are as follows:
1. Discharge prohibitions
  2. Receiving water limitations
  3. Special Provisions for Construction Activity
    - a. Standard Provisions 2, 3, 5, and 6
  4. Section A: Storm Water Pollution Prevention Plan
    - a. Contractor shall prepare a storm water pollution prevention submittal and obtain approval from City prior to the start of any construction activity with the potential for adverse impacts to storm water quality. It is recommended that Contractor's storm water pollution prevention submittal be developed by a Qualified Storm Water Pollution Prevention Plan ("SWPPP") Developer ("QSD") and implemented by a Qualified SWPPP Practitioner ("QSP") unless a SWPPP is not required under the Construction General Permit. In the event that a SWPPP is not required, Contractor shall remain obligated to acquire City approval of a storm water pollution prevention submittal.
  5. Section B: Monitoring and Reporting Requirements
    - a. The Contractor shall comply with all applicable paragraphs of this section of the SWPPP. The Contractor shall conduct inspections of the construction site prior to anticipated storm events and after storm events to assess effectiveness of the SWPPP.
    - b. A record of the inspections must include the date of the inspection, the individual(s) who performed the inspection and the observations.
    - c. The inspection reports shall be submitted within twenty-four (24) hours of the event.
  6. Storm Water Pollution Prevention Best Management Practices
    - a. In preparing and complying with its storm water pollution prevention submittal, Contractor shall consider best management practices ("BMPs") for erosion control, sediment control, run-on and runoff control and make all necessary provisions for inspection, maintenance and repair of all BMPs employed during the course of construction and until the Project is accepted and the Contractor has fully demobilized from the site. All BMPs must be periodically inspected, maintained, and repaired to ensure that receiving water quality is protected.

- b. Contractor shall properly handle, store and dispose of any potential pollutants, and actively prevent the contamination of waterways or subsoil.
- c. Contractor shall eliminate sediment discharge into storm drains, the Bay or any other receiving waters due to rainwater run-off, and shall eliminate all construction debris, soil or contaminants prior to discharge of storm water.
- d. Contractor shall ensure that construction materials are properly handled and managed to minimize threats to water quality. These procedures shall include good housekeeping measures for: construction materials, waste management, vehicle storage and maintenance, landscape materials, and other potential pollutant sources.
- e. Contractor shall control all non-storm water discharges directly connected to receiving waters or the storm drain system must during construction, including any dewatering activities associated with construction.

#### 1.04 EXISTING UTILITIES AND IMPROVEMENTS

##### A. General

- 1. Access shall be provided at all times to all fire hydrants.
- 2. Contractor shall contact Underground Services Alert (USA) at (800) 227-2600 or (800) 642-2444 one week in advance of starting excavation to provide for marking of utilities. Shutdown of utilities shall be performed only by the utility owner.
- 3. The Contractor shall protect all existing utilities, pavement, sidewalks, curbs, fences, landscaping, and other improvements that are not designated for removal, from damage by his operations. Any such features that are damaged or temporarily relocated by the Contractor during construction shall be repaired or restored by the Contractor to a condition equal to or better than they were prior to such damage or temporary relocation all in accordance with requirements of the Contract Documents and at no expense to the City.
- 4. The location of known existing utilities and pipelines are shown on the drawings in their approximate locations. Some of the locations include multiple conduits. The Contractor shall exercise care in avoiding damage to those facilities which are to remain in service subsequent to the Work, and shall be held responsible for their repair if damaged. The Contractor shall also exercise care in maintaining those facilities which will be removed or abandoned by the Work until such time as they can be removed or abandoned.

5. It shall be the Contractor's responsibility to ascertain the actual location of all existing utilities and other improvements that will be encountered in his construction operations, and to see that such utilities or other improvements are adequately protected from damage due to such operations. There is no guaranty that all utilities or obstructions are shown or that the locations indicated are accurate. The Contractor shall take all possible precautions for the protection of unforeseen utility lines to provide for uninterrupted service and to provide such special protection as may be necessary. The cost of repair of any damages to existing utilities shown on the Plans, marked in the field, or attributable to negligence on the part of the Contractor shall be at the Contractor's expense.
6. Nothing herein shall be deemed to require the public agency to indicate the presence of existing overhead power, telephone and TV cable or underground service laterals and appurtenances when the presence of such utilities on the site of the construction can be inferred from the presence of visible facilities, such as poles, buildings, or meter and junction boxes, on or adjacent to the site of construction; provided, however, nothing herein shall relieve the public agency from identifying buried main or trunk lines in the Plans and Specifications.

B. Owner's Right of Access

1. The right is reserved to the City and to the owners of public utilities and franchises to enter at any time upon any public street, alley, right-of-way, or easement for the purpose of making changes in their property made necessary by the Work of this Contract.

C. Exploratory Excavation

1. The Contractor shall verify the exact locations and depths of all utilities shown on the Plans or by Underground Services Alert (USA). Prior to trenching or excavating for any pipe or structure, the Contractor shall make exploratory excavations to completely expose all utilities shown on the drawings, or located by USA that may interfere with the Work. Excavations around underground electrical ducts and conduits shall be performed using extreme caution to prevent injury to workers or damage to the electrical ducts or conduits.
2. The Contractor shall contact the owner of each utility to determine if they permit potholing of their utility or if they pothole with their own personnel. All such exploratory excavations shall be performed as soon as practicable after award of the Contract and, in any event, a sufficient time in advance of construction to avoid possible delays to the Contractor's work.
3. New pipeline shall be laid to such grade as to clear all existing facilities which are to remain in service for any period subsequent to the construction of the run of pipe involved. A sufficient number of exploratory excavations shall be made for each utility to determine the alignment and grade of the utility.



4. The cost for performing said excavations shall be included in the Contractor's Bid Price. If the Contractor does not expose all required utilities, it shall not be entitled to additional compensation for work necessary to avoid interferences or for repair to damaged utilities.
5. When such exploratory excavations show the utility location as shown to be in conflict with the Work, the Contractor shall so notify the Construction Manager and a method for correcting the conflict will be supplied by the Construction Manager. The Contractor will be reimbursed for the cost of correcting the conflict in accordance with Section 00700-Article 7, **CHANGES IN THE WORK.**

D. Utilities to be Moved

1. Where the proper completion of the Work requires the temporary removal and/or relocation of an existing utility or other improvement the Contractor shall remove and, without unnecessary delay, temporarily replace or relocate such utility or improvement in a manner satisfactory to the Construction Manager and the owner of the facility. In all cases of such temporary removal or relocation, restoration to former location shall be accomplished by the Contractor in a manner that will restore or replace the utility or improvement as nearly as possible to its former locations and to as good or better condition than found prior to removal.
2. In case it shall be necessary to permanently move any existing utility or improvement, the Contractor shall notify the Construction Manager a sufficient time in advance for the necessary measures to be taken to prevent interruption of service or delay of the Work.

E. Underground Utilities Shown or Indicated

1. Existing utility mains and improvements that are shown on the Plans or the locations of which are indicated to the Contractor prior to excavation and that are to be retained, and all utility lines that are constructed during the Work shall be protected from damage during excavation and backfilling, and if damaged, shall be immediately repaired by the Contractor at no expense to the City. This provision shall also apply to existing utility services whose locations can be inferred from meters, vaults, valves, and other markings or those indicated by the owner of the utility.
2. All buried utilities shall be considered to be correctly shown or indicated if their true locations are within ten (10) horizontal feet of the locations shown either on the Plans or marked on the ground by the utility's owner regardless of depth.
3. The Contractor shall receive no additional compensation for extra work or delay for locating such correctly shown or indicated utilities.

F. Underground Utilities Not Shown or Indicated

1. If the Contractor encounters any existing utility mains that are not shown or correctly shown on the Plans, and the locations of which are not correctly indicated to the Contractor prior to excavation, he shall immediately make a written report to the Construction Manager. If directed by the Construction Manager, repairs shall be made by the Contractor under the provisions for changes and extra work. This provision shall also apply to existing utility services whose locations cannot be inferred from meters, vaults, valves, or other markings, and are not indicated to the Contractor prior to excavation by the owner of the utility.
2. The Contractor shall be reimbursed for repair, removal, and/or relocation of these utilities, provided that he exercised reasonable care to avoid causing the damage. Reimbursement will be limited to extra materials, extra labor, and idled equipment that was actually working on the portion of the Work that was stopped due to the damage and could not reasonably be reassigned to another task of the Work.
3. The Contractor shall not be assessed liquidated damages for delay in completion of the Project when such delay was due to utilities that were not shown or located, or could not be inferred from visual evidence.

G. Approval of Repairs

1. The utility or improvement owner shall have the sole discretion to perform repairs or relocation work or permit the Contractor to do such repairs or relocation work at a reasonable price.
2. All repairs to a damaged improvement are subject to inspection and approval by an authorized representative of the improvement owner before being concealed by backfill or other work.

H. Maintaining in Service

1. All oil and gasoline pipelines; railroad facilities; power, telephone or communication cable ducts; gas and water mains; irrigation, sewer, and storm drain lines; and overhead power and communication poles, wires and cables, encountered along the line of the Work shall remain continuously in service during all the operations under the Contract, unless other arrangements satisfactory to the Construction Manager are made with the owner of said facilities.
2. Planned facility shutdowns shall be accomplished as required by the owner of the facility. In some cases, this may require night or weekend work which shall be at no additional cost to the City. The Contractor shall program its work so that service will be restored in the minimum possible time and shall cooperate with the City in reducing shutdowns of utility systems to a minimum. No utility interruption will be permitted without the prior approval of the Construction Manager and the specific utility.

3. The Contractor shall be responsible for all damage due to its operations, and the provisions of this Section shall not be abated even in the event such damage occurs after backfilling or is not discovered until after completion of the backfilling.

I. Interruption of City, Spinnaker Restaurant, or Sausalito Yacht Harbor Facilities

1. Construction will occur adjacent to existing sanitary sewers crossing above, below, and parallel to the Work. The Contractor shall exercise extreme caution in working adjacent to existing sewerage facilities.
2. It is essential that all existing facilities be maintained in service for full-time operation, except where approved temporary facilities are installed or temporary closures are made as part of the Work. Where wastewater flow in existing facilities is interrupted or must be diverted for construction, the Contractor shall conduct this work in accordance with this paragraph and Section 02145, **SEWER BYPASSING AND CONTROL**.
3. Construction of connections between existing facilities and new facilities shall be scheduled to minimize disruption to sewer service. The Contractor shall coordinate the schedule for all work on existing facilities during periods acceptable to the City. Contractor shall notify the City at least 48 hours prior to such work.
4. When working on existing sewers, the Contractor shall investigate and ensure that temporary sewage flow stoppage does not cause the backing up and flooding of residences and businesses connected upstream of the location in question. Any lateral flow stoppage work requiring greater than 1/2 hour shall be approved in advance by the City staff in writing.
5. The Contractor shall advise the Construction Manager in writing at least five (5) calendar days prior to interrupting flow in any sanitary sewer main.
6. The Contractor shall immediately contact PG&E by calling (800) 743-5000 should any damage occur to gas pipelines, cables, appurtenances, or overhead power lines.
7. The Contractor shall immediately contact MMWD by calling Bob Pieri at 415-945-1481 should any damage occur to water pipelines or valves.
8. The Contractor shall immediately contact AT&T by calling 800-310-2355 should any damage occur to telephone conduit, cables or poles.

1.05 RIGHTS-OF-WAY

- A. The Contractor shall not do any work that would affect any existing oil, gas, sewer, or water pipeline; any existing telephone, telegraph, or electric transmission line; any fence; any railroad facility; or any other structure, nor shall the Contractor enter upon the rights-of-way involved until notified by the Construction Manager that the Owner has secured authority therefore from the proper party. After authority has been obtained, the Contractor shall give said party due notice of its intention to begin work, comply with any preconstruction easement conditions, and shall give said party convenient access for removing,

shoring, supporting, or otherwise protecting such pipeline, transmission line, ditch, fence, or structure, and for replacing same.

- B. When two or more contracts are being executed at one time on the same or adjacent land in such manner that work on one contract may interfere with that on another, the Owner shall determine the sequence and order of the Work. When the territory of one contract is the necessary or convenient means of access for the execution of another contract, such privilege of access or any other reasonable privilege may be granted by the Owner to the Contractor so desiring, to the extent, amount, in the manner, and at the times permitted. No such decision as to the method or time of conducting the Work or the use of territory shall be made the basis of any claim for delay or damage, except as provided in the General Conditions for temporary suspension of the Work, Section 00700-6.06, **SUSPENSION OF WORK**.

#### 1.06 CULTURAL RESOURCES

- A. The Contractor's attention is directed to the National Historic Preservation Act of 1966 (16 U.S.C. 470) and PRM 75-27 which provides for the preservation of potential historical architectural, archeological, or cultural resources (hereinafter called "cultural resources").
- B. The Contractor shall conform to the applicable requirements of the National Historic Preservation Act of 1966 as it relates to the preservation of cultural resources. Fair compensation to the Contractor for delays resulting from such cultural resources investigations shall be made.
- C. In the event potential cultural resources are discovered during subsurface excavations at the site of construction, the following procedures shall be instituted:
- D. The Construction Manager will issue a Stop Work Order directing the Contractor to cease all construction operations at the location of such potential cultural resources find.
- E. Such Stop Work Order shall be effective until such time as a qualified archaeologist can be called to assess the value of these potential cultural resources and make recommendations to the City. Any Stop Work Order shall contain the following:
  - 1. A clear description of the work to be suspended
  - 2. Any instruction regarding issuance of further orders by the Contractor for material services
  - 3. Guidance as to action to be taken on subcontracts
  - 4. Any suggestions to the Contractor as to minimization of his costs
  - 5. Estimated duration of the temporary suspension
- F. If the archaeologist determines that the potential find is a bona fide cultural resource, at the direction of the City, the Engineer shall extend the duration of the Stop Work Order in writing, and the Contractor shall suspend work at the location of the find.

- G. Equitable adjustment of the construction contract time shall be made in the following manner: If the work temporarily suspended is on the "critical path," the total number of days for which the suspension is in effect shall be added to the number of allowable contract days.

#### 1.07 SPECIAL WORK HOURS FOR SPECIFIC ITEMS OF WORK

- A. The following items of work are required to be completed during the specified time period:
  - 1. General working hours shall be defined in Section 01560-1.07
  - 2. At least one lane of traffic in each direction shall be maintained between 9:00 a.m. and 3:30 p.m.
  - 3. All traffic lanes shall be opened between 3:30 p.m. and 9:00 a.m. except during the "night work" as specified below.

#### 1.08 NIGHT WORK (NOT USED)

#### 1.09 PROTECTION OF STREET OR ROADWAY MARKERS

- A. It is the responsibility of the Contractor to protect all survey monuments, survey markers, and street markers in the area of his work.
- B. Prior to breaking pavement or starting excavation, the Contractor shall reference all survey monuments and markers that will be affected by his work, and reset such monuments and markers after construction, in accordance with the requirements of Marin County and the City of Sausalito.
- C. Referencing and resetting of survey monuments and markers shall be done by a land surveyor registered in the State of California who is hired by the Contractor.

#### 1.10 WORK WITHIN PRIVATE PROPERTY

- A. The Contractor shall restrict operations to cause the least amount of damage to the surrounding property and to save as many trees and plants as possible. If damage to the surrounding property has occurred, the Contractor shall restore the property to a condition equal to or better than that which existed prior to the Contractor's entry, or as required as part of these Contract Documents.

### **PART 2 - PRODUCTS (NOT USED)**

### **PART 3 - EXECUTION (NOT USED)**

**\*\*END OF SECTION\*\***

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## SECTION 01090

### REFERENCES

#### PART 1 - GENERAL

##### 1.01 CODES AND STANDARDS

Whenever reference is made to a code or standard, it means the latest edition in effect the date that the Contract Documents are dated. Where codes, standards, and reference documents are referred to in the Contract Documents, the Contractor may submit a written request to the Construction Manager for assistance in locating such documents. Within three days of receipt of such request, the Construction Manager will notify the Contractor as to where the document(s) can be reviewed.

No provision of any such standard, specifications, manual, code or instruction shall be effective to change the duties and responsibilities of the City, City's representative, or any of their consultants, agents, or employees from those set forth in the Contract Documents. Nor shall any of the aforementioned be effective to assign to the City or the City's representative, or any of their consultants, agents, or employees any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

##### 1.02 DEFINITIONS OF WORDS AND TERMS

Where used in the Contract Documents, the following words and terms shall have the meanings indicated. The meanings shall be applicable to the singular, plural, masculine, and feminine of the words and terms.

- A. Acceptance - Formal action of the City in determining that the Contractor's work has been completed in accordance with the Contract and in notifying the Contractor in writing of the acceptability of the Work.
- B. Acts of God - "Acts of God" shall include only the following occurrences or conditions and effects: earthquakes in excess of a magnitude of 3.5 on the Richter Scale and tidal waves.
- C. Addenda - Supplemental written specifications or drawings issued prior to bid submittal which modify or interpret these Contract Documents by addition, deletion, clarification, or corrections.
- D. Agreement - The written document covering the performance of the Work as more fully described in Section 00500, **AGREEMENT FOR CONSTRUCTION**.
- E. Bid - Offer of a bidder submitted on the prescribed form setting forth prices of the Work to be performed.

- F. Bidder - Individual, partnership, corporation, or a combination thereof, including joint venturers offering a bid to perform the Work.
- G. Clarification Letter - A Clarification Letter is issued by the Construction Manager to address the clarification of Contract issues raised by the Construction Manager, Design Consultant or City.
- H. City - City of Sausalito, California, as Owner, acting through the City Council or other duly authorized agents.
- I. Completion - The word completion shall indicate Substantial Completion.
- J. Construction Manager - The person designated, in writing, by the City to act as its representative at the construction site and to perform construction inspection services and administrative functions relating to this Contract. Initial contact by the Contractor with the City shall be through the Construction Manager.
- K. Contract - The word "Contract" means this Contract, as set forth in the Agreement and the Contract Documents.
- L. Contract Change Order - A written order to the Contractor, covering changes in the Plans or quantities, or both, and establishing the basis of payment and time adjustments for the Work affected by the changes. Also referred to as a Change Order.
- M. Contract Documents - The words "Contract Documents" shall mean any or all of the following items, as applicable:
1. Notice Inviting Bids
  2. Instructions to Bidders
  3. Bid Form and Bid Schedule
  4. Designation of Subcontractors
  5. Bid Guaranty Bond
  6. Agreement
  7. Performance Bond
  8. Payment Bond
  9. Insurance Endorsements
  10. Site Visit Affidavit
  11. Non-Collusion Affidavit
  12. General Conditions
  13. Supplementary General Conditions
  14. General Requirements
  15. Specifications
  16. Drawings



17. Addenda, if any
18. Executed Change Orders, if any
19. Field Orders
20. Notice to Proceed
21. Permits

Each of these items is to be considered by reference as part of the Contract Documents, also referred to as Contract.

- N. Contract Price (also referred to as Contract Amount) - The amount payable to the Contractor under the terms and conditions of the Contract based on the price given on the bidding schedule, with adjustments made in accordance with the Contract. The Total Base Amount given in the Bid Proposal shall be either a lump sum bid or the summation of the unit price bids multiplied by the estimated quantities set forth in the bid form.
- O. Contract Time - Number of calendar days stated in the Contract for the completion of the Work.
- P. Contractor - The individual partnership, corporation, or combination thereof including joint venturers who enter into the Contract with the City for the performance of the Work. The term appropriately extends to subcontractors, subtier subcontractors, consultants, equipment and material suppliers and their employees which are utilized by the Contractor.
- Q. Contractor's Plant and Equipment - Equipment, material, supplies, and all other items, except labor, brought onto the site by the Contractor to carry out the Work, but not to be incorporated in the Work.
- R. Corrective Work Item List - List of incomplete items of work, incomplete administrative requirements and items of work which are not in conformance with the Contract, prepared by the Construction Manager and issued to the Contractor as an attachment to the response to the Contractor's notification of Substantial Completion.
- S. Days - The word "Days" shall mean calendar days, including legal holidays, Saturdays and Sundays, unless specifically noted otherwise.
- T. Design Consultant - The engineer or architect designated by the City to have design control over the Work or a specified portion of the Work, acting either directly or through duly authorized representatives. Such representatives shall act within the scope of the particular duties delegated to them. The Design Consultant may also furnish inspection services as provided by the Contract.
- U. Direct - Action of the City or Construction Manager by which the Contractor is ordered to perform or refrain from performing work under the Contract.

- V. City - The word "City" refers to the City of Sausalito, the governing body of which is termed the Council.
- W. City Representative - The person designated in writing by the City to act as its agent on specified matters relating to this Contract. The City's Representative is not the Construction Manager, but an employee of the City who has been designated to represent the City.
- X. Drawings - Also referred to as "Plans". That part of the Contract Documents consisting of the graphical and technical requirements of the Contract as included on the Plan sheets.
- Y. Engineer - Engineer shall refer to either the Construction Manager or Design Consultant based on their roles as defined in Section 00700, **GENERAL CONDITIONS**, and their separate contracts with the City.
- Z. Favorable Review - "Favorable Review" means that the person or entity acting on behalf of the City has reviewed a proposal or submittal and found it acceptable as to the aspects for which review was sought. "Favorable Review" does not imply any approval of deviations from the Contract Documents which can only be made by formal Field Directive, Field Order or Contract Change Order.
- AA. Field Directive - Written documentation of the actions of the City or Construction Manager in directing the Contractor. Also referred to as a Directive.
- BB. Field Order - A written instruction given to the Contractor authorizing work that is a change to the scope of work carried out on a time and material basis.
- CC. Final Acceptance - The point at which work has been completed in accordance with the Contract Plans and Specifications to the satisfaction of the Engineer and there are no items of work remaining to be completed.
- DD. Final Inspection List - List of materials, equipment, workmanship, or administrative requirements, which are not in conformance with the Contract. The list shall be prepared by the Construction Manager and submitted to the Contractor following the Contractor's notice of completion of the Work, including all items on the Punch List.
- EE. Float - Float or "total float" shall be defined as provided in the Associated General Contractors of America "CPM in Construction, A Manual for General Contractors".
- FF. Furnish - To deliver to the job site or other specified location any item, equipment or material.
- GG. General Conditions - Sections 00700, **GENERAL CONDITIONS**, and 00800, **SUPPLEMENTARY GENERAL CONDITIONS**, which form the part of the Contract Documents representing the general clauses that establish how the Project is to be administered.

- HH. General Requirements - Division 1, **GENERAL REQUIREMENTS**, which forms the part of the Contract Documents establishing special conditions or requirements peculiar to the Work and supplementary to the General Conditions.
- II. Herein - Refers to information presented in these Contract Documents.
- JJ. Holidays - Legal holidays shall include the holidays designated by the City and listed in Section 01560.
- KK. Install - Placing, erecting, or constructing complete in place any item, equipment, or material.
- LL. Notice to Proceed - Notice to Proceed shall mean the written notice issued by the City to Contractor authorizing him to proceed with the Work and establishing the date of commencement of the Contract Time. Notice to Proceed may or may not include separate dates establishing the date of commencement of the submittal process.
- MM. Owner - The word "Owner" shall have the same meaning as the term "City."
- NN. Paragraph - For reference or citation purposes, a paragraph shall refer to the paragraph, or paragraphs, called out by paragraph number and alphanumeric designator.
- OO. Person - The term, person, includes firms, companies, corporations, partnerships, and joint ventures.
- PP. Plans - See "Drawings."
- QQ. Project - The undertaking to be performed under the provisions of the Contract.
- RR. Provide - Furnish and install, complete in place.
- SS. Punch List - List of incomplete items of work, incomplete administrative requirements, and items of work which are not in conformance with the Contract, prepared by the Construction Manager and issued to the Contractor as an attachment to the Certificate of Substantial Completion.
- TT. Request for Information - Also referred to as "Request for Clarification." A Request for Information (RFI) is issued by the Contractor to the Construction Manager to request resolution of a question on a Contract issue. A RFI is not to be used for request for material/equipment substitutions or value engineering/cost reduction incentive proposals.
- UU. Request for Quotation - A request for a proposed cost made of the Contractor by the Owner to add, delete or change the Work. A Contract Change Order is issued upon Agreement of Price and nature of the change of the Work.

- VV. Shall - The use of “shall” or “will” means that the Contractor or City, as appropriate, is contractually or legally obligated to take the required action, unless another meaning is clearly indicated.
- WW. Shown - Refers to information presented on the Drawings, with or without reference to the Drawings.
- XX. Specifications - That part of the Contract Documents consisting of written descriptions of the technical features of materials, equipment, constructions systems, standards, and workmanship.
- YY. Specify - Refers to information described, shown, noted or presented in any manner in any part of the Contract.
- ZZ. State of California Specifications - The State of California Department of Transportation Standard Specifications in effect at the time of advertising the Work. Also referred to as State Standard Specifications and Caltrans Standard Specifications.
- AAA. Subcontractor - A subcontractor is a person or entity who has a direct contract with the Contractor or a subtier subcontractor who has a direct contract with a subcontractor to perform any of the Work associated with the Project The term subcontractor, does not include any separate contractor or any separate contractor's subcontractors.
- BBB. Submittals - The information which is specified for submission to the Construction Manager in accordance with these Contract Documents.
- CCC. Substantial Completion - “Substantial Completion” means that there is sufficient completion of the Project or an agreed to portion thereof that the City can effectively utilize. Determination of substantial completion is solely at the discretion of the City. Substantial Completion does not mean Complete in accordance with the Contract nor shall Substantial Completion of all or any part of the Project entitle the Contractor to Acceptance under the Contract.
- DDD. Substantial Completion Date - Date when the City puts into service, the Project, or that portion of the Project, which the City has been determined to be Substantially Complete.
- EEE. Sub-subcontractor - A sub-subcontractor is a person or entity who has a direct or indirect contract with a subcontractor to perform any of the Work at the Site. The term sub-subcontractor means a sub-subcontractor or an authorized representative thereof, also referred to as subtier-subcontractor.
- FFF. Supplier - Any person, firm, corporation, or organization who supplies materials or equipment for the Work, including that fabricated to a special design, and may also be a Subcontractor or a Sub-subcontractor.

- GGG. Surety - The person, firm, corporation, or organization that joins with the Contractor in assuming the liability for the faithful performance of the Work and for the payment of all obligations pertaining to the Work in accordance with the Contract Documents by issuing the Bonds required by the Contract Documents or by law.
- HHH. Total Base Bid - The original Contract Price as established from the **BID PROPOSAL** in the **BASE BID FORM** as completed by the Contractor as a part of his Bid for the Work.
- III. Warranty Period - Period where the Contractor is responsible for repairs to equipment or the Work at no cost to the City after Substantial Completion. Length of period is as established in Section 01740 **WARRANTIES AND BONDS**, and/or elsewhere in the Contract Documents.
- JJJ. Will - See definition of shall.
- KKK. Work - The term “Work” means all labor, materials, equipment, supplies, services, and other items necessary for the execution, completion and fulfillment of the Contract.
- LLL. Work Day - Any day except Saturday, Sunday, and legal holidays. For time extension purposes a work day is equivalent to 1.45 calendar days.

### 1.03 ABBREVIATIONS

Whenever the following terms are used, the intent and meaning shall be as follows:

Abbreviation    Stands For

AASHTO	American Association of State and Highway and Transportation Officials
AAMA	Architectural Aluminum Manufacturers Association
ABMA	American Boiler Manufacturers Association
ACI	American Concrete Institute
ADC	Air Diffusion Council
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AMCA	Air Moving and Conditioning Association
ANSI	American National Standard Institute (formerly United States of America Standards Institute)
APA	American Plywood Association
API	American Petroleum Institute
AREA	American Railway Engineers Association
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Construction Managers

<u>Abbreviation</u>	<u>Stands For</u>
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing and Materials
AWPA	American Wood-Preserver's Association
AWS	American Welding Society
AWWA	American Water Works Association
BCDC	San Francisco Bay Conservation and Development Commission
CAGI	Compressed Air and Gas Institute CAL/OSHA State of California Department of Industrial Relations, Division of Industrial Safety
CBM	Certified Ballast Manufacturers
CBR	California Bearing Ratio
CI	Chlorine Institute
CISPI	Cast Iron Soil Pipe Institute
CMAA	Crane Manufacturers Association of America
CPSC	Consumer Products Safety Commission
CRA	California Redwood Association
CRSI	Concrete Reinforcing Steel Institute
CTI	Cooling Tower Institute
DFPA	Douglas Fir Plywood Association
EIA	Electronic Industries Association
EPA	U.S. Environmental Protection Agency
ETL	Electronic Testing Laboratory
FM	Factory Mutual Insurance Company
FPS	Fluid Power Society
FS	Federal Specifications
GO 95	General Order No. 95, California Public Utilities Commission Rules for Overhead Electric Line Construction
HI	Hydraulic Institute
HMI	Hoist Manufacturers Institute
IAPMO	International Association of Plumbing and Mechanical Officials
IBR	Institute of Boiler and Radiator Manufacturers
ICBO	International Conference of Building Officials
IEEE	Institute of Electrical and Electronic Engineers
IES	Illuminating Engineering Society
IPCE	International Power Cable Engineers Association
ISA	Instrument Society of America
MIL	Military Specifications
MSS	Manufacturer's Standardization Society
NAAMM	National Association of Architectural Metal Manufacturers
NBS	National Bureau of Standards
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NSF	National Sanitation Foundation
NWMA	National Woodwork Manufacturers Association
OSHA	Occupational Safety and Health Act

Abbreviation   Stands For

PCMAC	Prestressed Concrete Manufacturers Association of California
RWQCB	California Regional Water Quality Control Board
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SSPC	Structural Steel Painting Council TCA Tile Council of America
UBC	Uniform Building Code
UFC	Uniform Fire Code
UPC	Uniform Plumbing Code
UL	Underwriters Laboratories
USACOE	U.S. Army Corps of Engineers
WCLIB	West Coast Lumber Inspection Bureau
WIC	Woodwork Institute of California

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

**\*\*END OF SECTION\*\***

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## SECTION 01200

### PROJECT MEETINGS

#### PART 1 - GENERAL

##### 1.01 PRE-CONSTRUCTION CONFERENCE

Prior to the start of construction, the City will conduct a pre-construction conference that shall be attended by the Contractor's Project Manager/Project Engineers, major subcontractors, major equipment, and material suppliers, affected utilities, and others as determined by the Contractor and Construction Manager. At the conference, the City will review the Contractor's proposed schedule of operations and the construction procedure and sequence requirements. Also discussed will be the Contractor's field organization, submittals, progress payments, change order procedures, safety requirements, permits and inspections, and other matters.

##### 1.02 PROGRESS MEETINGS

The Construction Manager shall schedule, arrange, and conduct progress meetings. These meetings shall be conducted not more than once per week and shall be attended by the Contractor's superintendent and representatives of all subcontractors, utilities, and others, who are active in the execution of the Work. The purpose of these meetings shall be to review the Contractor's three (3) week schedule provided in accordance with Section 01310-1.07, **LOOKAHEAD SCHEDULE**, resolve conflicts, and in general, coordinate and expedite the execution of the Work.

The agenda of progress meetings shall include, as a minimum, review of progress and schedule, clarifications, changes, quality of work, progress payment request, and record documents. The Construction Manager shall prepare and distribute minutes of the meetings.

Contractor, in coordination with the City's construction manager, shall distribute meeting minutes and project status updates to:

- Sausalito Yacht Harbor, 501 Humboldt Ave, Sausalito, CA (415) 332-5000, Jim Madden
- Spinnaker Restaurant, 100 Spinnaker Drive, Sausalito, CA 415-332-1572, Jeff Scharosch
- Bank of America, 750 Bridgeway, Sausalito, CA (415) 499-5151,

1.03 PARTNERING MEETINGS (NOT USED)

1.04 OTHER PROJECT MEETINGS

The Contractor shall attend and require the participation of other subcontractors or suppliers for other project related meetings when requested by the Construction Manager or the City.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

**\*\*END OF SECTION\*\***

## SECTION 01300

### SUBMITTALS

#### 1 PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Where the Contractor is required by these Specifications to make submittals, they shall be made to the Construction Manager with a letter of transmittal and in accordance with the requirements of this Section.
- B. The Contractor shall submit the following items to the Construction Manager. Six (6) copies are to be submitted unless other provisions of the Contract Document stipulate a different quantity.
  - 1. Safety Program
  - 2. Substitutions
  - 3. Shop Drawings
  - 4. Material Safety Data Sheets
  - 5. Operation and Maintenance Manuals
  - 6. Working Drawings
  - 7. Warranty Data
  - 8. Others as Specified in the Technical Specifications
- C. Three (3) copies of submittals, which require review, will be returned to the Contractor with review comments, if any, noted.
- D. Reviewed copies of the Construction Schedule and the Final Operation and Maintenance Manuals will not be returned to the Contractor. It shall be the Contractor's responsibility to copy and/or conform reviewed submittals in sufficient numbers for its files, subcontractors, and vendors.

##### 1.02 CONTRACTOR'S RESPONSIBILITIES

- A. The Contractor shall submit, at its own expense, samples, submittals and details of structural and reinforcing steel, equipment, material, electrical controls, architectural fabrications, pipe, pipe joints, special pipe sections, and any other appurtenances as required in Technical Specifications.
- B. All samples, submittals and supporting data, catalogs, schedules, etc., shall be submitted as the instruments of the Contractor, who shall be responsible for confirming their accuracy and completeness and coordination before submitting them to the Construction Manager. Such responsibility shall not be delegated in whole or part to subcontractors or suppliers. These submittals may be prepared by the Contractor, subcontractors, or suppliers, but the Contractor shall ascertain that submittals meet all of the requirements of the Contract Documents, while

conforming to structural, space, and access conditions at the point of installation. Designation of work "by others," if shown in submittals, shall mean that the work will be the responsibility of the Contractor rather than the subcontractor or supplier who prepared the submittals.

- C. The Contractor shall insure that there is no conflict between submittals and notify the Construction Manager in each case where a submittal may affect the Work of another contractor or the City. The Contractor shall insure coordination of submittals among the related crafts and subcontractors. The Contractor accepts the responsibility and expense for additional costs and delays which may result from Work performed without Favorably Reviewed submittals.
- D. Submittals shall be prepared in such form that data can be identified with the applicable Specification paragraph. The data shall clearly demonstrate compliance with the Contract Documents and shall relate to the specific material or equipment to be furnished. Where manufacturer's standard drawings are employed, they shall be marked clearly to show what portion of the data is applicable to this Project.

### 1.03 MATERIAL AND EQUIPMENT SUBSTITUTIONS

#### A. General

1. In preparing these Contract Documents, the Design Consultant has named those products which to its knowledge meet the Technical Specifications and are equivalent in construction, function, efficiency, and durability.
2. Wherever catalog numbers and specific brands or trade names preceded by "similar and equal" or followed by the designation "or equal" are used in conjunction with a designated material, product, thing, installation, or service mentioned in these Specifications, they are used to establish the standards of quality and utility required.
3. The first-named manufacturer is the basis for the project design and the use of alternative named or unnamed manufacturer's products proposed by the Contractor may require modifications in the project design and construction. Contractor shall be responsible for all costs of those modifications, including labor, material, equipment, and services performed by a design professional.
4. Where only one product has been named by brand, it is the only brand, trade name, or manufactured product known to the Design Consultant that meets the requirements of the Technical Specifications.
5. The City has made a determination that no substitution will be considered and that the following listed materials and/or equipment must be furnished as designated below in order to match others in use by the City or because it is a unique or novel product application required to be used by the City:

No Sole Source Materials or Equipment Identified

#### Substitutions

1. Substitutions, which are equal in quality and utility to those specified, will, at the City's sole discretion, be permitted, subject to the following provisions. For this purpose, the contractor shall submit to the Construction Manager within fifteen (15) days of the Notice of Award a typewritten list containing a description of each proposed substitute item or material, along with sufficient data, drawings, samples, literature, calculations, or other detailed information as will demonstrate to the Design Consultant that the proposed substitute is equal in quality and utility to the material specified. The Design Consultant will Favorably Review only those proposed substitutions as are, in its opinion, equal in quality to the items or materials specified. In the event that a substitute is Favorably Reviewed, fifty (50) percent of all savings shall be credited to the City.
2. Failure of the Contractor to submit proposed substitutions for review in the manner described above and within the time prescribed shall be sufficient cause for rejection by the Construction Manager of any substitutions otherwise proposed.
3. When a proposed substitution is not accepted, Contractor shall provide the specified item or material without change to the Contract Sum or Contract Time.

C. Modifications and Costs

1. If alternative named or substitution materials or equipment is proposed by the Contractor and Favorably Reviewed by the Design Consultant, the Contractor is responsible for providing, at no additional cost to the City, any and all electrical, mechanical, structural, or other related changes or testing that may be required to accommodate or provide the particular material or equipment the Contractor desires to use. Contractor shall also compensate City for the costs of having Design Consultant and/or Construction Manager evaluate the proposed substitution. No change to the Specifications or the Drawings required to accommodate the substitution will entitle Contractor to additional compensation or extension of the Contract Time.
2. In addition, the Contractor is responsible for all additional costs to the City, and its agents and representatives, for evaluation of data submitted by the Contractor for alternative named or substitutions and any redesign necessary. The City shall deduct said costs from the Contract monies due the Contractor.

1.04 SUBMITTAL AND MATERIAL LIST

- A. Within fifteen (15) days after the Award of Contract and prior to the submission of the initial shop drawings, the Contractor shall submit a complete list of all required submittals to the Construction Manager for favorable review.

- B. The Submittal and Material List shall include a description of each item, Specification reference and the anticipated submittal date. The List shall include all items to be installed including but not limited to: materials for mechanical, piping, electrical, utilities, plumbing work; and the names of manufacturers with whom purchase orders have been placed.
- Items on the List shall be arranged in the same order as in these Specifications, and shall contain sufficient data to identify precisely the items of material and equipment the Contractor proposes to furnish. The List shall reference the applicable Specification section or Drawing.
- D. When a submission of this list is Favorably Reviewed and returned to the Contractor by the Construction Manager, Contractor shall use it as the basis for the submission of detailed manufacturer's drawings, catalog cuts, curves, diagrams, schematics, data, and information on each separate item for review.
- E. An incomplete submittal list shall not be the basis for avoiding a submittal required by the Contract Documents. No work shall proceed on any item until it has been submitted and favorably reviewed. An incomplete submittal list is not a basis for avoiding a submittal required by the Specifications.
- F. If Contractor proceeds with any part of the Work for which a submittal is required without having received a Favorably Reviewed submittal, Contractor does so at its own risk. Contractor shall be responsible for all costs and delay associated with correction or removal of work performed without a Favorably Reviewed submittal.

## 1.05 TRANSMITTAL PROCEDURES

- A. Transmittal Form
1. A separate transmittal form shall be used for each specific item, class of material, equipment, and items specified in separate, discrete sections, for which the submittal is required.
  2. Submittal documents common to more than one piece of equipment shall be identified with all the appropriate equipment numbers. Submittals for various items shall be made with a single form when the items taken together constitute a manufacturer's package or are so functionally related that expediency indicates checking or review of the group or package as a whole.
  3. The specification section and subsection or paragraph to which the submittal is related shall be indicated on the transmittal form.
  4. A unique number, sequentially assigned, shall be noted on the transmittal form accompanying each item submitted. Original submittal numbers shall have the following format: "XXX"; where "XXX" is the sequential number assigned by the Contractor. Resubmittals shall have the following format: "XXX-Y" where "XXX" is the originally assigned submittal number and "Y" is a sequential letter assigned for resubmittals, i.e., A, B,

or C being the 1st, 2nd, and 3rd resubmittals, respectively. Submittal 25B, for example, is the second resubmittal of Submittal 25.

B. Deviations from the Contract

1. If a submittal shows any deviations from the Contract requirements, the Contractor shall submit with the submittal a separate written description of such deviations and the reasons therefore, and shall mark the submittal to show the specific location of each deviation.
2. If the City accepts such deviation, the City shall issue an appropriate Contract Change Order, except that, if the deviation is minor, or does not involve a change in price or in time of performance, a Change Order need not be issued.
3. If any deviations from the Contract requirements are not noted on the submittal, the review of the shop drawing shall not constitute acceptance of such deviations.

C. Submittal Completeness

1. The Contractor shall review and check all submittals before submitting them to the Construction Manager.
2. The Contractor shall stamp and certify on the transmittal letter and on each shop drawing that they have been checked, are in compliance with the Plans and Specifications, and all deviations from the Contract requirements are noted.
3. If the Contractor submits an incomplete submittal, the submittal will be returned to the Contractor without review.
4. A complete submittal shall contain sufficient data to demonstrate that the items comply with the Specifications, shall meet the minimum requirements for submissions cited in the Technical Specifications, shall include materials and equipment data and seismic anchorage certifications where required, and shall include any necessary revisions required for equipment other than first named.
5. It is considered reasonable that the Contractor shall make a complete and acceptable submittal to the Construction Manager at least by the second submission of data.
6. The City reserves the right to deduct monies from payments due the Contractor to cover additional costs of review beyond the second submission, including fees for the Design Consultant and Construction Manager.

D. Submittal Period

1. All submittals shall be completed within fourteen (14) days after the Notice to Proceed unless the Construction Manager accepts an alternate schedule for submission of submittals proposed by the Contractor.

2. Submittals shall be submitted in time to allow appropriate time for review and response to submittals as provided for herein prior to the incorporation of materials and equipment in the Work.

E. Certificates of Compliance

1. For materials furnished and installed in accordance with Division 2 of these Specifications and for standard “off-the-shelf” materials where the Contractor is furnishing the materials listed in the Contract Documents, the Contractor may furnish a Certificate of Compliance in lieu of a full shop drawing for such materials.
2. The Certificate of Compliance shall be submitted as otherwise stipulated in Section 01300-1.05, **TRANSMITTAL PROCEDURES**. The certificate shall be signed by the manufacturer or supplier of the material and shall state that the materials involved comply in all respects with the requirements of the Contract Documents.
3. The fact that material is used on the basis of a Certificate of Compliance shall not relieve the Contractor of responsibility for incorporating material in the Work which conforms to the requirements of the Contract Documents.

F. Alternate Submittals

1. If a submittal is approved and the Contractor elects to submit an alternate item for review for the same application, the Contractor shall be responsible for the review costs for the alternate submittal.

## 1.06 REVIEW PROCEDURE

- A. Submittals shall be submitted to the Construction Manager for review and returned to the Contractor within fourteen (14) days after receipt.
- B. Review of submittals by the Design Consultant has as its primary objective the completion for the City of a project in full conformance with the Contract Plans and Specifications, unmarred by field corrections, and within the time provided.
- C. In addition to this primary objective, submittal review as a secondary objective will assist the Contractor in its procurement of equipment that will meet all requirements of the Project Plans and Specifications, will fit the structures detailed on the Plans, will be completed with respect to piping, electrical, and control connections, will have the proper functional characteristics, and will become an integral part of a complete operating facility.
- D. After review by the Design Consultant of each of the Contractor's submissions, the material will be returned to the Contractor with actions defined as follows:
  1. **NO EXCEPTIONS NOTED (RESUBMITTAL NOT REQUIRED)** - Accepted subject to its compatibility with future submissions and additional partial submissions for portions of the Work not covered in this



submission. Does not constitute approval or deletion of specified or required items not shown in the partial submission.

2. **MAKE CORRECTIONS NOTED (RESUBMITTAL NOT REQUIRED)** - Same as A, except that minor corrections as noted shall be made by the Contractor.
  3. **MAKE CORRECTIONS NOTED (RESUBMIT)** - Rejected because of major inconsistencies or errors, which shall be resolved or corrected by the Contractor prior to subsequent review by the Design Consultant.
  4. **NOT ACCEPTABLE (RESUBMIT)** - Submitted material does not conform to Plans and Specifications in major respect, i.e.: wrong size, model, capacity, or material.
- E. Items A and B above (no resubmittal required) are considered "Favorable Review." Items C and D above (correction and resubmittal required) are considered "Unfavorable Review."

#### 1.07 EFFECT OF REVIEW OF CONTRACTOR'S SUBMITTALS

- A. The Design Consultant's Favorable Review of submittals shall be obtained prior to the fabrication, delivery and construction of items requiring submittal review.
- B. Favorable Review of submittals does not constitute a change to the requirements of the Contract Documents.
- C. The Favorable Review of all submittals by the Design Consultant shall apply to general compliance with design criteria only and shall in no way relieve the Contractor from responsibility for errors or omissions contained therein.
- D. Favorable Review by the Design Consultant shall not relieve the Contractor of its obligation to meet safety requirements and all other requirements of laws, nor constitute a Contract Change Order.
- E. Favorable Review will not constitute acceptance of any responsibility for the accuracy, coordination, and completeness of the submittals or the items of equipment represented on the submittals.

## 2 PART 2 - PRODUCTS (NOT USED)

## 3 PART 3 - EXECUTION (NOT USED)

**\*\*END OF SECTION\*\***

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## SECTION 01310

### PROGRESS SCHEDULES

#### 1 PART 1 - GENERAL

##### 1.01 GENERAL

The Contractor shall provide a construction schedule that includes the sequential steps needed to reach the completion of the Contract Work. Contractor shall use the Critical Path Method (CPM) in planning, coordinating, performing and reporting on the Work, including all activities of Contractor, Subcontractors, equipment vendors, and suppliers, and in assisting Construction Manager and the City in monitoring the progress of the Work.

The construction schedule shall depict events and activities, their durations and their interrelationships, and shall recognize the progress that must be made in one task before subsequent tasks can begin. CPM network shall be comprehensive and shall include all activities, interdependencies and interactions required to perform the Work. Contractor shall submit the construction schedule to the Construction Manager for review.

##### 1.02 SCHEDULE REQUIREMENTS

- A. The Construction Schedule shall be created in the current version of one of the following scheduling programs:
  - 1. Primavera Project Planner (version P3 or P6)
  - 2. Suretrak Project Manager
  - 3. Microsoft Project
- B. All Construction Schedules, including the initial schedule, the baseline schedule, the monthly updates, and the Time Impact Analyses shall be submitted to the Construction Manager in both hard copy and electronic form. The electronic files shall be the actual scheduling program files, not a pdf version of the schedule.
- C. Contractor shall submit three hard copies of all Construction Schedules printed in a bar chart format on a timeline, showing the entire construction period. Bar chart shall include activity descriptions, early start and early finish dates, original duration, remaining duration, percent complete, and total float. Contractor shall submit three sets of tabular reports listing all activities sorted numerically including activity descriptions, predecessor and successor information and other activity information as requested by the Construction Manager.

##### 1.03 CONSTRUCTION SCHEDULE (CPM)

- A. General

The Contractor shall designate, in writing, an authorized representative in its firm who will be responsible for the preparation, revising, and updating of the Construction Schedule. The Contractor's representative shall have direct project control and complete authority to act on behalf of the Contractor in fulfilling the construction scheduling requirements set forth herein, and this person shall be assigned to the Project for the duration of the Project, unless the City requests that a different person be assigned. The requirements for the Construction Schedule are included to assure adequate planning and execution of the Work and to assist the Construction Manager in appraising the reasonableness of the proposed schedule and evaluating progress of the Work.

**B. Preliminary Construction Schedule**

1. Within fourteen (14) calendar days after award of Contract, the Contractor shall submit a Preliminary Construction Schedule covering the following project phases and activities:
  - a. Contract required constraints per Section 01010, 1.08.
  - b. Procurement and Submittals, including shop drawings and fabrication and delivery of key and long lead time procurement activities.
  - c. All activities required for the execution of the Work.
  - d. The total duration of the summary activities shall equal the Contract Time.
  - e. Approximate duration for each summary activity representing the Contractor's best estimate for the work the summary activity represents.
2. The Preliminary Construction Schedule shall describe the activities to be accomplished and their dependency subject to all requirements under these Construction Schedule provisions. The Preliminary Construction Schedule will be used to record and monitor the progress of the Work until a Detailed Construction Schedule has been completely developed and Favorably Reviewed. Data recorded on the Preliminary Construction Schedule shall be incorporated into the Detailed Construction Schedule.

**C. Detailed Construction Schedule**

1. Within 30 calendar days after the award of the Contract, the Contractor shall submit a Detailed Construction Schedule. The Detailed Construction Schedule shall be a computerized detailed task level CPM diagram in a precedence diagramming method (PDM) format. The work activities in the CPM shall be of sufficient detail to ensure adequate planning and execution of the Work and such that the schedules provide an appropriate basis for monitoring and evaluating the progress of the Work and the forecast for completion.

2. Activity durations shall be no longer than 14 calendar days.
3. Contractor's schedule should take into account the City holidays and other work day limitations as defined in Section 01560, 1.07 WORKING HOURS.
4. Construction schedule should identify the critical path for the project.
5. Construction schedule should identify interim completion dates as well as the Contract completion date as milestones.
6. A Schedule showing the Work completed in less than the Contract Time (an "Early Completion Schedule") may be acceptable only if 1) the Construction Manager reviews the Early Completion Schedule and agrees, in writing, that it is reasonable, and 2) Contractor and the City execute a binding Contract Modification revising the Contract Time to that shown on the proposed Early Completion Schedule. Contractor shall have no claim for "delayed early completion" unless the City and Contractor enter into a Contract Modification revising the Contract Time as described in this paragraph. 3) The Contractor shall not be entitled to job-site or home office overhead beyond the Contractor's Early Completion Date, if completion of the project occurs within the specified Contract Time.
7. A Schedule showing completion beyond the Contract Time will not be acceptable.
8. Contract float is for the mutual benefit of both the City and the Contractor. Changes to the project that can be accomplished within this available period of float may be made by the City without extending the Contract time, by utilizing float. No time extensions shall be granted nor delay damages owed until Work extends beyond Contract completion date as adjusted by duly executed Amendment. Likewise, Contractor may utilize float to offset delays other than delays caused by the City. Mutual use of float shall continue until all available float shown by schedule has been utilized by either the City or Contractor, or both. At that time, extensions of the Contract Time will be granted by the City for excusable delays which affect the planned completion date and which have been properly documented and established by Contractor.
9. The Construction Manager shall review the Detailed Construction Schedule and provide any comments, its Favorable Review of the schedule, or request a meeting to review the Detailed Construction Schedule with the Contractor within ten (10) days of receipt of the schedule. If requested, the Contractor shall participate in a review and evaluation of the Detailed Construction Schedule with the Construction Manager. Contractor shall submit any revisions necessary as a result of this review to the Construction Manager within five (5) days.
10. Once the Detailed Construction Schedule has received a Favorable Review, as defined in Section 01300, 1.06 REVIEW PROCEDURE, from the Construction Manager, it will become the Baseline Schedule for the

project. The Baseline Schedule shall be used in the implementation of the Work and progress of the Work will be compared to the Baseline Schedule at each weekly progress meeting.

#### 1.04 WEATHER CONDITIONS

Seasonal weather conditions shall be considered in the planning and scheduling of work influenced by high or low ambient temperatures, precipitation, wind, fog or water and tide conditions to ensure the completion of the Work within the Contract Time. No time extensions will be granted for the Contractor's failure to take into account such weather conditions for the location of the Work and for the period of time in which the Work is to be accomplished.

The expected loss of working days specified in the Supplementary General Conditions, Section 00800-1.03, **WEATHER DAYS**.

#### 1.05 CONSTRUCTION SCHEDULE UPDATES

##### A. Monthly Progress Updates

The Baseline Schedule shall be updated and submitted to the Construction Manager on a monthly basis for the purpose of recording and monitoring the actual progress of the Work. Each monthly update shall include actual dates of activities started and/or completed during the previous month, and the percentage of work completed to date on each activity started but not completed. The monthly update shall incorporate all changes mutually agreed upon by the Contractor and the Construction Manager during preceding periodic reviews and all changes resulting from approved Change Orders and Field Directives.

The monthly update shall also include a forecast of the remaining duration for each activity, if the remaining duration is expected to be greater than that calculated by the scheduling program based on the percentage complete.

##### B. Recovery Schedule

If the monthly schedule update forecasts or if, in the opinion of the Construction Manager, the Project is behind schedule, the Contractor shall provide a Recovery Schedule. The Recovery Schedule shall include a plan and timeline to complete the Project within the Contract Time as well as a summary of its plan to take some or all of the following actions at no additional cost to the City, unless authorized in writing:

- i. Increase construction labor in such quantities and crafts as will substantially eliminate, in the judgment of the Contractor and Construction Manager, the backlog of work.
- ii. Increase the number of working hours per shift, shifts per working day, working days per week, or the amount of construction equipment, or any

combination of the foregoing, sufficiently to substantially eliminate, in the judgment of the Contractor and Construction Manager, the backlog of work. This paragraph shall not be construed to permit Contractor to violate the work hour restrictions specified in Section 01560, 1.07 WORKING HOURS.

- iii. Reschedule activities to achieve maximum practical concurrence of accomplishment of activities.
- C. Favorable Review of the monthly schedule update will be a condition precedent to the payment of the monthly progress payment for work performed. If the Contractor does not submit its monthly schedule update, the City reserves the right to ask its Construction Manager to provide an interim schedule update, and to withhold the cost to do so from the Contractor's progress payment.

#### 1.06 TIME IMPACT ANALYSES

- A. When Change Orders are initiated or delays, as defined in Section 00700, 6.03 DELAYS, or any other event Contractor believes entitles it to an extension of the Contract Time occurs, the Contractor shall submit to the Construction Manager a written Time Impact Analysis illustrating the effect of each change, delay, or event on the Contract Time and/or completion date shown in the then-current Monthly Progress Schedule.
1. The analysis shall demonstrate the time impact based on the beginning and ending date of the change, delay or event; the status of construction at that point in time immediately preceding the change, delay or event; and the effect on the then-current critical path.
  2. The analysis shall include:
    - a. A fragmentary CPM type network (Fragnet) illustrating how Contractor proposes to incorporate the change or alleged delay into the then-current Monthly Progress Schedule.
    - b. Identification of the activities in the then-current Monthly Progress schedule which are proposed to be amended due to the change, alleged delay or other event, together with engineering estimates and other appropriate data justifying the proposal.
  3. The date or dates when the change was issued, or the alleged event or delay occurs that are used in the analysis or as adjusted shall be included in the Monthly Progress Schedule upon mutual agreement between the Construction Manager and Contractor.

- B. Delays in individual activities will not automatically mean that an extension of Contract Time is warranted or due the Contractor.
1. It is possible that an excusable delay or Contract modification will not affect activities on the critical path or cause noncritical activities to become critical, i.e., a delay or modification may only absorb a part of the available total float, and therefore, not affect the Contract completion date or Contract Time.
  2. The Contractor acknowledges and agrees that mitigation for changes to the Work, differing site conditions, and other events may require revision of preferential sequences of the Work. When a delay to the Project as a whole can be avoided by revising preferential sequencing, and the Contractor chooses not to implement the revisions, the Contractor will not be entitled to a time extension or to compensation for extended overhead.
  3. Actual delays in activities which do not affect the critical path work or which do not affect the Contractor's planned completion date, a milestone, or the Contract completion date will not be the basis for an adjustment to the Contract Time.
  4. Extensions of time will be considered for a delayed or impacted activity that is not on the critical path only to the extent that the duration of the time impact exceeds the total float for the schedule path wherein the activity is located, and the Contractor can demonstrate that the activity has become critical.
- C. Time Impact Analyses shall be submitted within fifteen (15) days after a delay occurs or with the Contractor's cost proposal in response to a notice of change from the Construction Manager. In cases where the Contractor does not submit a Time Impact Analysis for a specific Change Order, delay, event or other Contractor requested time extension within 15 days, then it is mutually agreed that the particular Change Order, delay, event or Contractor request has no time impact on the Contract completion date and no time extension is required.
1. Approval or rejection of Time Impact Analyses by the Construction Manager and the City will be made within fifteen (15) days after receipt of the Time Impact Analysis unless subsequent meetings and negotiations are necessary.
  2. Upon Favorable Review, a copy of the Time Impact Analysis signed by the Construction Manager and the City will be returned to the Contractor with a determination of the Time Extension to be granted to the Contractor pursuant to Section 00700, 6.04 TIME EXTENSIONS.
  3. Contractor will incorporate schedule revisions illustrating the influence of Change Orders, delays, events and/or Contractor requests into the next schedule update only if the Contractor and City have reached agreement on a time extension.



## 1.07 LOOKAHEAD SCHEDULE

On the last working day of every week the Contractor shall submit to the Construction Manager the Contractor's Lookahead Schedule for the following three weeks as well as the activities performed in the previous week. The Lookahead Schedule shall be a time scaled bar chart based on the current monthly progress update and shall include the activity description, location of the activity and the activity number as provided in the Detailed Construction Schedule. Lookahead Schedules shall also identify the Contractor or subcontractor performing each activity.

### **2 PART 2 - PRODUCTS (NOT USED)**

### **3 PART 3 - EXECUTION (NOT USED)**

**\*\*END OF SECTION\*\***

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## SECTION 01400

### QUALITY CONTROL

#### 1 PART 1 - GENERAL

##### 1.01 INSPECTION AND TESTING

###### A. General

Where the Contract Documents require work to be tested or approved, it shall be tested in the presence of the Construction Manager or its authorized representative. The Construction Manager shall have the right to witness all on-site tests performed by the Contractor and any shop tests. The results of any tests performed by the Contractor shall be made available for the information of the Construction Manager.

Inspections, tests or Favorable Reviews by the Construction Manager or others shall not relieve the Contractor from its obligation to perform the Work in accordance with the requirements of the Contract Documents or for its sole responsibility for the quality of workmanship and materials.

Except as specifically required under the Technical Specifications for testing and inspection, all tests for materials furnished by the Contractor will be done in accordance with commonly recognized standards of national organizations. Where tests are to be performed by the Construction Manager or by an independent laboratory or agency, the Contractor shall furnish such samples of all materials as required by the Construction Manager without charge. The sample or samples of materials to be tested shall be selected by such laboratory or agency, or the Construction Manager, and not by the Contractor. No material for which the Contract Documents require the submittal and approval of tests, certificates of compliance or other documentation shall be incorporated in the Work until such submittal has been made and approved.

The Contractor shall provide safe access for the Construction Manager and inspectors to adequately inspect the quality of work and the conformance with the Contract Documents. The Contractor shall furnish the Construction Manager the necessary labor and facilities for such things as excavation in the compacted fill to the depths required to take samples. The Contractor shall provide adequate lighting, ventilation, ladders and other protective facilities as may be necessary for the safe performance of inspections.

Records shall be available at all reasonable hours for inspection by other local or State agencies to ascertain compliance with laws and regulations.

Upon completion of the Work, the Construction Manager will conduct a final inspection as provided for in Section 00700-8.07, **FINAL INSPECTION AND PAYMENT**.

B. Notice

The Contractor shall notify the Construction Manager at least 24 hours before any field testing or special inspections are required to be performed by the Construction Manager or independent laboratory furnished by the City. The Contractor shall notify the Construction Manager at least two hours before any inspection is required to be performed or to witness the Contractor's on-site field testing.

Whenever the Contractor varies the period during which work is carried on each day, the Contractor shall give due notice to the Construction Manager so that proper inspection may be provided. Any work done in the absence of the Construction Manager shall be subject to rejection.

C. Costs of Testing

1. The Contractor shall be responsible for, and shall pay for, all quality control and off-site tests of materials required including all source and mix design tests for the approval of soil and concrete materials. The City will perform the soils and compaction tests detailed in the Technical Specifications during the performance of the Work. The City will retain and pay a qualified testing agency to perform soil compaction testing. All other testing required by the Technical Specifications shall be the responsibility of the Contractor.
2. The Contractor shall be responsible for, and shall pay for, all source quality control and all on-site tests of materials required, except those tests specifically noted to be performed and paid for by the City.
3. The Construction Manager shall have the authority to require additional tests or inspections due to the manner in which the Contractor executes its work. Examples of such additional tests and inspections include; tests of materials substituted for previously accepted materials, or substituted for specified materials, or retests made necessary by failure of material to comply with the requirements of the Specifications. Where such tests and inspections are required by Contract to be performed by the City, the City will pay for the additional tests and inspections but will issue a unilateral Change Order to deduct these costs from the Contract price.
4. In the event the Contractor prematurely notifies of testing, inspection, special inspection, or on-site inspection in accordance with Section 01400-1.01B, and the Contractor is not prepared or the Project has not progressed to the point requiring testing, inspection, special inspection, or on-site inspection, the Contractor shall pay for all costs associated with the premature notification of testing and inspection personnel and equipment.

D. Work Covered Prior to Inspection and/or Testing

Work requiring inspection and/or testing shall not be concealed or buried prior to the acceptance of such inspection or testing. Work covered without the favorable review or consent of the Construction Manager shall, if required by the Construction Manager, be uncovered for inspection and/or testing at the Contractor's expense.

E. Work Covered With Prior Inspection and/or Testing

If the Construction Manager considers it necessary or advisable that covered work which was favorably inspected and tested be uncovered for reinspection and/or retesting, the Contractor, at the Construction Manager's request, will uncover, expose or otherwise make available for observation, inspection or testing as the Construction Manager may require, that portion of the Work in question, furnishing all necessary labor, materials, tools, and equipment. If it is found that such work is defective, the Contractor will bear all expenses of such uncovering, exposure, observation, inspection and testing and of satisfactory reconstruction. If, however, such work is not found to be defective the Contractor will be allowed an increase in the Contract price or an extension of the Contract time, or both, directly attributable to such uncovering, exposure, observation, testing and reconstruction, and a Change Order shall be issued for such additional work.

F. Coordination of Other Inspections

The Contractor is completely responsible for scheduling all agency inspections in accordance with the agency requirements. The Contractor shall notify the Construction Manager of all building and other work component inspection notices and schedules. Failure of the Contractor to properly coordinate and schedule these inspections shall not be cause for time extensions.

1.02 TEST WATER

The Contractor shall furnish and properly dispose of the water which is required for testing of piping and structures. The Contractor shall dispose of all testing water without damage to property, and in accordance with applicable regulations.

**2 PART 2 - PRODUCTS (NOT USED)**

**3 PART 3 - EXECUTION (NOT USED)**

**\*END OF SECTION\*\***

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## SECTION 01510

### TEMPORARY UTILITIES

#### PART 1 - GENERAL

##### 1.01 ELECTRICAL SERVICE

The Contractor shall arrange, at its own cost, with the local utility to provide adequate temporary electrical service at a mutually agreeable location. The Contractor shall then provide adequate job site distribution facilities conforming to applicable codes and safety regulations. The Contractor shall provide, at its own cost, all electric power required for construction, testing, general and security lighting, and all other purposes whether supplied through temporary or permanent facilities.

##### 1.02 WATER

The Contractor shall pay for and shall construct all facilities necessary to furnish water for its use during construction. Water used for human consumption shall be kept free from contamination and shall conform to the requirements of the State and local authorities for potable water. The Contractor shall pay for all water used for the Contractor's operations prior to final Acceptance.

##### 1.03 TEMPORARY LIGHTING

The Contractor shall provide temporary lighting in all work areas sufficient to maintain a lighting level during working hours not less than the lighting level required by Cal/OSHA standards. As permanent lighting facilities are completed they may be used in lieu of temporary facilities, provided however, that bulbs, lamps, or tubes of such facilities used by the Contractor shall be replaced prior to final Acceptance of the Work.

##### 1.04 HEATING AND VENTILATION

The Contractor shall provide means for heating and ventilating all work areas as may be required to protect the Work from damage by freezing, high temperatures, weather, or to provide a safe environment for workers. Un-vented direct fired heaters shall not be used in areas where freshly placed concrete will be exposed to the combustion gases until at least two hours after the concrete has attained its initial set.

##### 1.05 SANITARY CONVENIENCES

The Contractor shall provide suitable and adequate sanitary conveniences for the use of all persons at the site of the Work. Such conveniences shall include chemical toilets or water closets and shall be located at appropriate locations at the site of the Work. All sanitary conveniences shall conform to the regulations of the public authority having jurisdiction over such matters. At the completion of the Work, all such sanitary conveniences shall be removed and the Site left in a sanitary condition.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

**\*\*END OF SECTION\*\***



## SECTION 01560

### TEMPORARY CONTROLS

#### PART 1 - GENERAL

##### 1.01 TEMPORARY FACILITIES

Construction hoists, elevators, scaffolds, stages, shoring, and similar temporary facilities shall be of ample size and capacity to adequately support and move the loads to which they will be subjected. Railings, enclosures, safety devices, and controls required by law or for adequate protection of life and property shall be provided.

##### 1.02 STAGING AND SHORING

Temporary supports shall be designed by a registered professional engineer with an adequate safety factor to assure adequate seismic and load bearing capability. The Contractor shall submit design calculations for staging and shoring prior to commencement of Work.

Excavation support shall be in accordance with Section 00700-4.07E, **Excavation Safety**.

##### 1.03 PROTECTION OF WORK, PROPERTY AND PERSONS

The Contractor shall be responsible for the care of all work until its completion and Final Acceptance; and the Contractor shall, at its own expense, replace damaged or lost material and repair damaged parts of the Work, or the same may be done by the City, and the Contractor and its sureties shall be liable therefore. The Contractor shall make its own provisions for properly storing and protecting all material and equipment against theft, injury, or damage from any and all causes. Damaged material and equipment shall not be used in the Work. The Contractor shall take all risks from floods and casualties, or for delays from such causes. The Contractor may, however, be allowed a reasonable extension of time on account of such delays, subject to the conditions herein before specified. The Contractor shall remove from the vicinity of the completed work all plants, buildings, rubbish, unused material, concrete forms, sheeting or equipment belonging to the Contractor or used under its discretion during construction; and in the event of the Contractor's failure to do so, the same may be removed by the City at the expense of the Contractor, and the Contractor and its sureties shall be liable therefore.

The Contractor shall adopt all practical means to minimize interference to traffic and inconvenience, discomfort, or damage. The Contractor shall protect against damage, any piling, duct or structures crossing trenching or encountered in the Work and shall be responsible for any damage done to such structures, or damage therefrom. The Contractor shall support or replace, any such structures without delay and without any additional compensation, to the entire satisfaction of the Construction Manager. All obstructions to traffic shall be guarded by flagmen as required and by barriers and illuminated at night. The

Contractor shall be responsible for all damage to persons and property directly or indirectly caused by its operations, and under all circumstances the Contractor shall comply with the regulations of the City or County, and the laws and regulations of the State of California, relative to safety of persons and property and the interruption of traffic and the convenience of the public within the respective jurisdiction, and the Contractor shall be solely responsible for any damages caused by failure to provide proper safety.

The Contractor will be held responsible for and be required to make restitution, at its own expense, for all damage to persons or property caused by the Contractor or subcontractor, or the agents, or employees of either during the progress of the Work and until its final Acceptance.

#### 1.04 FENCES

Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site.
2. City of Sausalito Planning Commission Condition of Approval 38: All construction perimeter fencing shall be maintained throughout construction until the issuance of final inspection.

#### 1.05 TEMPORARY ENCLOSURES

When sandblasting, spray painting, spraying of insulation, or other activities inconveniencing or dangerous to property or the health of employees or the public are in progress, the area of activity shall be enclosed adequately to contain the dust, over-spray, or other hazard. In the event there are no permanent enclosures of the area, or such enclosures are incomplete or inadequate, the Contractor shall provide suitable temporary enclosures.

#### 1.06 ABOVE GRADE PROTECTION (NOT USED).

#### 1.07 WORKING HOURS

Construction shall be allowed only between the hours of 8:00 a.m. and 6:00 p.m., Monday through Friday. Work outside of these hours will require the Contractor to reimburse the City for direct costs, indirect costs, and associated mark up for inspection services and administrative costs. Work outside of normally allowed working hours shall be limited to 7:00 a.m. to 8:00 a.m. and 6:00 p.m. to 8:00 p.m. Monday through Friday and 7:00 a.m. to 8 p.m. on Saturday,. No work will be allowed on Sunday or City holidays. City holidays consist of:

New Year's Day  
Martin Luther King, Jr.  
Presidents Day  
Memorial Day  
Independence Day

Labor Day  
Thanksgiving Day  
Friday following Thanksgiving Day  
Christmas Eve  
Christmas Day  
New Year's Eve

The Contractor shall be responsible for any inspection and additional administration costs incurred by the City, or its agents and representatives, for work by the Contractor outside the hours defined above on weekdays, or any work on weekends or holidays recognized by the City. If an inspection is required at any time other than during regular hours of business, Contractor shall notify the Construction Manager or shall make such request for overtime inspection at the office of the City at least one (1) hour prior to closing time. A fee shall be charged for overtime inspection and shall be determined as follows: the Inspector's hourly rate of pay in effect at that time shall be doubled; such double-time rate shall then be multiplied by a minimum chargeable time of two (2) hours. If the Inspector is required to stay on the job more than two hours, the double-time rate shall be paid for each hour thereafter; portions of hours shall be charged as a full hour. Such costs shall be withheld from the succeeding monthly progress payment. Any work in Section 01010, **SUMMARY OF WORK**, specifically required to be performed outside the normal working hours is excluded from the provisions of this paragraph. The City may also exclude other work performed outside the normal working hours from the provisions of this paragraph.

The Contractor shall notify the Construction Manager at least 24 hours prior to any work outside the normal working hours defined above, on weekends or holidays.

The Contractor shall be responsible for any inspection and additional administration costs incurred by the City, or its agents and representatives for the following conditions:

- A. For work by the Contractor outside the hours defined above on weekdays, or any work on weekends or holidays recognized by the City.
- B. For overtime costs beyond ten (10) hours in any one workday shift, regardless if the ten (10) hours occur in the allowed working hours.

Such costs shall be withheld from the succeeding monthly progress payment. Any work in Section 01010, **SUMMARY OF WORK**, specifically required to be performed outside the normal working hours is excluded from the provisions of this paragraph.

## 1.08 DUST CONTROL

During the performance of all Work under this Contract, the Contractor shall assume all responsibility for dust control and shall furnish all labor, equipment, and means required to carry out proper and efficient measures wherever and whenever dust control is necessary to prevent the Contractor's operations from producing dust damage and nuisance to persons and property.

Unless the construction dictates otherwise, and unless otherwise approved by the Construction Manager, the Contractor shall furnish and operate a self-loading motor sweeper with spray nozzle at least once each working day to keep paved areas acceptably clean whenever construction, including restoration, is incomplete.

If the contractor does not provide and/or conduct dust control as required above or otherwise approved in writing by the Construction Manager, the City has the right to contract such services separately and withhold those costs from the contractor.

Any claims resulting from dust damage or nuisance shall be borne solely by the Contractor.

#### 1.09 FIRE EXTINGUISHER

Sufficient number of fire extinguishers of the type and capacity required to protect the Work and ancillary facilities, shall be provided and maintained by the Contractor in readily accessible locations.

#### 1.10 USE OF EXPLOSIVES

The use of explosives is prohibited.

#### 1.11 REMOVED MATERIALS

All concrete, paving, reinforcing steel, fencing materials, rock, soil, strips, and other waste material and construction debris shall be removed from the Site by the Contractor and disposed of in accordance with applicable regulations and laws.

#### 1.12 CONSTRUCTION CLEANING

Throughout the period of construction the Contractor shall keep the Work site; including work, storage, parking, and employee areas; free and clean of all rubbish and debris, and shall promptly remove from the Site, or from property adjacent to the site of the Work, all unused and rejected materials, surplus earth, concrete, plaster, and debris. In particular the Contractor shall keep the Site clean to maintain safe access and to avoid fire hazard.

#### 1.13 NOISE ABATEMENT

Operations at the Work site shall be performed so as to minimize unnecessary noise. Special measures shall be taken to suppress noise during night hours. Noise levels due to construction activity shall not exceed the levels specified by local ordinance.

Internal combustion engines used on the Work shall be equipped with a muffler of a type recommended by the manufacturer. No internal combustion engine shall be operated without said muffler.

#### 1.14 DRAINAGE CONTROL

In excavation, fill, and grading operations care shall be taken to disturb the pre-existing drainage pattern as little as possible. Particular care shall be taken not to direct drainage water onto private property, into the Bay, or into streets or drainage ways inadequate for the increase flow. Drainage means shall be provided to protect the Work.

#### 1.15 EROSION CONTROL

- A. All excavated areas shall be provided with temporary erosion control measures.
- B. Temporary erosion control shall be required for all areas where natural ground cover is disturbed, all temporary excavation stockpiles, including structures and trench excavations.
- C. Erosion control shall be by means of filter fabric fences or hay bales placed to completely circumvent the down-slope side of any excavated stockpile.
- D. Protected areas shall be regularly inspected and maintained by the Contractor during the course of the Work.
- E. All excavations, spills, and waste materials shall not be placed in areas subject to washout, flooding or natural drainage.
- F. See Section 01060-1.03, **STORM WATER QUALITY CONTROLS**, for additional requirements

#### 1.16 WARNING DEVICES AND BARRICADES

The Contractor shall adequately identify and guard all hazardous areas and conditions by visual warning devices and, where necessary, physical barriers. Such devices shall, as a minimum, conform to the requirements of Cal/OSHA.

The Contractor is responsible for providing and maintaining barricades necessary to prevent accidental falls through any unattended open hatches or trenches, or entrances into potentially hazardous work areas in the Contractor's work area.

#### 1.17 TRAFFIC REGULATIONS

##### A. General

The Contractor shall take all necessary steps to minimize inconvenience to the general public throughout all Work under this Contract. No driveways or private roads shall be blocked without notifying the property owner and access must be restored during all non-working hours. Safe access must be maintained for pedestrian traffic throughout the Work area at all times.

At least one lane of traffic in each direction must be kept open at all times unless prior approval is provided by the City and the Public Agency(ies) which has authority for the right-of-way. No roads shall be blocked or made inaccessible, due to the Contractor's work, without prior written approval of the City and the affected agencies. More stringent requirements may be imposed in the right-of-way permits.

The Contractor shall not block or obstruct fire lanes at any time.

The Contractor shall adopt all practical means to minimize interference to traffic and inconvenience, discomfort, or damage. The Contractor shall protect against damage, any piling, duct or structures crossing trenching or encountered in the Work and shall be responsible for any damage done to such structures or damage therefrom. The Contractor shall support or replace, any such structures without delay and without any additional compensation, to the entire satisfaction of the Construction Manager. All obstructions to traffic shall be guarded by flagmen as required and by barriers and illuminated at night. The Contractor shall be responsible for all damage to persons and property directly or indirectly caused by its operations, and under all circumstances the Contractor shall comply with the regulations of the City or County, and the laws and regulations of the State of California, relative to safety of persons and property and the interruption of traffic and the convenience of the public within the respective jurisdiction, and the Contractor shall be solely responsible for any damages caused by failure to provide proper safety.

**B. Haul Routes**

In addition to any haul routes that may be designated in the Contract Documents, or at the preconstruction conference, the Contractor shall furnish evidence that the Public Agency(ies) which has authority for the right-of-ways proposed to be utilized by the Contractor for haul routes has approved the proposed route(s) for all construction traffic created by the Project. Upon approval, the Contractor shall strictly adhere to that route(s) only, unless written permission is obtained from such Public Agency(ies) to change the route(s).

**C. Traffic Control**

Traffic control shall be in accordance with the California Manual of Uniform Traffic Control Devices. The Contractor shall submit for approval, by the City, its traffic control plans prior to work on public streets.

Traffic control shall include signs, warning lights, reflectors, barriers, and other necessary safety devices and measures, including sufficient flaggers to direct vehicular traffic through the construction areas.

No material or equipment shall be stored/parked where it will interfere with the free and safe passage of public traffic, and at the end of each day's work, and at other times when construction operations are suspended for any reason, the Contractor shall remove all equipment and other obstructions from the public right-of-way.

Should the Contractor appear to be negligent in furnishing warning and protective measures, as above provided, the Construction Manager may direct attention to the existence of a hazard, and the necessary warning and protective measures shall be furnished and installed by the Contractor at its expense.

#### 1.18 ROADS AND FENCES

Roads subject to interference by the prosecution of the Work covered by this Contract shall be kept open, and fences subject to interference shall be maintained by the Contractor during the Work and shall be replaced to their original condition unless specifically shown otherwise on the Drawings. Such signs and barricades as are required by local laws and as necessary for the safe prosecution of the Work shall be provided.

Excavated dirt shall not be stored on roads, paths, or planted areas. Care shall be taken to protect improvements.

#### 1.19 PARKING AND STAGING AREAS (NOT USED)

#### 1.20 TREES AND SHRUBS

Except as noted on the Plans, the Contractor shall not remove trees or shrubs without authorization of the Construction Manager. Injuries to tree roots and limbs shall be avoided. No roots shall be cut or limbs pruned, without prior notification to and review of Contractor's proposed methods by the Construction Manager.

#### 1.21 OFFICE OF CONTRACTOR AT SITE

Owner will provide space for Offices and field support in Staging Area as shown on Drawings. Contractor may provide an on-site field office facility for its field personnel.

The Contractor shall provide sanitary facilities at its cost. The Contractor will be responsible for providing sufficient fencing to enclose the assigned areas and for the security of these areas. The Contractor will be responsible for all costs and arrangements to extend, meter and service the required electrical power and telephone service to the assigned areas, and to provide drinking water in the offices. The Contractor must provide for any other yard or staging areas necessary for its performance of the Work at its own initiative and expense. The Contractor must complete the field office setup and equipping at least ten (10) calendar days prior to physical work start at the Project Site.

#### 1.22 CONTRACTOR'S WORK AND STORAGE AREA

The Contractor shall make its own arrangements for staging, storage and shop areas necessary for the proper execution of the Work.

The Contractor's construction equipment, vehicles, and materials shall not remain in public streets during non-working hours. It shall be the responsibility of the Contractor to

transport and store such items at the Contractor's own facility or within construction easements on nonpublic areas at the end of each workday.

1.23 CONSTRUCTION MANAGER'S FIELD OFFICE (NOT USED)

1.24 PHOTOGRAPH AND VIDEO RECORDING OF SITE CONDITIONS

Existing conditions throughout the Project site and adjacent properties, including but not limited to the Marine Shop at 100 Bay St. and the Spinnaker Restaurant, shall be photographed and videotaped by Contractor before starting construction. Recording shall include and show every detail of existing location, including the current condition of the curb, gutter, sidewalk, paving, landscaping, streetlights, and structures along the sewer alignment and near the Project including backyards, face of buildings, canopies, shades, decking, fences, concrete, irrigation systems, driveways, canals, access roads, plants and landscaping, and any other features within the limits of Work, including Contractor staging areas. Photos and videotape shall be performed in the presence of the Construction Manager.

The Contractor shall provide additional photos and video recording as deemed necessary by the Construction Manager at no additional cost to the Owner.

The Contractor shall not start any work on Site until the photos and video images are submitted and approved by Construction Manager.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

**\*\*END OF SECTION\*\***



## **SECTION 01580**

### **MATERIAL AND EQUIPMENT**

#### **PART 1 - GENERAL**

##### **1.01 SALVAGING AND STORAGE OF EQUIPMENT AND MATERIALS**

Unless noted elsewhere no salvage of materials is anticipated in this project. All material and items, including all junk or scrap material produced by the Contractor in the performance of the Work and not suitable for reuse in the Work shall be removed from the Site no less often than [weekly] and properly disposed of by the Contractor at its sole cost and expense. As noted in Section 02220, 3.01D, The boardwalk lumber and piles to be removed shall be salvaged for off haul by others. The boardwalk shall be disassembled and all nails, bolts, and other appurtenances removed. The lumber and piles shall be stockpiled in a neat manner acceptable to the City and ready for off haul.

##### **1.02 CONTRACTOR STORAGE AREAS**

The Contractor shall take all responsibility for storage of materials. No equipment for incorporation in the project may be stored in any area subject to natural or man-made flooding.

The Contractor's construction equipment, vehicles, and materials shall not remain in public streets during non-working hours unless approved by the Construction Manager in writing. It shall be the responsibility of the Contractor to transport and store such items at the Contractor's own facility or within construction easements on nonpublic areas at the end of each workday.

Should the Contractor elect to use private property or other property not owned by the City for construction purposes or storage of materials for the Project, the Contractor shall defend, indemnify and hold harmless the City from any claims arising from such storage or use, to the fullest extent permitted by law.

##### **1.03 HAZARDOUS MATERIALS**

All hazardous materials shall be stored and handled in strict accordance with the Material Safety Data Sheets for the products. Material Safety Data Sheets shall be submitted to the Construction Manager prior to the delivery of materials to the Project. The storage and handling of potential pollution-causing and hazardous materials, including but not necessarily limited to, gasoline, oil and paint shall be in accordance with all local, state and federal requirements.

##### **1.04 DISPOSAL OF EXCAVATED MATERIAL**

The Contractor shall be responsible for making its own arrangements for disposal of all excavated material or other materials at a permitted disposal site.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

**\*\*END OF SECTION\*\***

## **SECTION 01710**

### **FINAL CLEAN-UP**

#### **PART 1 - GENERAL**

##### **1.01 FINAL SITE CLEAN-UP**

Upon completion of the Work, and prior to Final Acceptance, the Contractor shall remove from the vicinity of the Work all plant, surplus material, and equipment belonging to the Contractor or used under its direction during construction.

In addition to general broom cleaning of paved surfaces and rake cleaning of other surfaces of grounds, the following shall be performed at completion of the Work:

- A. Remove waste and debris from the entire Site.
- B. Sweep paved areas.
- C. Clean/landscape areas.
- D. Clean storm drains.

##### **1.02 FINAL PROJECT CLEAN-UP**

Upon completion of the work, and prior to final acceptance, the Contractor shall remove from the vicinity of the work all surplus material and equipment belonging to the Contractor or use under its direction during construction.

- A. Patch, touchup and repair marred surfaces and finishes. Replace finishes and surfaces that cannot be satisfactorily repaired or restored.
- B. Wipe surfaces, remove excess paint splatter or plaster dropping.
- C. Clean plumbing fixtures and mirrors.
- D. Clean light fixtures, lamps and bulbs. Replace any broken fixtures.

#### **PART 2 - PRODUCTS (NOT USED)**

#### **PART 3 - EXECUTION (NOT USED)**

**\*\*END OF SECTION\*\***

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## SECTION 01720

### PROJECT RECORD DOCUMENTS

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Section contains instructions for creating and maintaining Project Records.

##### 1.02 RECORD DOCUMENTS

- A. Maintain at the Project site, available to the City and Construction Manager, one (1) copy of the Contract Documents, shop drawings and other submittals, in good order.
1. Mark and record field changes and detailed information contained in submittals and Change Orders.
  2. Record actual depths, horizontal and vertical location of underground pipes, duct banks and other buried utilities. Reference dimensions to permanent surface features.
  3. Identify specific details of pipe connections, location of existing buried features located during excavation, and the final locations of piping, equipment, electrical conduits, manholes, and pull boxes.
  4. Identify location of spare conduits including beginning, ending and routing through pull boxes, and manholes. Record spare conductors, including number and size, within spare conduits, and filled conduits.
  5. Provide schedules, lists, layout drawings, and wiring diagrams.
  6. Make annotations with erasable colored pencil conforming to the following color code:
    - a. Additions: Red
    - b. Deletions: Green
    - c. Comments Blue
    - d. Dimensions: Graphite
  7. Prior to owner's acceptance of work, Contractors shall provide owner As-Built/Record drawings documenting changes made to the plan during the course of construction.

Compensation for conforming to this specification will be considered as included in the various items and no additional compensation will be allowed.

- B. Maintain documents separate from those used for construction. Label documents "RECORD DOCUMENTS."
- C. Record Documents shall be updated at least once each week and shall be available to the Construction Manager for review. Keep documents current. Record required information at the time the material and equipment is installed and before permanently concealing.
- D. Deliver Record Documents with transmittal letter containing date, Project title, Contractor's name and address, list of documents, and signature of Contractor prior to request for Final Payment.
- E. Record Documents shall be available for the Construction Manager to review to ascertain that changes have been recorded.
- F. Failure of the Contractor to keep current with the updating of the Record Documents shall be grounds for withholding monies from partial payment estimates as specified in Section 00700-8.03B, **Other Withholds**.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3- EXECUTION (NOT USED)**

**\*\*END OF SECTION\*\***

## SECTION 01740

### WARRANTIES AND BONDS

#### PART 1 - GENERAL

##### 1.01 GUARANTEE OF WORK

The Contractor hereby agrees to make, at its own expense, all repairs or replacements necessitated by defects in materials or workmanship supplied under terms of this Contract, and pay for any damage to other works resulting from such defects, which becomes evident within one (1) year after the date of the Substantial Completion date of the Project, or Acceptance date of the Project for items of work listed on the Punch List(s) or within such longer period of time as may be prescribed by law or by the terms of any applicable special guarantee required by the Contract Documents. The Contractor's guarantee applies to all work and materials provided by Contractor, subcontractors or manufacturers of packaged equipment components. The Contractor also agrees to indemnify, defend, and hold the City harmless from liability of any kind arising from damage due to defects in the Work.

Specific items of equipment or work may be placed in continuous service by the City prior to the Substantial Completion of the Project. At the City's discretion, the specific items may be accepted as Substantially Complete, commencing the warranty period for those specific items.

The Contractor shall execute and submit a completed Warranty Form in the format as appended to this Section for the Work, and any portion of the Work possessed in accordance with Section 00700-3.04, **CITY'S RIGHT TO USE OR OCCUPY**. The Warranty Form shall be submitted prior to the Substantial Completion date or the final acceptance of the Project or within five (5) days of the occupancy or use of a portion of the Work, whichever is applicable.

The Contractor shall, upon the receipt of notice in writing from the City, promptly make all repairs arising out of defective materials, workmanship, or equipment. The City is hereby authorized to make such repairs and the Contractor and its Surety shall be liable for the cost thereof, if ten (10) days after giving of such notice to the Contractor, the Contractor has failed to make or undertake the repairs with due diligence. In case of emergency, where in the opinion of the City delay could cause serious loss or damage, repairs may be made without notice being sent to the Contractor, and the expense in connection therewith shall be charged to the Contractor, and its Surety shall be liable for the cost thereof.

Prior to the expiration of the Warranty period, the City reserves the right to hold a meeting and require the attendance of the Contractor. The purpose of the meeting is to review warranties, bonds and maintenance requirements and determine required repair or replacement of defective items.

For the purpose of this paragraph, Acceptance of the Work or a portion of the Work by the City, shall not extinguish any covenant or agreement on the part of the Contractor to be performed or fulfilled under this Contract which has not, in fact, been performed or fulfilled at the time of such Acceptance. All covenants and agreements shall continue to be binding on the Contractor until they have been fulfilled.

The City and the Contractor agree that warranty on the parts of the work possessed and used by the City in accordance with Section 00700-3.04, **CITY'S RIGHT TO USE OR OCCUPY**, shall commence on the date that the City takes possession of such Work and so notifies the Contractor in writing. The City and the Contractor further agree that such possession and use of the Work shall not be deemed as Substantial Completion or Acceptance of any other part of the Work.

If, after installation, the operation or use of the materials or equipment furnished under this Contract proves to be unsatisfactory to the Construction Manager or the City, the City shall have the right to operate and use such materials or equipment until it can, without damage to the City, be taken out of service for correction or replacement. Such period of use of the defective materials or equipment pending correction or replacement shall in no way decrease the Warranty Period. Warranty Period for equipment shall be extended by the number days from the date the equipment is found by the City to be non-functional or defective to the date the Contractor repairs and makes fully operational the same equipment.

Nothing in this Section shall be construed to limit, relieve or release the Contractor's, subcontractor's and equipment supplier's liability to the City for damages sustained as the result of latent defects in the materials and equipment furnished or work performed; nor shall it be deemed to be a waiver by the City of any rights or remedies, or time limits in which to enforce such rights or remedies, it may have against the Contractor, subcontractors, or suppliers of the equipment to be furnished under these Specifications.

## 1.02 BONDS

Contractor shall furnish the Payment and Performance Bonds required under 00700-1.08, **BONDS**, in the forms included in the Contract Documents: Section 00610 – PERFORMANCE BOND and Section 00620 – PAYMENT BOND.

## **PART 2 - PRODUCTS (NOT USED)**

## **PART 3- EXECUTION (NOT USED)**



# WARRANTY FORM

## Warranty For

### Priority 1 Sewer Replacement Project

#### Project 1B: Spinnaker/Humbolt Street Sewer and Anchor Pump Station Rehabilitation

City of Sausalito, California

[Contractor's Name] hereby unconditionally guarantees that the work performed on the **Priority 1 Sewer Replacement Project; Project 1B: Spinnaker/Humbolt Street Sewer and Anchor Pump Station Rehabilitation (the "Project")**, has been done in accordance with the requirements of the Contract Documents and further guarantees the Project in its entirety for a period of one year from the date on which the Project is accepted by the City of Sausalito's City Council, unless a longer period is specified in the Contract Documents (the "Warranty Period"). Contractor hereby agrees that it will, during the Warranty Period:

- 1) Repair and/or replace any of the materials, equipment or workmanship in the Work that are defective or do not meet the requirements of the Contract Documents, or
- 2) If the Work as a whole does not operate properly, as originally intended and in accordance with the Contract Documents due to defective or nonconforming material, equipment or workmanship, repair or replace any such material, equipment or workmanship.

Contractor shall, within fifteen (15) days after receipt of written notice thereof from City, repair and/or replace any such materials, equipment, work or workmanship at its own expense and without cost to the City. This obligation applies whether the materials, equipment or work were furnished, installed, performed or constructed by Contractor or a Subcontractor or Supplier of any tier.

In addition, Contractor shall repair and replace any adjacent portions of the Work damaged as a result of the repair or replacement of defective materials, equipment or workmanship, or the Work itself.

If Contractor fails to remedy any such defect or nonconformance within fifteen (15) days after receipt of the City's written notice (unless Contractor has commenced the repair and is diligently pursuing the repair to completion), City may, without further notice to Contractor or its surety, proceed to have such defects remedied at Contractor's expense and Contractor shall pay all costs and charges incurred thereby. The City of Sausalito shall have the sole option to make any needed replacements or repairs itself or to have such replacements or repairs done by the undersigned.

Neither acceptance of the Work nor any payment to Contractor nor any provision of the Contract Documents shall be deemed to be a waiver by City or relieve Contractor of any responsibility under this contract.

In the event of any emergency constituting an immediate hazard to health, safety, property, or public services during the Warranty Period due to materials, equipment or workmanship that are defective or do not meet the requirements of the Contract Documents, or if the Work as a whole does not operate properly, as originally intended and in accordance with the Contract Documents due to defective or nonconforming material, equipment or workmanship, City may undertake at Contractor's expense, and without prior notice to Contractor, all Work necessary to correct such condition.

Contractor agrees to pay the City of Sausalito, no later than thirty (30) days from the City's written demand, for all costs and expenses the City incurs in repairing, replacing and/or restoring the Work to the conditions contemplated in the Contract Documents, including but not limited to the cost of any such equipment or materials replaced, the cost of removing and replacing any other work necessary to make such replacement or repairs, and all administrative and legal expenses. City's records of the costs of repairing, replacing, rebuilding or restoring any damage or defects by performed by a party other than Contractor shall be binding and conclusive evidence of the amount Contractor shall pay City.

Defective or nonconforming work remedied under this section shall be subject to an extended warranty obligation identical in terms to that provided by this Section, starting from the date the City accepts the remedial work.

Nothing contained in this Section shall be construed to establish a period of limitation with respect to other obligations Contractor may have under the Contract Documents or applicable law. The period established above relates only to the specific obligation of Contractor to correct work on the Project and has no relationship to the time within which City may enforce the obligation to comply with the Contract Documents.

SIGNED: \_\_\_\_\_

CONTRACTOR: \_\_\_\_\_

By: \_\_\_\_\_ Title: \_\_\_\_\_

Dated this: \_\_\_\_\_ day of \_\_\_\_\_, 201\_\_

Contractor: \_\_\_\_\_

Signed: \_\_\_\_\_

Titled: \_\_\_\_\_

Date: \_\_\_\_\_

**\*\*END OF SECTION\*\***

## **SECTION 02050**

### **DEMOLITION, SALVAGE, AND ABANDONMENT**

#### **PART 1 – GENERAL**

##### **1.01 THE REQUIREMENT**

- A. Contractor shall perform all demolition of existing facilities, equipment, and materials as required by the Contract Documents in an orderly and safe manner.
- B. Contractor shall salvage and return to the City of Sausalito existing facilities, equipment, and materials as required by the Contract Documents.
- C. Contractor shall abandon existing facilities, equipment, and materials as required by the Contract Documents.

##### **1.02 CONTRACTOR SUBMITTALS**

- A. Contractor shall submit proposed methods, equipment, and sequence of operations for demolition of structures and other facilities. The submittal shall include proposed methods and materials for shutting off, capping, plugging, and removing pipelines.
- B. The proposed demolition and abandonment schedule shall be submitted for review.

##### **1.03 OWNERSHIP OF MATERIAL AND EQUIPMENT**

- A. Materials and equipment not designated for reuse or salvage shall become the property of Contractor.

#### **PART 2 – PRODUCTS**

##### **2.01 EQUIPMENT AND MATERIALS FOR DEMOLITION**

- A. Only equipment and materials submitted and approved shall be used for demolition.
- B. Fires shall not be used for disposal of demolished items or refuse.
- C. Drop hammers, impact hammers, or other types of impact devices shall not be used under circumstances that may allow damage to existing underground utilities.

## **PART 3 – EXECUTION**

### **3.01 SALVAGE OF EXISTING FACILITIES**

- A. Existing materials and equipment removed by Contractor under the provisions of the Contract, and not reused in the Work shall become Contractor's property and shall be removed from the site of the Work upon completion of the Work.
- B. Contractor shall carefully remove, in a manner to prevent damage, any and all materials and equipment specifically designated in the Contract Documents to be removed and salvaged, or to remain the property of the City of Sausalito. Contractor shall store and protect all salvaged items specified or indicated in the Contract Documents to be reused in the Work.
- C. Salvaged items not designated for reuse in the work, and items to be retained as Owner's property, shall be delivered to the City of Sausalito's Corp. yard by Contractor in good and clean condition to corner of Nevada Street and Tomales, Sausalito, CA 94965.
- D. Any items damaged during the removal, storage, or handling as a result of carelessness, negligence, or improper procedures shall be replaced by Contractor with corresponding items of equal or greater value.
- E. Contractor may at its option furnish and install new items in lieu of those indicated to be salvaged or reused, in which case the original items shall become the property of Contractor and shall be removed from the Site after completion of the Work.
- F. Existing materials and equipment removed by Contractor shall not be reused in the Work, except where otherwise called for in the Contract Documents.

### **3.02 ENVIRONMENTAL CONTROLS**

- A. Contractor shall minimize the generation of dust and other airborne particles. If required by Laws and Regulations, temporary enclosures and other suitable measures shall be used to prevent the spread of dust, dirt, airborne particles, and debris.
- B. Noise generated by the demolition activities shall be limited to levels allowed by Laws and Regulations. Demolition equipment shall have noise suppression devices.
- C. Water shall not be used in a manner that creates dangerous or objectionable conditions such as flooding, erosion, overspray, or sedimentation in nearby ditches or streams. Stormwater shall be contained and managed as required by Laws and Regulations.

- D. If underground fuel storage tanks, asbestos, PCBs, contaminated soils, or any other hazardous materials are encountered the affected demolition work shall be stopped and Engineer and Owner notified promptly.
- E. Promptly remove equipment and materials not designated for reuse or salvage and all waste and debris resulting from demolition operations. Dispose of removed equipment, materials, waste, and debris in a manner that conforms to applicable Laws and Regulations.

### 3.03 EXAMINATION OF SITE

- A. Prior to demolition, Contractor shall make an inspection with Engineer to determine the baseline condition of existing structures and other facilities adjacent to the items designated for demolition. Engineer will make a written report of the condition of each adjacent facility and will transmit the report to Contractor for review. Contractor shall not proceed with demolition operations until after the inspection and report have been completed and the Engineer has authorized Contractor to proceed.
- B. Contractor shall mark or tag existing equipment to be salvaged or to remain in place as the property of Owner. Engineer will determine and mark the locations of the limits of removal for connecting piping, electrical facilities, and other related facilities.

### 3.04 PROTECTION OF PROPERTY

- A. Take precautions to prevent damage to facilities which are to remain in place or are to be salvaged, and be responsible for any damages to these facilities resulting from this work. Repair or replace damages to such work to return the facilities to its pre-existing condition at no additional cost to the Owner.
- B. Contractor shall provide safe access to adjacent property, facilities, and buildings at all times. Roadways, sidewalks, and passageways shall not be obstructed.
- C. Demolition shall be performed using procedures that prevent damage to adjacent property. Contractor shall promptly repair damage to Owner's property and property owned by others.
- D. Contractor shall be responsible for integrity of adjacent structures and facilities, and shall be liable for any damage due to movement or settlement. Suitable shoring for support of adjacent structures shall be installed and maintained.
- E. If adjacent structures or facilities appear to be in danger by the demolition operations, Contractor shall take additional steps to prevent damage.
- F. Contractor shall erect and maintain enclosures, barriers, warning lights, and other required protective devices.

### 3.05 UTILITY SERVICES

- A. Contractor shall comply with the operating rules and regulations of utility companies that have jurisdiction over utilities affected by the demolition operations.
- B. Notify and coordinate with the utility companies, adjacent building occupants, and farming operations when temporary interruptions of utility services are required.

### 3.06 BACKFILL OF STRUCTURES AND EXCAVATIONS

- A. Backfill of excavations and structures shall as shown on the Drawings and in accordance with Section 02300 Earthwork.
- B. Materials from the demolition work shall not be used for backfill unless approved by Engineer.

### 3.07 DISPOSAL OF DEMOLISHED MATERIALS

- A. Concrete, site debris, rubbish, and other materials resulting from demolition operations, as well as mechanical and electrical equipment designated to be demolished, shall be the property of the Contractor and shall be legally disposed of at the Contractor's expense.

### 3.08 DEMOLITION WITHIN WET WELL AND OTHER STRUCTURES

- A. Buildings and structures shall be demolished to the lines and grades indicated on the plans. Where no limits are shown, the limits shall be 5 feet outside of new facilities to be installed. Removals beyond these limits shall be at Contractor's expense. If removals are considered excessive by Engineer, and will affect the performance, serviceability, or value of adjacent facilities, Contractor shall reconstruct the structures that were excessively removed.
- B. Structures shall be demolished as shown on the Drawings. Concrete and masonry shall be removed in small sections.
- C. Demolish structures to a minimum of 3 feet below finished grade indicated on the Drawings. Backfill the remaining structure and demolition excavations to the levels shown on the Drawings.

### 3.09 DEMOLITION OF MECHANICAL FACILITIES

- A. Mechanical demolition consists of dismantling and removal of existing piping, pumps, motors, water tanks, equipment, and other mechanical items. It includes cutting, capping, and plugging as required to preserve the operation of existing facilities to remain in service.

- B. Existing water, chemical, gas, fuel oil, and other piping shall be removed as shown on the Drawings.
1. Piping shall be removed to the limits shown, or to a point where it will not interfere with the new facilities. Piping not indicated to be removed, or which does not interfere with the new construction, shall be removed to the nearest solid support, capped, and left in place.
  2. Chemical and fuel piping and tanks shall be emptied of contents and cleaned before removal. Fuels, chemicals, and other contents from the demolition work shall be removed and disposed of at a location that is in compliance with Laws and Regulations. Contractor shall verify that the remaining piping and tanks are in a safe condition prior to removal or capping.
  3. Piping Through Walls:
    - a. Where piping of size less than 12” passes through existing walls, the piping shall be cut and capped on each side of the wall.
    - b. Piping 12” and larger shall be completely removed. Contractor shall sawcut a square scoremark at the pipe to a depth just less than the reinforcing steel on each side of the wall. The concrete shall be chipped and removed to remove the pipe. Reinforcing steel shall be added to restore any bars cut during removal of the pipe, and to provide reinforcing at least equal to reinforcing in the existing wall. The opening shall be formed and grouted with nonmetallic, nonshrink grout per Section 03600.
  4. Pipe and tank capping materials shall be suitable for the types of pipe and tank to be capped.
  5. Where underground piping associated with mechanical facilities is to be altered or removed, cap the remaining piping that is to be abandoned. Abandoned underground piping may be left in place unless it interferes with new work or is shown to be removed. Piping less than 15” in size may be capped and abandoned in place. Piping equal or greater than 15” in size shall be filled with sand and plugged prior to abandonment.
- C. Where existing piping is to be cut and capped, but a portion will remain in service, Contractor shall do the following.
1. Capping and plugging materials and installation work shall be in accordance with the applicable building codes, standards, and specifications that govern the remaining piping.
  2. Remaining piping shall be pressure tested before being returned to service in accordance with the applicable building codes, and as approved by Engineer.

### 3.10 DEMOLITION OF ELECTRICAL FACILITIES

- A. Demolition of electrical facilities shall be in accordance with applicable codes and standards for electrical construction.
- B. Electrical removals consist of disconnecting and removing existing switchgear, distribution switchboards, control panels, bus ducts, conduits and wires, panelboards, lighting fixtures, and associated electrical equipment.
- C. Where existing electrical facilities are to be removed, but a portion will remain in service, Contractor will do the following.
  - 1. Remove the facilities as required, and provide terminations consisting of new conduit caps, junction boxes, and panel modifications required to maintain the remaining facilities in service and maintain the integrity of the grounding systems.
  - 2. Remove wiring in underground duct systems. Verify the functions of wiring before disconnecting and removing and cap ducts that will not be continued in service.
  - 3. Work required for facilities that remain in service shall be in accordance with applicable codes and standards for electrical construction and the Specifications.

### 3.11 DEMOLITION OF PIPELINES AND YARD PIPING

- A. Piping shall be removed to the limits shown, or to a point where it is not beneath new structures and it will not interfere with the new facilities. Where limits are not shown, piping shall be removed to a point that is at least 5 feet outside of the limits of new construction.
- B. Normally, piping shall be removed to the first joint outside of the limits required. Where sections of pipe exceed 16 feet in length, the piping may be cut using saws, cutting torches, or other approved methods to provide clean and unbroken end points.
- C. Where underground piping is to be removed, plug the remaining piping that is to be abandoned. Abandoned underground piping may be left in place unless it interferes with new work, is beneath new structures, or is shown to be removed. Piping less than 15" in size shall be plugged and abandoned in place. Piping equal or greater than 15" in size shall be filled with sand and plugged prior to abandonment. Where indicated, piping shall be filled with flowable fill in compliance with Section 02220 Controlled Low Strength Material.
- D. Where existing piping is to be demolished, but a portion will remain in service, Contractor shall do the following.



1. Capping and plugging materials and installation work shall be in accordance with the Specifications. If the pipe materials are not in the Specifications, the applicable building codes, standards, and specifications that govern the remaining piping shall be used for installation of capping and plugging materials.
  2. Remaining piping shall be pressure tested before being returned to service in accordance with the applicable building codes, and as approved by Engineer.
- E. Plugs for abandoned piping shall consist of solid concrete or brick and mortar plugs installed for a length of at least 2 feet. As an alternative, Contractor may install approved plugs or caps that are of the same material as the pipe.
- F. Manholes along pipelines to be abandoned shall be filled with sand and have covers removed.

### 3.12 CLEANING

- A. During and upon completion of the demolition operations, promptly remove unused tools and equipment, surplus materials, rubbish, debris, and dust and shall leave work areas in a clean condition.
- B. Do not sweep, grade, or flush surplus materials, rubbish, or debris into storm drains, channels, lakes, or streams.

**\*\*END OF SECTION\*\***

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## SECTION 02080

### SHEETING, SHORING AND BRACING

#### PART 1 – GENERAL

##### 1.01 SECTION INCLUDES

Requirements for temporary excavation support systems for excavation equal to and greater than 5 feet deep, and where indicated on the Drawings.

##### 1.02 INSTALLER QUALIFICATIONS

Shoring installer must have a minimum of five successful past installations of shoring systems of comparable overall heights and comparable penetration of soils similar to those found on the project site.

##### 1.03 PERFORMANCE REQUIREMENTS

- A. Design and install excavation support and protection systems that are capable of:
  - 1. Supporting excavation sidewalls and bottom to maintain the required excavation or trench section.
  - 2. Resisting soil and hydrostatic pressure and superimposed construction loads and other live loads.
  - 3. Protecting existing facilities in the vicinity of the excavation from damage due to settlement or movement of soil
  - 4. Provide professional engineering services needed to assume engineering responsibility, including preparation of Shop Drawings and a comprehensive engineering analysis by a qualified professional engineer registered in the state of California.
- B. Install and remove excavation support and protection systems without damaging existing buildings, pavements, utilities, railroad facilities and other improvements adjacent to excavation.
- C. Trench Excavations
  - 1. Provide protection systems to protect workers from hazard of caving ground and other hazards.
  - 2. Install protection system in locations where:
    - a. Protection system is specifically indicated on the Drawings.
    - b. Trenches are equal to, or greater than, 5 feet deep.
    - c. Trenches are less than 5 feet deep, but there is a potential for cave-in.
    - d. When engineering analyses prepared by the Contractor indicate the stability of existing structures and facilities may be jeopardized by settlement or movement of soil.

3. Protection Systems:
  - a. Sloping or benching systems for excavated slopes.
  - b. Structural support systems, shield systems, and other protection systems.

#### 1.04 GENERAL DESIGN REQUIREMENTS

- A. Design excavation support systems to meet requirements and standards of the Occupational Safety and Health Administration (OSHA).
- B. Design excavation support systems to meet the requirements of California Code of Regulations, Title 8 – Construction Safety Orders and California Labor Code Sections 6705 to 6707.
- C. Design structural steel members in accordance with the American Institute of Steel Construction (AISC) Manual of Steel Construction Allowable Stress Design and the Uniform Building Code.
- D. Excavation support systems for trench excavations shall be selected by the Contractor based on the soil conditions, depths of trench excavations, groundwater conditions and other site conditions. No attempt has been made by Engineer to define acceptable trench shoring options.

#### 1.05 GEOTECHNICAL REPORT

A soil investigation report has been prepared by DCM/GeoEngineers Engineering, dated September 2009. This report was obtained only for the Owner's use in design and is not part of the Contract Documents. A copy of the report may be obtained from the City of Sausalito or West Yost Associates. The information presented in this report is not a warrant of subsurface conditions.

#### 1.06 SUBMITTALS

- A. Prepare and submit in accordance with Section 01300.
- B. Submit information as a complete package. Include all items required by the Contract Documents. Incomplete submittals will not be reviewed and will be returned for resubmittal as a complete package.
- C. Shop Drawings
  1. For support of excavations equal to or greater than 5 feet, shop drawings shall be signed sealed by a professional engineer who is registered to practice in the state of California.
  2. Clearly indicate structural sections of shoring members, welding details, bolting details and bracing details.
  3. Indicate existing and new structures, pipelines and other improvements located in the vicinity and impacting the design of the shoring system.

4. Provide details for bracing, reinforcement and sealing around penetrations.
- D. Calculations: Structural calculations verifying and demonstrating the structural safety and adequacy of the sheeting, shoring and bracing to be used.
1. Prepared, signed and sealed by a registered Professional Civil or Structural Engineer who is registered to practice in the State of California.
  2. Provide calculations for the different load, support and other conditions that occur during the sequence of installation, construction of facilities protected by the shoring and the sequence of removal of the internal bracing and shoring.
- E. Sheet Pile Driving Equipment: Information on type of equipment to be used, including manufacturer, model number and driving energy.
- F. Qualifications of registered Professional Engineer and shoring installer, including project references.
- G. Prepare a detailed plan illustrating the sequence of installation and removal of shoring systems and internal bracing. Include sketches showing the various stages in the sequence.
- H. Letter confirming installation of the shoring system is in accordance with the shoring design.
- I. Control Points and Stability Measurements:
1. Submit proposed location and details of control points and method and schedule for obtaining stability measurements.
  2. Submit field notes documenting stability measurements.

#### 1.07 JOB SITE POSTINGS

- A. Maintain at least one copy of the protection system design at the job site while the excavation is open in accordance with the requirements of California Code of Regulations, Title 8 Construction Safety Orders and the California Labor Code.]

#### 1.08 SEQUENCE AND SCHEDULING

- A. Do not begin excavations or installation of excavation supports until submittals for excavation support systems have been accepted by the Engineer and until materials necessary for installation are on site.
- B. Allow a minimum of 15 calendar days for Engineer's review of submittals for excavation support systems.

- C. Do not begin excavations or installation of excavation supports until initial survey measurements on control points on existing structures and other improvements are obtained to document initial elevations and locations.

## **PART 2 – PRODUCTS**

### **2.01 MATERIALS**

- A. General: Provide materials that are either new or in serviceable condition.
- B. Structural Steel Soldier Beams: ASTM A 36, ASTM A 690 or ASTM A 992.
- C. Steel Sheet Piling: ASTM A 328, ASTM A 572 or ASTM A 690; with continuous interlocks.
- D. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness as determined by design calculations, but not less than 3 inches.
- E. Lean Concrete Mix:
  - 1. Controlled Low Strength Material in accordance with Section 02220, as modified below.
  - 2. A mixture of sand, fine aggregate, water and 2 sacks of cement per cubic yard to create a flowable mixture that fills voids.
  - 3. Minimum Compressive Strength: 1500 psi.

## **PART 3 – EXECUTION**

### **3.01 PREPARATION**

Prior to beginning installation of the excavation support system, pothole to locate existing buried utilities in the vicinity of the excavation. Survey utilities and compare actual locations to those locations indicated on the Drawings and the Shop Drawings. Determine any areas of conflict and revise the design and layout of the excavation support system to eliminate these conflicts.

### **3.02 SLOPING AND BENCHING OF EXCAVATED FACES**

- A. Where structural excavation support systems are not specifically indicated on the Drawings, sloping and benching systems for exposed faces of excavations may be utilized, as deemed appropriate by the Contractor's competent person per Cal-OSHA T8-1451.

### **3.03 TRENCHING SUPPORT SYSTEMS**

- A. Where structural excavation support systems are not specifically indicated on the Drawings, trench support systems consisting of hydraulic jacks and plates, trench shield systems, and other trench protection systems may be utilized, as deemed appropriate by the Contractor's competent person per Cal-OSHA T8-1451.

### 3.04 BRACING

- A. Locate bracing to clear temporary and permanent work and to allow lowering of material and equipment into the excavation.
- B. If necessary to move brace, install new bracing before removing original brace.
- C. Install internal bracing when calculations indicate bracing is required to prevent spreading or distortion of braced frames.
- D. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

### 3.05 INSPECTION

- A. Designer of the shoring system is responsible for confirming proper installation of the shoring system. Shoring system designer, or a representative of the designer, shall make site visits to confirm installation is in accordance with the accepted shoring design.
- B. Submit letter of proper installation confirming installation is in accordance with the shoring design.

### 3.06 MONITORING AND STABILITY MEASUREMENTS

- A. Establish stability control points on shoring and structures in vicinity of the excavation for measurement of horizontal and vertical movement. Clearly identify benchmarks and record existing elevations.
  - 1. Control Points on Shoring Systems:
    - 2. Set points at distances not exceeding 25 feet at each support level.
    - 3. Support levels include levels of tie-backs, wales, bottom of excavation and other types of supports.
    - 4. Set control points in corners of the following existing structures:
      - a. Monitor excavation support and protection systems once per week during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.
      - b. Survey control points established on adjacent structures and improvements once per week during excavation and for as long as the excavation remains open.
      - c. Use the services of a qualified professional engineer or land surveyor to monitor control points.
      - d. Maintain an accurate log of surveyed elevations and control point positions for comparison with original elevations and positions. Promptly notify the Engineer if changes in elevations

or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

### 3.07 REMOVAL

- A. Remove excavation support and protection systems when backfilling of the excavation has progressed sufficiently to support the remaining open excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.
- B. Repair or replace adjacent work damaged or displaced by removing excavation support and protection systems.

**\*\*END OF SECTION\*\***



## SECTION 02120

### PRESSURE PIPELINE TESTING

#### PART 1 – GENERAL

##### 1.01 REQUIREMENT

- A. Contractor shall perform cleaning, flushing, and testing of all pipelines and appurtenant piping, including conveyance of test water from Engineer-designated source to point of use and all disposal thereof, all in accordance with the requirements of the Contract.

##### 1.02 CONTRACTOR SUBMITTALS

- A. Contractor shall submit a minimum 48-hour advance written notice of the proposed testing schedule for review and concurrence of Engineer.
- B. Contractor's proposed plans for water conveyance, control, and disposal shall be submitted in writing.
- C. The submittals shall indicate Contractor's proposed division of the pipeline into sections for testing and the design of bulkheads, test heads, and other appurtenances required for testing.

#### PART 2 – PRODUCTS

##### 2.01 MATERIALS REQUIREMENT

- A. All test equipment, temporary valves, bulkheads, or other water control equipment and materials shall be determined and furnished by Contractor subject to Engineer's review. No materials shall be used which would be injurious to the construction or its future function.

#### PART 3 – EXECUTION

##### 3.01 GENERAL

- A. Unless otherwise provided herein, water for flushing and testing will be furnished by the City; however, Contractor shall make all necessary provisions for conveying the water for flushing and testing from Engineer-designated source to the points of use.
- B. All pipelines shall be tested. All testing operations shall be performed in the presence of Engineer.

- C. Release of water from pipelines, after testing has been completed, shall be in accordance with a written disposal plan reviewed by Engineer. Contractor shall not discharge water that contains chemicals or contaminants that exceed the limits established by the appropriate regulatory agencies.

### 3.02 PRESSURE TESTING OF PIPELINES

- A. Prior to pressure testing, pipelines shall be cleaned of all debris, construction materials, dirt, and any other materials not suitable for inclusion in the completed pipeline. Pipeline cleaning shall conclude with water flushing, performed so that the velocity of flushing water is at least 2.5 ft/sec in the pipeline to be tested.
- B. Contractor shall test all pipelines either in sections or as a unit. No section of the pipeline shall be tested until all field-placed concrete, thrust blocks, or mortar have attained an age of at least 14 days.
- C. The test shall be made by closing valves when available, or by placing temporary bulkheads in the pipe and filling the line slowly with water. Contractor shall be responsible for ascertaining that all test bulkheads are suitably restrained to resist the thrust of the test pressure without damage to, or movement of, the adjacent pipe. Care shall be taken to see that all air vents are open during filling. The pipeline shall be filled at a rate which will not cause any surges or exceed the rate at which the air can be released through the air valves at a reasonable velocity. All the air within the pipeline shall be properly purged.
- D. After the pipeline or section thereof has been filled, it shall be allowed to stand under a slight pressure for at least 24 hours to allow the concrete or mortar lining, as applicable, to absorb water and allow the escape of air from any air pockets. During this period, bulkheads, valves, and connections shall be examined for leaks. If leaks are found, corrective measures satisfactory to Engineer shall be taken.
- E. Test
  - 1. The pressure test shall consist of maintaining the test pressure on the pipeline by introduction of a measured amount of water, if necessary, for a period of four hours. The test pressure shall be the 150 psi or 50 psi greater than the operating pressure of the pipeline, whichever is greater. The amount of water introduced into the pipeline to maintain the test pressure shall be measured volumetrically using a calibrated test reservoir.
  - 2. All visible leaks shall be repaired in a manner acceptable to Engineer.
  - 3. The test pressure shall not be applied against a closed valve that is connected to a potable water system.
- F. Allowable Leakage
  - 1. The maximum allowable leakage for pipelines with rubber-gasketed joints shall be 0.0919 gallons per hour per inch per 1,000 feet.

2. Exposed pipe, and pipe with welded, solvent-welded, butt fused, flanged, or coupled joints shall have no leakage.
3. In the case of pipelines that fail to pass the prescribed leakage test, Contractor shall determine the cause of the leakage, take corrective measures to repair the leaks, and again test the pipelines.

### 3.03 CONNECTIONS TO EXISTING SYSTEM

- A. Where connections are to be made to an existing force main system, the interior surfaces of all pipe and fittings used in making the connections shall be cleaned before they are installed.

**\*\*END OF SECTION\*\***

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## SECTION 02130

### NON PRESSURIZED PIPELINE TESTING

#### PART 1 – GENERAL

##### 1.01 GENERAL

- A. Acceptance testing of non-pressurized pipelines includes the following:
1. Visual inspection of pipes.
  2. Leakage testing of pipes.
  3. Leakage testing of manholes.
  4. Television inspections.
- B. Contractor shall perform cleaning and testing of all pipelines and appurtenant facilities, including conveyance of test water from Engineer-designated source to point of use and disposed thereof, all in accordance with the Contract Documents.

##### 1.02 REFERENCES

This Section contains references to the following documents. They are a part of this Section as specified and modified. In case of conflict between this Section and the listed documents, the requirements of this Section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by the organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, reference to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued, or replaced.

Reference	Title
ASTM C828	Standard Test Method for Low Pressure Air Test of Vitrified Clay Pipe Lines
ASTM C924	Standard Practice for Testing Concrete Pipe Sewer Lines by Low Pressure Air Test Method
ASTM D3034	Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
UNI-B-3	Recommended Standards for the Installation of Polyvinyl Chloride (PVC) Pressure Pipe

### 1.03 PERFORMANCE REQUIREMENTS

- A. Gravity flow sanitary sewers and drainage pipelines are required to have a straight alignment and uniform grade between manholes.
- B. Plastic pipe is required to have no more than 5% deflection when measured at least 30 days following completion of backfilling for the segment being tested, using a standard mandrel as defined herein.
- C. Refer to table for measuring leakage in sewers and drainage pipelines at the end of this Section. Perform leakage testing to verify that leakage criteria are met.
- D. Sections of pipelines and manholes that fail any test shall be repaired or replaced, as acceptable to Engineer, and retested until the test is passed.

### 1.04 SUBMITTALS

- A. Submittals shall conform to requirements of Section 01300 Submittals of these Technical Specifications.
- B. Before testing begins and in adequate time to obtain approval through the submittal process, prepare and submit a test plan for review by Engineer. Include testing procedures, methods, equipment, and tentative schedule. Obtain advance written approval for deviations from the Drawings and Specifications.
- C. Submit test reports for each test on each segment of pipeline.
- D. Submit videotapes of line survey and post-completion television inspection of gravity sanitary sewers and drainage pipelines with each monthly pay estimate.

### 1.05 GRAVITY SANITARY SEWER AND DRAINAGE PIPELINE QUALITY ASSURANCE

- A. Repair, correct, and retest manholes or sections of pipe which fail to meet specified requirements when tested.
- B. Provide testing reports and videotape of television inspection. Tape quality shall be acceptable to Engineer.
- C. Upon completion of tape reviews by Engineer, Contractor will be notified regarding final acceptance of the sewer segment.

### 1.06 SEQUENCE AND SCHEDULING

- A. Perform testing as work progresses. Schedule testing so that no more than 1,000 LF of installed sewer remains untested at any one time.
- B. Coordinate testing schedules with Engineer and perform testing under observation of Engineer.

## **PART 2 – PRODUCTS**

### **2.01 EXFILTRATION TEST**

- A. Contractor shall provide a transient water meter for use when water for testing will be taken from the City system. Conform to City requirements for water meter use.
- B. Test Equipment
  - 1. Pipe plugs.
  - 2. Pipe risers where the manhole cone is less than 2 feet above highest point in pipe or service lead.

### **2.02 INFILTRATION TEST EQUIPMENT**

- A. Calibrated 90° V-notch weir.
- B. Pipe plugs.

### **2.03 LOW PRESSURE AIR TEST**

- A. Minimum Requirement for Equipment
  - 1. Control panel.
  - 2. Low pressure air supply connected to control panel.
  - 3. Pneumatic plug of acceptable size for diameter of pipe to be tested and capable of withstanding internal test pressure without leaking or requiring external bracing.
  - 4. Air hoses from control panel to the following:
    - a. Air supply.
    - b. Pneumatic plugs.
    - c. Sealed line for pressuring.
    - d. Sealed line for monitoring internal pressure.
- B. Testing of Pneumatic Plugs

Place a pneumatic plug in each end of a length of pipe on the ground. Pressurize plugs to 25 psig; then pressurize sealed pipe to 5 psig. Two plugs are acceptable if they remain in place against the test pressure without external aids.

### **2.04 EQUIPMENT FOR GROUNDWATER DETERMINATION**

Pipe probe or small diameter casing for groundwater elevation determination.

## **PART 3 – EXECUTION**

### **3.01 PREPARATION**

- A. Provide labor, equipment, tools, test plugs, risers, air compressor, air hose, pressure meters, pipe probe, calibrated weirs, or any other device necessary for property testing and inspection.
- B. The selection of test methods and pressures for gravity sanitary sewers and drainage pipelines shall be determined based on groundwater elevation.

### 3.02 VISUAL INSPECTION OF GRAVITY NON PRESSURIZED PIPELINES

Check pipe alignment visually by flashing a light between structures. Verify if alignment is true and no pipes are misplaced. In case of misalignment or damaged pipe, remove and re-lay or replace pipe segment.

### 3.03 LEAKAGE TESTING FOR NON PRESSURIZED PIPELINES

- A. Non pressurized pipelines shall be tested as complete systems including service laterals.
- B. Test Options
  - 1. Test non-pressurized pipes for leakage by low pressure air testing.
  - 2. Test new or rehabilitated sanitary sewer manholes with water or low pressure air. Manholes tested with low pressure air shall undergo a physical inspection prior to testing.
- C. Compensating for Groundwater Pressure
  - 1. Where groundwater exists, install a pipe nipple at the same time sewer line is placed. Use a 1/2" capped pipe nipple approximately 10" long. Make the installation through manhole wall on top of the sewer line where line enters manhole.
  - 2. Immediately before performing line acceptance test, remove cap, clear pipe nipple with air pressure, and connect a clear plastic tube to nipple. Support tube vertically and allow water to rise in the tube. After water stops rising, measure height in feet of water over invert of the pipe. Divide this height by 2.3 ft/psi to determine the groundwater pressure to be used in the line testing.
- D. Air Test

An air test shall be conducted on gravity flow piping only.

- 1. The testing method shall properly consider the existing groundwater elevations during the test. When the prevailing groundwater is above the sewer being tested, the air pressure shall be increased 0.43 psi for each foot the water table is above the flow line of the sewer.
- 2. If the test is not passed, the leak shall be found and repaired to the satisfaction of the Engineer and the length of repaired line retested. If the test section fails the test for excessive leakage, the Contractor shall repair



or replace all defective materials and/or workmanship at no additional cost to the Owner.

3. The pressure gauge used for acceptance testing shall be calibrated and supplied by Contractor. The test pressure gauge full range shall measure and read from 0 to 10 psi. A current certification of calibration shall also be provided by the Contractor upon request from the Engineer.
4. The air testing equipment shall be set up such that the pressure gauge is at ground level during the test.
5. The air test procedure shall be as follows:
  - a. The length of line tested at one time shall be limited to the length between adjacent manholes.
  - b. Pressurize the test section to 4.0 pounds per square inch (psi) and hold above 3.5 psi for not less than five (5) minutes.
  - c. Add air, if necessary, to keep the pressure above 3.5 psi. At the end of the five (5) minute stabilization period, note the pressure and begin the time period.
  - d. If the pressure drop is more than 1.0 psi in the time given in the following table, the section of pipe shall have failed the test.

**Minimum Test Time for Various VCP and DIP Sizes**

Nominal Pipe size, inches	Time, minutes/100 ft	Nominal Pipe size, inches	Time, minutes/100 ft
6 and 8	1.2	27	4.2
10	1.5	30	4.8
12	1.8	33	5.4
15	2.1	36	6.0
18	2.4	39	6.6
21	3.0	42	7.3
24	3.6		

**3.04 LEAKAGE TESTING FOR MANHOLES**

- A. The test shall be performed after completion of the manhole assembly, including mortaring of exterior joints, backfilling, and compaction, and just prior to placing asphalt concrete, installing the manhole frame and cover and concrete collar. The test may also be performed at the Contractor's option prior to installation of grade rings unless otherwise required on the Contract Drawings.
- B. The Contractor shall furnish the materials and equipment necessary to conduct the test.

- C. All lift holes shall be filled with non-shrink grout prior to testing.
- D. All pipes entering the manhole shall be temporarily plugged, taking care to securely brace the plugs to prevent being sucked into the manhole during testing. Unused channels shall be permanently plugged and eliminated with mortar. The plug shall not affect the flow characteristics of the remaining channel(s).
- E. Vacuum Testing
  - 1. Install vacuum tester head assembly at top access point of manhole and adjust for proper seal on straight top section of manhole structure. Following manufacturer's instructions and safety precautions, inflate sealing element to the recommended maximum inflation pressure; do not over-inflate.
  - 2. Evacuate manhole with vacuum pump to 10" mercury (Hg), disconnect pump, and monitor vacuum for the time period specified in the following table.

Depth in Feet	Time in Seconds by Manhole Diameter		
	48"	60"	72"
4	10	13	16
8	20	36	32
12	30	39	48
16	40	52	64
20	50	65	80
24	60	78	96
T (a)	5	6.5	8.0

<sup>(a)</sup> Add T times for each additional 2 foot depth. (The values listed above have been extrapolated from ASTM C924-85.)

- 3. If the drop in vacuum exceeds 1" Hg over the specified time period tabulated above, locate leaks, complete repairs necessary to seal manhole and repeat test procedure until satisfactory results are obtained.

F. Hydrostatic Testing

- 1. Fill manhole with water to top of frame. Add water over a 24-hour period to compensate for absorption and evaporation losses. After 24 hours, refill to top of frame and observe for loss of water. If, after a 4-hour period the water level is reduced by more than 1/4", the leakage shall be considered excessive. Contractor shall make necessary repairs and retest the manhole.
- 2. If water loss exceeds amount tabulated above, locate leaks, complete repairs necessary to seal manhole and repeat test produce until satisfactory results are obtained.

### 3.05 CLOSED CIRCUIT TELEVISION INSPECTION (CCTV)

- A. All new gravity flow sewer main pipe installations shall be inspected by closed circuit television subject to the following conditions and requirements:
1. The entire sewer system as shown on the Contract Drawings is ready for television inspection when the following work has been completed:
    - a. All structures are in place, all channeling is complete, and pipelines are accessible from structures.
    - b. All other underground facilities, utility piping and conduits are installed.
    - c. Pipelines to be inspected have been cleaned and flushed and in the case of PVC pipe, mandrel tested.
    - d. Final air test has been completed.
  2. The Contractor shall inform the Engineer 48 hours in advance of performing the television inspection. The Engineer shall have the right to witness the CCTV inspection as it occurs. The CCTV inspection shall be video recorded in color with digital video disk (DVD) format. A DVD disk of the television inspection shall be produced and delivered to the Engineer together with a typed log of the inspection.
  3. The following observations from CCTV inspection will be considered defects in the construction of sewer pipelines and will require correction subject to the approval of the Engineer prior to paving:
    - a. Low spot (1 inch or greater)
    - b. Joint separation (3/4 inches or greater opening between pipe sections)
    - c. Cocked joints present in straight runs, or on the wrong side of pipe curves.
    - d. Chips in pipe ends more than 1/4 inch deep
    - e. Cracked or damaged pipe or evidence of the presence of an external object bearing upon the pipe (rocks, roots, etc.)
    - f. Dropped or offset joints
    - g. Infiltration
    - h. Debris or other foreign objects
    - i. Other obvious deficiencies
  4. The Inspector shall notify the Contractor in writing of any deficiencies revealed by the CCTV inspection that will require repair. If corrective work is indicated and viewing of the DVD is desired, the Engineer shall be contacted to set a time for the viewing with the Contractor.
  5. All corrective work shall be completed by the Contractor. The Contractor shall test and perform a television inspection of all the repair work from manhole to manhole.

6. CCTV inspection of new work and correction of observed defects will not relieve the Contractor of his responsibility for the one-year guarantee period. The Engineer may inspect and/or test portions of any new sewer installation during said guarantee period.

### 3.06 TESTING OF SANITARY SEWER FORCE MAINS

Sewage force mains shall be tested in accordance with Section 02120 Pressure Pipeline Testing.

**\*\*END OF SECTION\*\***

## SECTION 02140

### CONTROL OF GROUNDWATER

#### PART 1 – GENERAL

##### 1.01 SCOPE

Contractor shall provide the following services for control of groundwater, surface water, and excavation drainage.

- A. Dewatering, depressurizing, and draining to maintain trench, structure, and embankment excavations and foundation beds in a dry and stable condition, and controlling groundwater conditions in excavations.
- B. Protection of the Work against surface runoff, exfiltration from existing pipes and structures, and rising flood waters.
- C. Facilities to convey groundwater to the proper locations.

##### 1.02 REFERENCES

This Section contains references to the following documents. They are a part of this Section as specified and modified. In case of conflict between this Section and the listed documents, the requirements of this Section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by the organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, reference to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued, or replaced.

Reference	Title
OSHA 29 CFR Part 1926 State Water Resources Control Board (SWRCB) Order No. 99-08-DWQ, National Pollutant discharge elimination system (NPDES) General Permit No. CAS000002	Federal Regulations, Standards-Excavation Water Discharge Requirements (WDRS) for Discharges of Storm Water Runoff Associated with Construction Activity

### 1.03 DEFINITIONS

- A. Groundwater control includes both dewatering and depressurization of water-bearing soil and rock formations.
  - 1. Dewatering includes lowering the water table and intercepting seepage which would otherwise emerge from slopes or bottoms of excavations, and disposing of removed water. The intent of dewatering is to increase stability of excavations and excavated slopes; prevent dislocation of material from slopes or bottoms of excavations; improve excavating and hauling characteristics of excavated material; and prevent failure, heaving, or pumping of the bottom of excavations.
  - 2. Depressurization includes reduction in piezometric pressure within soil strata not controlled by dewatering alone, as required to prevent failure, heaving, or pumping of excavation bottom or instability of excavations.
- B. Excavation drainage includes keeping excavations free of surface water, seepage water, and exfiltration from existing pipes and structures.
- C. Surface drainage includes use of temporary drainage ditches and dikes and installation of temporary culverts and sump pumps with discharge lines as required to protect the Work from any source of surface water.
- D. Equipment and instrumentation for monitoring and control of the dewatering system includes piezometers and monitoring wells, and devices, such as flow meters, for observing and recording flow rates.

### 1.04 PERFORMANCE REQUIREMENTS

- A. Design, install, operate and maintain a groundwater, surface water, and excavation drainage control system, compatible with requirements of all laws and regulations to produce the following results:
  - 1. Effectively lower groundwater levels, reduce piezometric pressures, and eliminate infiltration of water into excavations.
  - 2. Lower and maintain groundwater levels to elevations at least 2 feet below the depth of stripping and at least 3 feet below excavation subgrades, or to lower elevations if indicated. Develop substantially dry and stable subgrades for subsequent earthwork compaction and construction operations.
  - 3. Preclude damage to adjacent properties, buildings, structures, utilities and other work.
  - 4. Prevent the loss of fines, seepage, boils, quick conditions, or softening of the foundation soils.
  - 5. Maintain stability of sides and bottoms of excavations.

6. Remove and exclude water including storm water, groundwater, irrigation water, surface water, and exfiltration from existing pipes, and wastewater from all excavations.
- B. Groundwater control systems may include single-stage or multiple-stage well point systems, eductor and ejector-type systems, deep wells, or combinations of these equipment types. Excavation and surface drainage may also include sump pumping.
- C. Groundwater control and drainage systems shall be located so as not to interfere with utilities, construction operations, adjacent properties, traffic, pedestrians, bicycles, emergency vehicles or adjacent water wells.
- D. Contractor shall assume sole responsibility for groundwater control systems and for any loss or damage resulting from partial or complete failure of protective measures and any settlement or resultant damage caused by the groundwater control operations. Groundwater control systems or operations shall be modified if they cause or threaten to cause damage to new construction, existing site improvements, adjacent property, or adjacent water wells, or affect potentially contaminated areas. Contractor shall repair damage caused by groundwater control systems or resulting from failure of the system to protect property as required.
- E. An adequate number of piezometers shall be installed at the property locations and depths as required to provide meaningful observations of the conditions affecting the excavation and adjacent structures.
- F. Contractor shall maintain backup pumping facilities capable of pumping the entire flow produced by dewatering activities, in the event of the failure of the primary pumping facilities.

## 1.05 SUBMITTALS

Submittals shall be provided in accordance with Section 01300 Submittals of these Technical Specifications and shall include the following information:

- A. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the Specifications are indicated and, therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the Specifications. The submittal shall be accompanied by a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to

the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

- B. Submit a Groundwater and Surface Water Control Plan for review by the Engineer prior to start of any work. The Plan shall be signed by a Professional Engineer registered in the State of California. The Plan shall satisfy all requirements of a Storm Water Pollution Prevention Plan, as required by SWRCB Order No. 99-08-DWQ, as well as the requirements of this Section. Information regarding the SWRCB Storm Water Program is available at:

[http://www.waterboards.ca.gov/water\\_issues/programs/stormwater/gen\\_const.shtml](http://www.waterboards.ca.gov/water_issues/programs/stormwater/gen_const.shtml)

The Plan shall include the following:

1. Required elements of SWPPP, as described in the SWRCB General Permit. Required elements include a site map(s) that shows the construction site perimeter, existing and proposed buildings, lots, roadways, storm water collection and discharge points, general topography both before and after construction, and drainage patterns across the project, and Best Management Practices (BMPs) to be used to protect storm water runoff and the placement of those BMPs.
2. A description of proposed groundwater control systems indicating arrangement, location, depth and capacities of system components, installation details and criteria, and operation and maintenance procedures.
3. Design calculations demonstrating adequacy of proposed systems for intended applications.

- C. Submit the following records upon completion of each installation:

1. Installation and development reports for well points, eductors, and deep wells.
2. Installation reports and baseline readings for piezometers and monitoring wells.
3. Initial flow rates.

- D. Submit the following records on a weekly basis during operations:

1. Records of flow rates and piezometric elevations obtained during monitoring of dewatering and depressurization.
2. Maintenance records for groundwater control installations, piezometers, and monitoring wells.



## 1.06 ENVIRONMENTAL REQUIREMENTS

- A. Comply with requirements of agencies having jurisdiction.
- B. Comply with all laws and regulations for development, drilling, and abandonment of wells used in dewatering systems.
- C. Obtain all necessary permits from agencies with control over the use of groundwater and matters affecting well installation, water discharge, and use of existing storm drains and natural water sources. Because the review and permitting process may be lengthy, take early action to pursue and submit for the required approvals.
  - 1. Discharge of dewatering water to the sanitary sewer system is not desirable to the City of Sausalito. However, this option may be considered by the Engineer, if necessary.

## PART 2 – PRODUCTS

### 2.01 EQUIPMENT AND MATERIALS

- A. Equipment and materials shall be selected by Contractor as necessary to achieve desired results for dewatering. Selected equipment and materials are subject to review of Engineer through submittals required in Subsection 1.05 Submittals.
- B. Eductors, well points, or deep wells, where used, shall be furnished, installed and operated by an experienced contractor regularly engaged in groundwater control system design, installation, and operation.
- C. All equipment shall be in good repair and operating order.
- D. Sufficient standby equipment and materials shall be kept available to ensure continuous operation, where required.

## PART 3 – EXECUTION

### 3.01 GROUNDWATER CONTROL

- A. Install, operate, and maintain groundwater control systems in accordance with the Groundwater and Surface Water Control Plan. Notify Engineer in writing of any changes made to accommodate field conditions and changes to the Work. Provide revised drawings and calculations with such notification.
- B. Provide for continuous system operation, including nights, weekends, and holidays. Provide standby pumping equipment capable of pumping the entire flow produced by dewatering activities, in the event of the failure of the primary pumping equipment. Provide appropriate backup energy source if electrical power is primary energy source for dewatering systems.

- C. Monitor operations to verify that the system lowers groundwater levels at a rate required to maintain a dry excavation resulting in a stable subgrade for performance of subsequent operations.
- D. Do not allow groundwater or drainage water levels to rise until foundation concrete has achieved its design strength and backfilling operations have begun.
- E. During backfilling, the dewatering effort may be reduced to maintain water level a minimum of 5 feet below the prevailing level of backfill. However, do not allow the water level to result in uplift pressures in excess of 80% of the downward pressure produced by weight of structure or backfill in place.
- F. Remove all groundwater control systems upon completion of construction or when dewatering and control of surface or groundwater is no longer required.
- G. Replace any excavation performed for convenience of dewatering in foundation beds with materials as impermeable as original foundation material. Compact backfill to not less than 95% of the maximum dry density in accordance with Section 02300 Earthwork or as indicated on the Drawings.
- H. Provide additional groundwater control installations, or change groundwater control methods, in the event that the installations installed and operated according to the Groundwater Control Plan do not provide satisfactory results based on the performance criteria defined by the Plan and by the Specifications. Revise and submit the revised plan.

### 3.02 MAINTENANCE AND OBSERVATION

- A. Conduct daily maintenance and observation of piezometers and monitoring wells while the groundwater control installations are operating. Groundwater control installations shall be maintained in reliable operating condition.
- B. Replace damaged and destroyed piezometers or monitoring wells with new piezometers or wells as necessary to meet the observation schedule.
- C. Remove and grout piezometers inside or outside the excavation area when groundwater control operations are complete. Remove and grout monitoring wells when directed by the Engineer.

**\*\*END OF SECTION\*\***

## SECTION 02145

### SEWER BYPASSING AND CONTROL

#### PART 1 – GENERAL

##### 1.01 DESCRIPTION

###### A. SCOPE:

This Project consists of removal and replacement of a portion of an existing active sewer. It shall be the Contractor's responsibility to maintain at all times the sewer flows through the Project site and from the adjacent properties.

The Contractor shall provide plugs and/or bypass pumping during work on the sewer. The Contractor shall accommodate flows from laterals at all times. The Contractor may request that property owners minimize wastewater flows during scheduled work in accordance with Section 02145-3.07.

This section specifies the requirements for temporary bypassing, dewatering, and disposal of raw wastewater and treated wastewater as required to perform the work. Contractor shall extract, pump, and/or dispose of wastewater from bypassing and dewatering gravity, sanitary sewer pipelines, sewer laterals, and storm drain discharges as required by the Contractor's Storm Water Pollution Prevention Plan (SWPPP) referenced in Section 01060.

Dewatering requirements for grading, excavation, backfilling, and compacting are specified in Section 02140.

###### B. REQUIREMENTS:

Contractor shall provide labor, materials, and full-time supervision, as required, to contain, bypass, dewater, and dispose of raw wastewater, as necessary for spot repairs, rehabilitation, and other modifications made to complete the work.

The work shall not result in water or wastewater flows to surcharge or exceed the limits specified in this Section, except where otherwise indicated. Surcharge shall be defined as the condition where the depth of flow exceeds the crown elevation in any pipe in any existing gravity pipe systems. Water or wastewater discharges or disposals shall be in conformance with the requirements of the SWPPP.

Contractor shall bypass, dewater, and dispose of water from pipeline systems including, but not limited to, the following:

1. Sanitary sewer mains, laterals, manholes, and cleanouts

## 1.02 SUBMITTALS

Within 14 calendar days of notice to proceed, the Contractor shall submit drawings and complete design data in accordance with Section 01300. Submittal shall show all proposed methods, equipment, and discharge locations for bypassing and dewatering. The submittal shall include the following information:

1. Drawings shall indicate the locations of temporary plugs, taps, pumping systems, suction and discharge piping, and locations of sanitary sewers and manholes to receive discharges of raw wastewater.
2. Data shall include the locations of off-site disposal areas or facilities, locations and elevations of existing sanitary sewer systems, and the capacities of duty and standby pumps, prime movers, power and standby power, and other equipment.
3. Design calculations shall prove the adequacy of the bypassing, dewatering, and disposal system(s) and selected equipment. Design calculations shall confirm that the bypassing and pumping operations shall not cause surcharge in any portion of the existing sanitary sewer system. Design calculations shall be signed and sealed by a civil engineer registered in the State of California qualified to perform said analysis.

## 1.03 JOB CONDITIONS

### A. PROTECTION:

Where bypassing is required, the Contractor shall ensure that service for connecting laterals is not disrupted. All bypassed flow shall be discharged into the nearest (downstream) sanitary sewer manhole. Contractor shall take appropriate steps to ensure odor control at the discharge manholes.

Bypassing and dewatering operations resulting in discharges to the ground surface, streams, creeks, culverts, ditches, storm drains, or groundwater shall not be permitted. The Contractor shall perform work so as to protect the public from potential health hazards, and shall protect the environment from contamination.

All bypass pumping and dewatering operations shall conform to Section 01560 13.0, Noise Abatement.

### B. SCHEDULING:

The bypassing and dewatering systems shall not be shut down between shifts, on holidays or weekends, or during work stoppages without written permission from the Construction Manager.

The Contractor shall provide 14 days written notice to THE CITY prior to performing all bypassing, dewatering, and disposal work.

## C. PERMITS AND APPROVALS

The Contractor shall obtain all approvals from the jurisdictions owning and operating the sanitary sewer to receive discharges of raw or treated wastewater, including, but not limited to, the following jurisdictions:

1. City of Sausalito
2. Sausalito Marin City Sanitary District

## PART 2 – PRODUCTS

No products are included in this section.

## PART 3 – EXECUTION

### 3.01 PLUGGING, BLOCKING, AND PUMPING

Flow control will be required for this Project. For this Project, bypass pumping will be allowed during Contractor's working hours. No bypass pumping shall be performed on weekends or overnight except during Contractor's night work activities. The Contractor shall provide bypass pumping of flows in sanitary sewer mains of approximately 700 gallons per minute. The Contractor shall also provide control of flow for the installation of sanitary sewer laterals and control of sewer flow, where applicable. The Contractor shall submit a plan for bypass pumping around the work area and facilities where wastewater flows must be interrupted. The plan shall include, at a minimum, the following information:

- A. A site plan showing the size and layout of pumps, valves, and temporary pipelines. Layout shall show how temporary facilities will be protected during use.
- B. Catalog data on pump controls and audible alarms.
- C. Catalog data for portable generators when electric pumps are used.
- D. An emergency response plan to be followed in the event of a failure of the bypass pumping systems.

The plan shall be reviewed by the City, Sausalito Marin City Sanitary District, and the Construction Manager prior to the start of construction of the bypass system.

The Contractor shall furnish, install and operate pumps, plugs, conduits, and other equipment to divert the flow of wastewater around the pipeline reach in which work is to be performed and to maintain service to all properties connected to the sewer being replaced. Plugs shall be so designed that all or any portion of the wastewater can be released. Plugs shall be provided with a tag line. The pumping system shall be of sufficient capacity to manage existing flows plus additional flow that may occur during a rainstorm. If pumping is required outside normal working hours, engines shall be equipped and/or shielded in a manner to keep noise to a minimum. Noise level shall conform to the noise ordinance

requirements of the City, unless otherwise approved by the Construction Manager. STANDBY PUMPS AND STANDBY POWER SHALL BE PROVIDED WITH COMPLETE 100 PERCENT REDUNDANCY.

Bypass pumping shall be done in such a manner as will not damage private or public property, or create a nuisance or public health menace. The pumped wastewater shall be in an enclosed hose or pipe that is adequately protected from traffic, and shall be redirected into the sanitary sewer system. Dumping or free flow of wastewater on private property, gutters, trenches, streets, sidewalks, or into storm sewers is prohibited. The Contractor shall be liable for all damages associated with this work. After the work is completed, flow shall be restored to original conditions and temporary facilities removed.

At least ten (10) working days prior to removing existing sewer piping, the Contractor shall submit for approval to the Construction Manager a detailed Bypass Pumping Plan showing the layout, equipment and method of the bypass pumping system.

### 3.02 SEWER DEWATERING

Contractor shall extract, pump, and/or dispose of wastewater from bypassing and dewatering the existing sewers.

Contractor shall dewater all sagged or submerged portions of the existing sewer as required for abandonment, make connections, and as otherwise required to complete the work. Dewatering of excavations shall be conducted in accordance with the these Specifications.

The Contractor shall coordinate all work with the City. The Contractor shall comply with Section 01010 for work outage requests related to the City's existing facilities.

### 3.03 SEWER BYPASSING

Where Contractor's work on constructing project pipeline requires local sanitary sewers owned and operated by others to be removed temporarily, sewer bypassing shall be accomplished by pumping or diverting the upstream flow around the Contractor's work in accordance with owner of sewer system.

The Contractor shall provide temporary pumps, conduits, and other equipment to bypass the sewer flow. Contractor shall furnish the necessary labor and supervision to set up and operate the pumping and bypass system. Engines shall be equipped with mufflers and/or shall be enclosed to comply with all local noise ordinances. Pumps and bypass lines shall be of adequate capacity and size to handle the flows. All bypassed flow shall be discharged to the nearest downstream manhole.

Unless otherwise specified, the Contractor shall bypass flow around his work whenever the depth of flow, as measured at the inlet pipe to the upstream manhole adjacent to the Contractor's work, exceeds the crown elevation of the pipe. The Contractor shall bypass flow around his work whenever the Contractor's equipment operating in the sewer provides an obstruction that restricts flow and causes the depth of flow to exceed the crown elevation.

### 3.04 STANDBY EQUIPMENT

The Contractor shall maintain on site sufficient equipment and materials to ensure continuous and successful operation of the bypass and dewatering systems. Standby pumps shall be fueled and operational at all times. The Contractor shall maintain on site a sufficient number of valves, tees, elbows, connections, tools, sewer plugs, piping and other parts or system hardware to ensure immediate repair or modification of any part of the system as necessary. Bypassing and dewatering system(s) shall have 100 percent redundancy.

### 3.05 DAMAGES

The Contractor shall pay for all fines and repair without cost to the Owner any damage that may result from his negligence, inadequate or improper installation, maintenance and operation of bypassing and a dewatering system including mechanical or electrical failures.

### 3.06. MONITORING

Monitoring of the flow levels and pump operation shall be provided to assure continued operation of bypass pumping. Monitoring by Contractor's personnel shall take place at all times that bypass pumps are in operation (including 24-hour, around-the-clock operation). An audible alarm system shall be installed to notify workers when the pumps fail to operate. In the event the pumps fail, workers shall immediately evacuate trenches until the bypass pumping system is operational. In the event that wastewater is spilled as a result of the Contractor's operations, the Contractor shall pay any and all fines imposed on the City.

### 3.07 LATERALS AND PROPERTY OWNER NOTIFICATION

- A. Within one week of receipt of Notice to Proceed, send a letter to each property owner/resident with lateral replacement work. The letter shall inform the resident of the work to be performed and the approximate date and time that the work will occur.
- B. Provide at door hanger at each property with lateral replacement work 48 hours in advance of the work advising the resident of the date and time of the work.
- C. Knock on the doors at each property with lateral replacement work approximately 2 hours advance notice of the lateral work. The Contractor shall also notify each property resident as soon as work is completed.
- D. While laterals are disconnected for more than 2 hours, the Contractor shall continue to accommodate flows from laterals by installing temporary piping, pumps, and containers.

**\*\*END OF SECTION\*\***

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## **SECTION 02160**

### **SITE PREPARATION**

#### **PART 1 – GENERAL**

##### **1.01 THE REQUIREMENT**

- A. Contractor shall perform site preparation work, as required by this Section, during its initial activities at the Site. The Work of this Section includes the following:
  - 1. Installation of safety and protective barriers
  - 2. Construction of Contractor Site access, work areas, and storage areas
  - 3. Clearing and other initial work required for the earthwork operations
  - 4. Excavations for structures and fill areas
  - 5. Over-excavation and removal of unsuitable materials

#### **PART 2 – PRODUCTS (NOT USED)**

#### **PART 3 – EXECUTION**

##### **3.01 LOCATING EXISTING FACILITIES**

- A. Contractor shall review the Drawings and other resources for the existing facilities at the Site to determine and mark the approximate locations of underground facilities. Locations of underground facilities within the work area shall be determined by exploratory excavations prior to any excavations or construction traffic in the affected areas.
- B. Public utility agencies that are owners of underground utilities at the Site shall be contacted and coordinated by Contractor to have the utilities located and marked prior to construction activities in the affected areas. Following the marking by the utility agencies, the location of each underground utility shall be determined by exploratory excavations prior to any excavations in the affected areas.

##### **3.02 SAFETY AND PROTECTIVE BARRIERS**

- A. Contractor shall install appropriate barriers such as temporary fencing, sound barriers, berms, or concrete traffic barriers to protect workers, visitors, lift station operations, and existing facilities from damage and disturbance. Remove temporary fences when work in the vicinity is substantially complete.
- B. Protective concrete slabs or encasements shall be provided for existing underground facilities that may be damaged by Contractor's equipment and vehicles.
- C. Contractor shall prepare and submit drawings that define the proposed safety and protective barriers prior to any construction activities.

### 3.03 PRIMARY SITE ACCESS, WORK, AND STORAGE AREAS

- A. Contractor shall develop its primary access and work area within the limits of work as indicated on the Drawings, clean up areas at the conclusion of the project, and return the areas to their original condition.
- B. Storage of materials and vehicles on the street is not allowed.
- C. Staging and storage areas are to be located within City property but not with the Humbolt Avenue Right-of-Way. Staging and storage areas should be placed to minimize disruption of Spinnaker Restaurant parking.
- D. City has not secured rights of access from the property owners or residents. If the Contractor requires access from private property, the Contractor shall make arrangements for such access.

### 3.04 CLEARING

- E. All construction areas shall be cleared of grass and weeds to at least a depth of 6” and cleared of structures, pavements, fences, concrete and masonry debris, trees, logs, upturned stumps, loose boulders, and any other objectionable materials of any kind which would interfere with the performance or completion of the Work, create a hazard to safety, or impair the Work's subsequent usefulness or obstruct its operation.
- F. All material from the clearing process that is not to be incorporated into the Work shall be removed from the Site and disposed of in compliance with Laws and Regulations. Material at the Site shall not be burned as a means of disposal.
- G. Following clearing of the Site, Contractor shall allow a period of at least 3 working days for Engineer's review for presence of unsuitable materials. Where indicated or ordered, soil identified as unsuitable by Engineer shall be over-excavated and either removed from the Site or incorporated into fill as required in Section 02320. When such over-excavation is indicated, both over-excavation and subsequent backfill to the required grade shall be performed by Contractor. When such over-excavation is not indicated but is ordered by Engineer, such over-excavation and any resulting backfill will be paid for in accordance with a negotiated price.

### 3.05 DUST CONTROL

- A. The contractor shall control all dust generated as a result of the Contractor's performance of the Work, either inside or outside the right-of-way. The Contractor shall apply water or a dust palliative for the alleviation or prevention of dust nuisance. Should the Contractor elect to use a dust palliative, the palliative and method of application shall be approved by the Engineer prior to use of the palliative on the Site.

**\*\*END OF SECTION\*\***

## SECTION 02220

### CONTROLLED LOW STRENGTH MATERIAL

#### PART 1 – GENERAL

##### 1.01 SECTION INCLUDES

- A. Requirements for controlled low strength material (CLSM) as backfill and encasement material in specific locations.

##### 1.02 DEFINITION

- A. Controlled Low Strength Material (CLSM): A highly flowable, lean concrete mix consisting of a mixture of cement, fly ash, densely graded mineral aggregates, water and admixtures. Characteristics include:
  1. Capable of freely flowing to fill excavations and voids without compaction or other additional effort.
  2. Used in trenches and for backfill adjacent to structures where clearance is limited, and in other areas specifically identified on the Drawings or specified.
  3. Low permeability to prevent migration of adjacent fines into the set mix.
  4. Easily excavated after curing with minimum risk of damage to buried utility.

##### 1.03 SUBMITTALS

- A. Mix Design: Identify name and/or number of the mix design. Provide the proportions and gradations of materials proposed for CLSM.
- B. Certified test results for compressive strength.

##### 1.04 QUALITY ASSURANCE

- A. Demonstrate that the CLSM mix meets the specified requirements, including compressive strength.
- B. Enlist the services of a testing laboratory to prepare test cylinders and to transport cylinders to the laboratory for testing.
- C. Testing expenses shall be borne by the Contractor.
- D. Test Cylinders
  1. Procedure: Make 6-inch diameter by 12-inch high test cylinders in accordance with ASTM C31.

2. Required Number: Not less than 3 cylinders for each 200 cubic yards of CLSM placed, with a minimum of 3 cylinders for each location where CLSM is used.
  3. Test two cylinders at 28 days, third cylinder is spare.
- E. Field Testing: Furnish slump testing equipment and test slump in accordance with ASTM C143.
- F. Mix design based on historical mixes with the same strength requirements as those in these Specifications may be substituted in lieu of mix conformation testing.

## **PART 2 – PRODUCTS**

### **2.01 GENERAL**

- A. CLSM Mix: Consist of a mixture of cement, fly ash, aggregate, water, and admixtures that produce a controlled low strength material capable of filling all spaces between the pipe, the bedding and the trench walls.
- B. Mix shall be provided by ready-mix plant. On-site batching will not be permitted.

### **2.02 MATERIALS**

- A. Cement: Conforming to ASTM C150, Type III with total alkali content not more than 0.8%.
- B. Water: Clean, potable water.
- C. Fly Ash: Class C or Class F in conformance with ASTM C618.
- D. Aggregate Materials
1. Densely graded rock conforming to the following gradation:

Sieve Size	Percentage Passing
1"	100
No. 8	50-100
No. 200	0-5

### **2.03 DESIGN REQUIREMENTS**

- A. Water-cement Ratio: Not to exceed 3.5.
- B. Maximum Cement Content: 30 pounds per cubic yard.

- C. Use fly ash to improve flow-ability of the fresh CLSM and to regulate the strength. Do not use more than 300 pounds per cubic yard.
- D. Compressive Strength: Between 50 and 100 psi when tested at 28 days. Test in accordance with ASTM C39.

#### 2.04 CONSISTENCY AND MIXING

- A. Consistency: Similar to that of a thick liquid so that it flows readily and fills spaces and voids around pipes and structures.
- B. Slump: Between 6 inches and 8 inches when tested in accordance with ASTM C143.
- C. Uniform consistency and appearance.
- D. Mixing Method and Time: As required to produce a uniform mixture of cement, fly ash, aggregate, admixtures, and water.

#### 2.05 MEASUREMENT OF MATERIALS

- A. Use weighing equipment to determine the amount of cement, fly ash, and aggregate entering into each batch. Where batches are proportioned to contain an integral number of conventional sacks of cement, and the cement is delivered at the mixer in the original unbroken sacks, the weight of the cement contained in each sack may be taken without weighing as 94 lbs.
- B. Use a suitable water meter or other acceptable method of measuring the quantity of water entering the mixer.

### **PART 3 – EXECUTION**

#### 3.01 PLACEMENT

- A. Thoroughly settle and consolidate CLSM as the material is placed in excavations. Fill the entire depth of the layer that is being consolidated, into a dense, homogeneous mass, filling all spaces and voids and bringing only a slight excess of water to the exposed surface. Place and consolidate CLSM by means that will not cause segregation of the mix.
- B. Do not place CLSM under the following conditions:
  - 1. When the air temperature is below 40 degrees Fahrenheit.
  - 2. When the excavation contains water or when the bottom or walls of the excavation are frozen or contain frozen material.

- C. Prevent flotation of pipes by placing CLSM in two or more lifts, with each lift reaching an initial set before the succeeding lift is placed. Contractor shall be responsible for prevention and, if necessary, correction of flotation and displacement of the pipeline due to the use of CLSM.
- D. Encase repair coupling in CLSM to inhibit further root intrusion.

### 3.02 PROTECTION OF CLSM

- A. Protect CLSM from equipment, traffic and backfilling operations until the surface has achieved an initial set and has hardened enough to develop a minimum penetration number of 650 when tested in accordance with ASTM C403.
- B. If the trench backfill is not to be placed over the CLSM within eight hours after CLSM placement, place a 6 inch layer of moist backfill over the CLSM.

**\*\*END OF SECTION\*\***

## SECTION 02300

### EARTHWORK

#### PART 1 – GENERAL

##### 1.01 SCOPE

This Section includes requirements for site excavation, engineered fill construction, and finish grading. Requirements are also specified for structure and trench excavation and backfill.

##### 1.02 GEOTECHNICAL REPORT

A soil investigation report has been prepared by DCM/GeoEngineers Engineering, dated September 2009. This report was obtained only for the Owner's use in design and is not part of the Contract Documents. A copy of the report may be obtained from the City of Sausalito or West Yost Associates. The information presented in this report is not a warrant of subsurface conditions.

##### 1.03 QUALITY ASSURANCE

###### A. Reference Specifications, Codes, and Standards

This Section references the following documents. They are a part of this Section insofar as specified and modified herein. In case of conflict between the requirements of this Section and the listed documents, the requirements of this Section shall prevail.

Reference	Title
County or Marin County	County of Marin Uniform Construction Standards, Adopted 2008 and the latest amendments approved prior to the date of Approval of the Contract Documents
Caltrans	Standard Specifications, State of California Business, Transportation and Housing Agency, Department of Transportation, 2006
ASTM C 33	Standard Specification for Concrete Aggregates
ASTM C117	Material Finer Than 75-Micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C136	Sieve Analysis of Fine and Coarse Aggregates
ASTM D1556	Density of Soil in Place by the Sand-Cone Method
ASTM D1557	Moisture Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb. (4.54-kg) Rammer and 18-in. (457-mm) Drop
ASTM D2487	Classification of Soils for Engineering Purposes
ASTM D2922	Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D3017	Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

State Standard Specifications: Whenever this specification is referenced, the following is understood.

1. All references to statistical testing are deleted.
2. All references to measurement and payment are deleted.

B. Testing

The Engineer will take samples and perform moisture content, gradation, compaction, and density tests during placement of backfill materials to check compliance with these Specifications. The Contractor shall remove surface material at locations designated by the Engineer and provide such assistance as necessary for sampling and testing. The Engineer may direct the Contractor to construct inspection trenches in compacted or consolidated backfill to determine that the Contractor has complied with these Specifications. Tests will be made by the City in accordance with the following:

Test	Standard Procedure
Moisture content	ASTM D3017
Density in-place	ASTM D1556 or ASTM D2922
Moisture-density relationships	ASTM D1557

C. Submittals

Submittals shall be made in accordance with Section 01300 Submittals, and shall include test results, certifications, and source for all earthwork materials.

1.04 DEFINITIONS

A. Backfill

Material used in refilling a cut or other excavation (not including bedding material, or structure backfill).

B. Structure Backfill

Material used to refill space between cut or excavation and foundation/below grade walls.

C. Compaction

The process of mechanically stabilizing a material by increasing its density at a controlled moisture condition. “Degree of Compaction” is expressed as a percentage of the maximum density obtained by the test procedure described in ASTM D1557.



D. Excavation

The removal of soil to obtain a specified depth or elevation.

E. Fill

Specified material placed at a specified degree of compaction to obtain an indicated grade or elevation.

F. Lift

Layer (or course) of soil placed on top of a previously prepared or placed soil in a fill or embankment.

G. Rock

Rock is defined as any material which cannot be excavated with a crawler D-9 Caterpillar Dozer with ripper teeth, and requires the use of rock teeth, jack-hammering, blasting and/or other special methods of excavation.

H. Subgrade

The bottom layer of material (sometimes in-situ soil or rock) graded or otherwise prepared for supporting the addition of base material, fill material, or structural foundations.

I. Unsatisfactory Material

Existing, in-place soil or other material which can be identified as having insufficient strength characteristics or stability to carry intended loads in fill or embankment without excessive consolidation or loss of stability. As a minimum, materials classified as PT, OH, or OL by ASTM D2487 are unsatisfactory.

J. Optimum Moisture Content

Optimum moisture content shall be determined in accordance with ASTM D1557.

## **PART 2 – PRODUCTS**

### **2.01 MATERIALS**

A. Fill, backfill, and embankment materials: Selected or processed clean earth, rock, or sand, free from grass, roots, brush, other vegetation, corrosive and hazardous materials, manmade objects, and debris.

B. Suitable Materials

1. Selected and obtained from on-site excavations and designated borrow areas.
2. Processed on-site materials.

3. Imported from offsite borrow areas and processing plants.
  - a. If imported materials are required by this Section, or to meet the quantity requirements of the Project, provide the imported materials at no additional expense to Owner, unless a unit price item is included for imported materials in the Bidding Schedule.

C. The following types of suitable materials are defined:

1. Drainage Rock: Clean gravel or crushed rock of one-inch (1”) maximum size, with no material passing a No. 4 sieve.
2. Rock Rip Rap: Rocks shall be angular, rounded boulders will not be accepted. Rock slope protection shall conform to the following weight requirements:

Weight (pounds)	Percentage Larger Than
200	0-5
75	50-100
25	90-100

And meet the following quality requirements:

Test	California Method	Requirement
Apparent Specific Gravity	206	2.5 min.
Absorption	206	4.2% max.
Durability Index	229	52 min.

3. Foundation Material: Clean, durable, natural crushed (i.e., angular) aggregate graded within the following requirements:

Sieve Size	Percentage Passing
2-inch	100
1-1/2-inch	90-100
¾ inch	5-30
3/8 inch	0-5
No. 200	0-2

4. Aggregate Base: Caltrans Class 2, ¾ inch maximum. Course crushed rock aggregate base material of such nature that it can be compacted readily by watering and rolling to form a firm, stable base. Sand equivalent per California Method 217 of no less than 22. Resistance or R-value per California Method 301 of no less than 78. The aggregate base course material shall meet the following gradation requirements:

Sieve Size	Percentage Passing
1-inch	100
¾ inch	90-100
No. 4	35-60
No. 30	10-30
No. 200	2-9

5. Light Weight Aggregate: Processed, naturally occurring volcanic cinder or and expanded shale/clay/slate (ESCS) material produced by the rotary kiln process. No by-product slags, cinders, or by-products of coal combustion shall be used. Lightweight aggregate shall be durable, non-corrosive and meet the following gradation requirements:

Sieve Size	Percentage Passing
1-1/2-inch	100
1 inch	95-100
¾-inch	90-100
3/8 inch	15-85
No. 200	0-9

Light weight aggregate shall have durability index per California Method 229B of no less than 35. Resistance or R-value per California Method 301 of no less than 50. Light weight aggregate shall have a maximum calculated saturated surface dry unit weight of 60 pounds per cubic foot.

6. Grease Interceptor Backfill: Backfill must meet ASTM C-33 for quality and soundness. Use either approved pea gravel or crushed stone no more than 5% of either material may pass through the No. 8 sieve. Pea gravel shall be clean naturally rounded aggregate whose size shall not be less than 1/8” but not more than 3/4”. Crushed stone shall be washed with angular particle size that is not less than 1/8” but not more than 1/2”. Dry density must be a minimum of 95 pounds per cubic foot.
7. Sand Backfill: Sand with 90% to 100% passing a No. 4 sieve, and not more than 5% passing a No. 200 sieve.

8. Geotextile: See Section 02330.
9. Gravel Surfacing: Crushed rock aggregate base material of such nature that is can be compacted readily by watering and rolling to form a firm, stable base for vehicle traffic. The material shall meet the following gradation requirements:

Sieve Size	Percentage Passing
1-inch	100
¾ inch	90-100
½ inch	30-60
3/8 inch	0-20
No. 4	0-2
No. 30	-

10. Embankment Fill:
- Granular, low to non-expansive soil
  - Plasticity index 15-40
  - Liquid limit 35-60
  - Meeting the following gradation requirements:

Sieve Size	Percentage Passing
3-inch	100
No. 200	more than 50

11. Engineered Fill / Structure Backfill: Engineered and structure fill material shall be ¾-inch maximum Class 2 aggregate base conforming to Section 26-1 of the State Standard Specifications.
12. Crushed Rock: Crushed rock shall conform to the following gradation:

Sieve Size	Percent Passing by Weight
1"	100
¾"	90-100
½"	20-50
No. 4	0-5

Crushed rock material shall be composed of hard, durable, sound pieces having a specific gravity of not less than 2.60.

13. Pipe Bedding Material
  - a. Pipe bedding material shall be either crushed rock or sand, as indicated on the Drawings. However, pipe bedding for PVC pipe shall be sand only.
  - b. Sand bedding material shall be sand or silty sand of which 100% will pass ¾-inch sieve and which shall have a minimum sand equivalent of 30, as determined by Test Method No. Calif. 217.
14. Trench Backfill: Trench backfill shall be the material between the pipe bedding material and the top of the trench or subgrade. The material for trench backfill may be of job excavated, native material provided that such material is free of organic materials or other unsuitable materials as determined by the Engineer that may cause voids or depressions to develop during or after placement of the backfill. Rocks, stones, and solid earth chunks exceeding 3” in greatest dimension shall be removed from the trench backfill material. If native material is found to be not acceptable the trench backfill shall be the same material as engineered fill.
15. Planting Soil: Planting soil shall consist of fertile, friable soil of loamy character, and shall contain an amount of organic matter normal to the region. It shall be obtained from well-drained arable land and shall be reasonably free from subsoil, refuse, roots, heavy or sticky clay, stones larger than one inch in size, coarse sand, noxious seeds, sticks, brush, litter, and other deleterious substances. Planting soil shall be capable of sustaining healthy plant life.

## 2.02 UNSUITABLE MATERIALS

A. Unsuitable materials include the materials listed below:

1. San Francisco Bay Mud Soils
2. Soils which, when classified under ASTM D 2487, fall in the classifications of Pt, OH, CH, MH, or OL, or in a classification that contains Pt, OH, CH, MH, or OL in combination with any other letter designation, such as CH/CL.
3. Soils which cannot be compacted sufficiently to achieve the density specified for the intended use, or are unstable or pump regardless of the degree of compaction.
4. Materials that contain hazardous or designated waste materials including petroleum hydrocarbons, pesticides, heavy metals, and any material which may be classified as hazardous or toxic according to applicable regulations.
5. Soils that contain greater concentrations of chloride or sulfate ions, or have a soil resistivity or pH less than the average values for existing on-site soils.
6. Topsoil, sludge and sludge-entrained soils.
7. Rocks, stones, and boulders larger than allowed for use as suitable fill and backfill materials.

## **PART 3 – EXECUTION**

### **3.01 GENERAL**

#### **A. Control of Water**

The Contractor shall keep excavations free from water during construction. The static water level shall be drawn down a minimum of 2 feet below the bottom of excavations to maintain the undisturbed state of natural soils and allow the placement of any fill to the specified density. Disposal of water shall not damage property or create a public nuisance. Disposal of water to the City's sanitary sewer system will not be allowed.

Additional requirements for dewatering are specified in Section 02140 Control of Groundwater.

#### **B. Overexcavation**

Overexcavation shall be per the recommendations in the Geotechnical Report.

#### **C. Shoring and Sheeting**

Shore and sheet excavations in accordance with Section 02080 Sheeting, Shoring and Bracing.

#### **D. Surplus Material**

1. Unless otherwise specified, surplus excavated material shall be disposed of at the Contractor's expense.
2. The Contractor shall verify that there is sufficient material available for the completion of the Work before disposing of any material inside or outside the Site. Shortage of material, caused by premature disposal of any material by the Contractor, shall be replaced by the Contractor at his/her expense.
3. The Contractor shall protect all excavated material that is to be used as native backfill from exposure to weather. Any material that is damaged due to exposure to weather shall be replaced with engineered fill at the Contractor's expense.
4. Material shall not be stockpiled to a depth greater than 5 feet above finished grade within 25 feet of any excavation or structure.
5. The Contractor shall maintain stability of the soil adjacent to any excavation.

#### **E. Hauling**

When hauling is done over highways or city streets, the loads shall be trimmed and the vehicle shelf areas shall be cleaned after each loading. The loads shall be watered after trimming and covered to eliminate dust.

F. Maintenance of Roadways

All earthwork operations shall be performed in a manner which does not disrupt the continuous flow of traffic on existing roadways. All streets shall be swept clean daily where dirt and debris result from Contractor's operations.

G. Finish Grading

Finish grades and existing or natural grades in the area of Work are indicated on the Contract Drawings. The Contractor shall do all grading, filling or excavating as required to completely grade the Site to lines and grades shown, and to provide for the indicated drainage. Where finished grade corresponds practically with existing grade, the ground shall be worked up and graded off evenly with existing grade. Filled areas shall be compacted so as to prevent settlements or wash and the Contractor shall be responsible for a period of one year after final acceptance of the project to provide additional fill as necessary to bring to grade any areas which settle below the indicated grades and to replace or repair any planting or work damaged by such settlement.

The Contractor shall provide slight drainage away from the building walls in all directions. All grades, fills, or slopes shall be trimmed to even natural lines, suitable for planting or landscaping.

H. Tolerances

Finished grade shall be to the line and grade shown on the Contract Drawings to within a tolerance of plus or minus 0.05 feet. Allowance for topsoil and grass cover, and subbase and pavement thickness shall be made so that the specified thickness can be applied to attain the finished grade.

I. Control of Erosion

The Contractor shall maintain earthwork surfaces true and smooth and protected from erosion. Where erosion occurs, the Contractor shall provide fill or shall excavate as necessary to return earthwork surfaces to the grade and finish specified.

### 3.02 EXCAVATION

A. General

Excavation shall be to the elevations and dimensions indicated. Excavations shall be kept free from water while construction is in progress. The Engineer shall be notified immediately in writing in the event that it becomes necessary to remove hard, soft, weak, or wet material to a depth greater than indicated. Soil disturbed or weakened by the Contractor's operations and soils permitted to soften from exposure to weather shall be excavated to firm foundation and refilled with engineered fill material compacted to 95% of ASTM D1557, maximum density. All work of this nature will be at the Contractor's expense.

## B Trench Excavation

Trench excavation shall conform to County Detail 330 as supplemented these Contract Documents. Trench sides shall be constructed as nearly vertical as practicable. Sides of trenches shall not be sloped between the bottom of the trench and the elevation of the top of the pipe. Bottom of trenches shall be graded accurately to provide uniform bearing and support for each section of pipe or conduits on undisturbed soil, or bedding material as indicated or specified at every point along its entire length except for portions where it is necessary to excavate for bell holes and for making proper joints. Bell holes and depressions for joints shall be dug after trench has been graded. Dimension of bell holes shall be as required for properly making the particular type of joint to ensure that the bell does not bear on the bottom of the excavation. Trench dimensions shall be as indicated.

## C. Structural Excavation

### 1. General

The bottom excavation elevation shall be sufficient to allow the proper placing of forms and concrete construction to the elevations indicated, as specified herein. Slopes shall vary no more than 0.5 feet from specified grade. Prior to placing structure foundation materials, the subgrade shall be scarified and recompactd in accordance with Subsection 3.05 Compaction.

Unless otherwise specified, excavations shall extend a sufficient distance from walls and footings to allow for placing and removal of forms, installation of services, and for inspection, except where concrete is specified to be placed directly against excavated surfaces.

### 2. Foundation Inspection

Whenever any structure excavation is substantially completed to grade, the Contractor shall notify the Engineer who will make an inspection of the foundation for uniformity and suitability as a structure foundation. No concrete or masonry shall be placed until the foundation has been inspected by the Engineer. The Contractor shall, if directed by the Engineer, dig test pits and make test borings and foundation bearing tests. If the material tested complies with the Specifications, the cost thereof will be paid for as extra work. If the material tested does not comply with the Specifications, the cost thereof (initial testing, remedial work, re-testing) will be borne by the Contractor.

## 3.03 SUBGRADE PREPARATION

Ground surfaces receiving engineered fill shall be prepared by clearing and grubbing as specified in Section 02160 Site Preparation, and by removing soil which is high in organic content and other deleterious material. Subgrade shall then be scarified to a depth of 12", moisture conditioned and recompactd as specified for fill.



### 3.04 FILLING OPERATIONS

#### A. General

The Contractor shall be responsible for the maintenance and protection of all embankments and fills made during the contract period and shall bear the expense of replacing any portion which has been displaced due to carelessness, negligent work, erosion or failure to take proper precautions.

All fill work shall be engineered fill. If the existing slope in an area to be filled is greater than 5:1, the Contractor shall bench the area prior to filling to allow each two lifts to be keyed 1 foot into the existing slope. Site fill shall be placed in 8" lifts and compacted as specified herein.

#### B. Construction of Engineered Fill

All engineered fill material shall be placed in layers of 8" or less in loose thickness, uniformly moisture conditioned to 3% to 5% above optimum moisture content and compacted to 95% relative compaction as determined by ASTM D1557.

No fill shall be placed during weather conditions which will alter the moisture content of the fill materials sufficiently to make adequate compaction impossible. After placing operations have been stopped because of adverse weather conditions, no additional fill material shall be placed until the last layer compacted has been checked and found to be compacted to the specified densities.

#### C. Structure Backfill and Foundation Materials

##### 1. Structure Backfill

Unless otherwise specified, structure backfill shall be constructed as specified in Subsection 3.04 Paragraph B of this specification section.

After completion of construction below the elevation of the final grade, and prior to backfilling, forms shall be removed and the excavation shall be cleaned of debris.

Structure backfill shall not be placed until the subgrade portions of the structure have been inspected by the Engineer. No backfill material shall be deposited against concrete structures until the concrete has developed a strength of not less than 2,500 psi in compression, or until the concrete has been in place for 28 days, whichever occurs first. Backfill material shall be placed in uniform layers (6" thick) and shall be brought up uniformly on all sides of the structure.

##### 2. Structure Foundation Materials

Materials immediately below structures shall be crushed rock. Materials shall be placed in 6" lifts and compacted as specified herein.

#### D. Pipe Bedding and Trench Backfill

##### 1. General

Pipe bedding and trench backfill shall conform to these Contract Documents.

##### 2. Bedding

Bedding shall be placed in 6" maximum loose lifts. Provide uniform and continuous support for each section of utility except at bell holes or depressions necessary for making proper joints. Bring up evenly on each side and along the full length of the pipe. Ensure that no damage is done to piping or their protective coatings. Compact each loose lift as specified below before placing the next lift. Do not place bedding in freezing weather or where the material in the trench is already frozen or is muddy, except as authorized.

##### 3. Backfilling

Backfill shall be placed in 6" maximum loose lifts. Do not backfill in freezing weather or where the material in the trench is already frozen or is muddy, except as authorized. Where settlements greater than the tolerance allowed herein for grading occur in trenches and pits due to improper compaction, excavate to the depth necessary to rectify the problem, then backfill and compact the excavation as specified herein and restore the surface to the required elevation. Coordinate backfilling with testing of utilities. Provide buried locator tracer tape installed between the bedding and initial backfill as per Specification 025010.

### 3.05 COMPACTION

#### A. General

Compact each layer or lift of material specified so that the in-place density tested is not less than the percentage of maximum density identified herein. Compaction shall be accomplished by mechanical equipment such as tamping rollers, sheepsfoot rollers, pneumatic tire rollers, vibrating rollers, or other mechanized tampers suitable for the Work. Compaction of materials behind earth retaining structures shall be accomplished solely by means of mechanical plate compactors. Compaction of materials by ponding and jetting is prohibited. Compaction equipment and procedures are subject to approval by the Engineer.

#### B. Structure Subgrade

Native subgrade under structures shall have a density of 90% of ASTM D1557, Method D, maximum density to a depth of 12"; if the existing subgrade natural density is less than 95% of ASTM D1557, Method D, maximum density, it shall be compacted to that value at the Contractor's expense.

C. Structure Foundation Materials and Backfill

Structure foundation material and backfill materials shall be compacted to 95% of ASTM D1557, Method D, maximum density.

D. Compaction of Pipe Bedding

Compact to 85% of ASTM D1557 maximum density.

E. Compaction of Trench Backfill

Compact backfill material to 90% of ASTM D1557 maximum density, except that the upper 18" of trench backfill shall be 95% of maximum density.

F. Compaction of Paving Subgrade

Compact subgrade to 95% of ASTM D1557 maximum density.

3.06 CLEAN UP

After completing all earthwork, the Contractor shall leave the Site in a neat and clean condition, doing all such grading as is required by the Contract Drawings. Any existing features, structures, and other facilities damaged or affected by the Work shall be replaced, repaired, or restored to their original condition or better.

3.07 DUST CONTROL

A. The contractor shall control all dust generated as a result of the Contractor's performance of the Work, either inside or outside the right-of-way. The Contractor shall apply water or a dust palliative for the alleviation or prevention of dust nuisance. Should the Contractor elect to use a dust palliative, the palliative and method of application shall be approved by the Engineer prior to use of the palliative on the Site.

**\*\*END OF SECTION\*\***

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## SECTION 02310

### TRENCH EXCAVATION

#### PART 1 – GENERAL

##### 1.01 GENERAL

In general, a trench is defined as an excavation in which the depth is greater than the width of the bottom of the excavation. Additionally, a trench shall include excavation for appurtenant structures including but not limited to, manholes, transition structures, junction structures, vaults, valve boxes, catch basins, thrust blocks, and boring pits. The Contractor's attention is directed to the rules, orders, and regulations of the California Division of Occupational Safety and Health (CAL/OSHA) for a more specific definition.

- A. The requirements specified in this Section apply to all trench excavations. Nothing in these Specifications shall relieve the Contractor from conforming to the requirements of CAL/OSHA. If there is a conflict between the two aforementioned standards, the more stringent requirement shall apply.
- B. Trench excavation shall include the removal of all water and materials of any nature which interfere with the construction work.
- C. The method for installation of pipe or conduit (open trench, tunnel, or bore and jack) shall be shown on the Plans.
- D. Where pipe is to be installed in new embankment, the embankment shall be first constructed to the following dimensions and compacted prior to any excavation for placement of pipe:
  - 1. A height of 12 inches above the top of pipe.
  - 2. A width of not less than 5 times the diameter of the pipe on each side of the pipe, after which the trench shall be excavated.
- E. Excavated material from trenches located within paved areas shall be immediately loaded into trucks and hauled off and disposed of outside the public right of way. No excavated material shall be placed or stored within the public right of way unless otherwise allowed by the Engineer.

##### 1.02 EXISTING UNDERGROUND UTILITIES

- A. The Contractor shall contact Underground Services Alert (U.S.A.), at least 48 hours in advance of any excavation.
  - 1. The Contractor shall not commence excavation in a location prior to U.S.A. members marking the location of their utilities or indicating that none exist within the excavation limits outlined by the Contractor.

2. The Contractor shall notify the Inspector of any conflict discovered as a result of the U.S.A marking prior to commencing excavation at that location.
- B. It is the Contractor's responsibility to verify the location and elevation of all existing utilities within the limits of excavation.
  - C. All existing pipes within the trench zone and any other facilities adjacent to the trench shall be carefully supported and protected from damage as a result of the Contractor's operations.

1.03 EXCAVATION METHOD

Methods used in excavation shall be such as not to cause damage to surrounding property or to unnecessarily damage pavement. Street pads for backhoe outriggers and other equipment shall be utilized to prevent unnecessary damage.

1.04 MINIMUM AND MAXIMUM TRENCH WIDTH

All trench widths shall be in compliance with the Drawings. In the event that unsuitable materials or unstable trench walls are encountered, the trench width shall be modified in accordance with the applicable ASTM standard.

- A. The pipe or conduit shall be positioned in the center of the trench.
- B. The trench width for utility company owned facilities shall conform to the utility company standards.
- C. The minimum trench width for City owned facilities shall conform to the requirements of Table 1.

**Table 1**

Pipe Material	Pipe Size (Nominal Diameter)	Minimum Trench Width
All Pipes	6-Inches and less	O.D. <sup>(a)</sup> + 12-inches
Ductile Iron Pipe	Greater than 6-inches	O.D. + 24-inches
Polyvinyl Chloride and High Density Polyethylene Pipes	Greater than 6-inches	O.D. + 16-inches <sup>(c)</sup>
Reinforced Concrete and Vitrified Clay Pipes	Greater than 6-inches	O.D. + 16-inches

<sup>(a)</sup> O.D. – Outside Diameter

<sup>(b)</sup> Where trench walls can not sustain a vertical cut, trench width shall be three times O.D.

- D. If the maximum trench width specified on the Plans is exceeded, the Contractor shall be required to provide a higher strength bedding class or a higher strength pipe as approved by the Engineer.
- E. The minimum trench width for installation of water service, signal conduit of two inches in diameter or less, shall be in accordance with the manufacturer's recommendation for the conduit.

#### 1.05 FOUNDATION

- A. All loose material shall be removed from the new trench bottom before placing the bedding material.
- B. Special Foundation Treatment
  - 1. Whenever the bottom of the trench is soft or rocky, or, otherwise unsuitable as a foundation for the pipe in the opinion of the Engineer, the unsuitable material shall be removed as directed by the Engineer to provide a stable and satisfactory foundation.

#### 1.06 MAXIMUM LENGTH OF OPEN TRENCH

- A. The maximum length of open trench where prefabricated pipe is to be laid shall be the distance necessary to accommodate that amount of pipe which can be installed and backfilled in that same day, but in no case shall exceed 400 feet.
- B. At the end of each working day, there shall be no open trench in paved or improved areas. Open end of pipe shall be temporarily plugged and trenches shall be fully backfilled and have temporary pavement or cold-only asphalt concrete (cutback) installed to math adjacent grade. Temporary pavement shall be a minimum of 2-inches thick. Improved areas are defined as any areas within 300 feet of any existing housing or commercial structure or paved area whether paved with asphalt concrete or Portland cement concrete.
- C. A maximum of 25 feet of trench may be left open in unimproved areas if barricaded.

#### 1.07 TRENCH PLATES

Trench plates shall be used for temporary cover of trenches and other excavations, unless otherwise specified.

- A. When the backfilling of trenches and excavations can not be completed in the same day within areas with no vehicle traffic, a temporary fence or barrier may be used, along with ¾" plywood. For excavation within a paved street section or within the concrete curb and gutter and sidewalk area where vehicle traffic may be present, trench plates shall be required and the following conditions shall apply:

1. The plates shall be of steel construction capable of supporting H2O loading.
2. The plates shall have a skid resistant surface.
3. The plates must extend beyond the edge of the trench wall to adequately support the traffic loads on it. In no case shall the plates extend less than twelve (12) inches beyond the trench wall.
4. Each plate must be fully supported around the perimeter to prevent wobbling or rocking.
5. The plates shall be secured to prevent any movement.
6. Trenches and excavations shall be adequately shored and braced to withstand highway traffic loads.
7. Temporary paving or cold-mix asphalt concrete (cutback) shall be placed and continuously maintained around all outside edges of the trench plates until removal of the plates.

**PART 2 – PRODUCTS (NOT USED)**

**PART 3 – EXECUTION (NOT USED)**

**\*\*END OF SECTION\*\***



## SECTION 02320

### TRENCH FOUNDATION, BEDDING AND BACKFILL

#### PART 1 – GENERAL

##### 1.01 GENERAL

- A. The foundation, bedding and backfill for all trenches shall conform with the requirements of these Specifications and the Drawings. These requirements also apply to non City-owned Utilities located within the City right-of-way. The Plans may require more stringent requirements than specified in these Specifications.
- B. The trench foundation shall be defined as the material below the bottom elevation of the bedding.
- C. Bedding shall be defined as that material supporting the pipe from the trench foundation surrounding, and extending to one foot above the top of pipe.
- D. Backfill for all pipe materials shall be defined as that layer of material extending from above the bedding material to the elevation of the subgrade within the proposed or existing paved area. The backfill shall extend to the finish grade and conform to the adjacent grade where the trench is located within an unpaved area.
- E. No jetting will be allowed for trench bedding or backfill.
- F. All existing pipes within the trench zone and any other facilities adjacent to the trench shall be supported and protected from damage as a result of the Contractor's operations.

##### 1.02 SPECIAL FOUNDATION TREATMENT

- A. Special foundation treatment shall be required whenever the bottom of the trench has been over excavated as required in Section 02310 Trench Excavation.
- B. The over excavated portion of trench shall be backfilled with drain rock in accordance with these Specifications.
- C. Geotextile filter fabric shall be placed between the crushed rock and bedding material as specified on the Drawings.
- D. An additional layer of geotextile fabric may be required to stabilize the trench bottom. The specification for this fabric shall be as approved by the Engineer.

### 1.03 BEDDING

- A. Particular attention must be given to the placement of the bedding material to ensure that firm support to the pipe is obtained to prevent any change in alignment of the pipe.
- B. The bedding shall be shaped to accommodate the pipe bell and other related appurtenances to allow the bottom of the pipe to be supported uniformly by the bedding. The bedding material shall be sliced into the haunch of the pipe with a shovel or other hand tool to fill the voids in this area. The remainder of bedding shall be carefully placed and consolidated to the proper depth in eight (8) inch maximum lifts.
- C. Bedding Material
  - 1. Bedding materials for non City-owned utilities shall conform to the Utility Company specifications except that at a minimum, the material shall conform to the minimum requirements for Bedding Material as specified in these City Standard Specifications whenever the trench is located within the limits of an existing paved area.

### 1.04 BACKFILL

- A. The Contractor shall not place any backfill material until the Engineer has inspected and accepted the placement of the bedding.
- B. Backfill shall conform to the Drawings.
- C. Native material and Class II Aggregate Base Rock backfill shall be placed in uniform layers. The thickness of each layer of backfill shall not exceed eight (8) inches before compaction. Compaction equipment or methods which may cause displacement or damage to the pipe shall not be used.
- D. Existing Paved Areas

Trenches located within the existing paved areas shall be backfilled with Class II Aggregate Base Rock (Aggregate Base) conforming to these Specifications. The Aggregate Base backfill shall be compacted to the requirements indicated on the Drawings. The Aggregate Base shall be placed to the elevation to allow for placement of asphalt concrete in accordance with the Drawings. Temporary paving shall be installed and maintained until final pavement is completed. Asphalt concrete shall conform to these Specifications and placed in accordance with the Drawings.

- E. New Paved Areas

Trenches located within new paved areas (areas required to be paved with the Project Plans) may be backfilled with native material providing that the native

material is free of rock(s), rubbish, debris and other objectionable material. The maximum size of any component of the native material shall not exceed 2-1/2 inches in size. The backfill shall be compacted to the requirements indicated on the Drawings. When the required compaction can not be achieved with the native material, select import material shall be required. The backfill shall be placed up to the new pavement subgrade elevation shown on the Plans.

F. Unpaved Areas

Trenches located within unpaved areas may be backfilled with native material providing that the native material is free of rock(s), rubbish, debris and other objectionable material. The maximum size of any component of the native material shall not exceed 2-1/2 inches in size. The backfill shall be compacted to the requirements indicated on the Drawings. When the required compaction can not be achieved with the native material, select import material shall be required. The backfill shall be placed to final grade to conform to the elevation of the adjoining surface elevation.

1.05 TUNNELING, BORING, AND JACKING

- A. Tunneling, boring, and jacking shall only be permitted when approved by the Director of Public Works.
- B. Any pipe or facility that is placed underground in any method other than open cut trenching shall be considered as tunneling or boring and jacking.
- C. All existing utilities shall be potholed for actual depth prior to tunneling or boring and jacking.
- D. All voids between the inside of the casing and the pipe shall be completely backfilled by blowing sand or pumping grout between the casing and the pipe.

1.06 UTILITY COMPANY CONDUIT INSTALLATION

Installation of Utility Company conduit shall be done by either open cut trenching (when the trench width is greater than six inches), open cut trenching (when the trench width is six inches or less) or by bore and jack. The method of installation shall be subject to the approval of the Engineer.

**PART 2 – PRODUCTS (NOT USED)**

**PART 3 – EXECUTION (NOT USED)**

**\*\*END OF SECTION\*\***

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## SECTION 02330

### GEOTEXTILE FABRICS

#### PART 1 – GENERAL

##### 1.01 GENERAL

- A. Geotextile fabrics consisting of Subgrade Separation Fabric, Subgrade Stabilization Fabric, and Trench Filter Fabric, shall conform to this Section.
- B. Geotextile fabric shall be placed as required by the Plans and various sections of the Specifications, which includes the Drawings.
- C. A Certificate of Compliance for each kind of fabric used on the Project shall be furnished to the Engineer in conformance with the provisions in Section 6-1.07, “Certificates of Compliance” of the Caltrans Standard Specifications.
- D. Geotextile fabric shall be furnished in protective covers capable of protecting the fabric from ultraviolet rays, abrasion, and water.
- E. Atmospheric exposure of geotextile fabric (with the exception of Pavement Fabric) to the elements following lay down of the material shall be a maximum of 14 days. Pavement Fabric shall be covered with asphalt concrete the same day the fabric is laid down. Fabric not in compliance with these requirements shall be removed from the Work and disposed of at the Contractor’s expense.
- F. The Contractor shall immediately repair damaged fabric, as identified by the Engineer. The Contractor shall clear the damaged area plus an additional three (3) feet of all fill material. Cover the damaged area with a new fabric patch extending three (3) feet beyond the perimeter of the damage.

##### 1.02 SUBMITTALS

- A. Geotextile Fabric
- B. Samples: Provide 12 inch by 12 inch sample of each type of geotextile.

##### 1.03 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, unload, and store geotextile fabric in manufacturer's wrapping with a minimum amount of handling.
- B. Protect geotextile rolls from excessive dust, rainfall, mud, ultraviolet exposure, and debris.
- C. Follow manufacturer's recommendations regarding storage.

## **PART 2 – PRODUCTS**

### **2.01 MANUFACTURERS**

- A. One of the following or equal:
  - 1. Propex
  - 2. Mirafi

2.02 Subgrade Separation Fabric shall be furnished and installed over the entire limits of subgrade for all roadways, curbs, curb and gutters and driveways as shown on the Drawings. The requirement to install fabric does not supersede the Contractor's obligation to conform to Section 19-2.02, "Unsuitable Material" of Caltrans Standard Specifications.

- A. Subgrade Separation Fabric shall be, at the option of the Contractor, either woven or nonwoven type material, unless the Plans specify the type, and shall meet or exceed the specifications presented in Table 1.

**Table 1. Subgrade Separation Fabric**

Property	ASTM Test Method	Woven Minimum Average Roll Value <sup>(a)</sup> English/Metric	Nonwoven Minimum Average Roll Value <sup>(a)</sup> English/Metric
Grab Tensile Strength	D 4632	247 lbs/1100N <sup>(b)</sup>	157 lbs/700N
Trapezoidal Tear Strength	D 4533	90 lbs/400N	56lbs/250N
Puncture Strength	D 4833	90 lbs/400N	56lbs/250N
Permittivity	D 4491	0.05 sec <sup>-1</sup>	1.2 sec <sup>-1</sup>
Apparent Opening Size (AOS)	D 4751	Maximum #40 sieve/ 0.425mm	Maximum #70 sieve/ 0.212 mm
UV after 500 hours	D 4355	70%	70%

<sup>(a)</sup> All values in this table are the minimum values allowed in each direction except as noted, and are based on Minimum Average Roll Value (MARV).

<sup>(b)</sup> The abbreviation shown as “N” for the metric unit designates Newtons.

2.03 Stabilization Fabric shall be furnished and installed over the entire limits of subgrade for paved locations where the Engineer determines that the subgrade is unstable for placement of aggregate base rock, or where indicated on the Plans.

A. Stabilization Fabric shall be woven fabric subject to the following conditions as specified herein.

1. Street and Paved Roads and Other Paved Locations - At locations where the Inspector determines the subgrade is unstable for placement of aggregate base rock and requires additional support, the Engineer may require the Contractor to install a woven Subgrade Stabilization Fabric in lieu of a Subgrade Separation Fabric, or install a Geogrid in combination with Subgrade Separation or Stabilization Fabric. The Geotechnical Engineering firm testing the materials on the Project will make a recommendation for the specification of the woven Stabilization Fabric and/or Geogrid. The Contractor shall furnish and install the Geogrid and/or Geotextile fabric as recommended by the Geotechnical Engineer and approved by the Engineer. The Geotextile fabric shall meet or exceed the specifications presented in Table 2. These requirements do not supersede the Contractor’s obligation to conform to Section 19-2.02, “Unsuitable Material” of Caltrans Standard Specifications.

**Table 2. Stabilization Fabric**

Property	ASTM Test Method	Woven Minimum <sup>(a)</sup> Average Roll Value (English)/(Metric)
Wide Width Tensile Strength	D 4595	2400 lbs/ft 35 kN/meter <sup>(b)</sup>
Grab Tensile Strength	D 4632	315 lbs/ft 1.4 kN/meter
Trapezoidal Tear Strength	D 4533	125 lbs/0.556kN
Puncture Strength	D 4833	140 lbs/0.622kN
Permittivity	D 4491	0.50 sec <sup>-1</sup>
Apparent Opening Size (AOS)	D 4751	Maximum #40 sieve/0.425 mm
UV after 500 hours	D 4355	80%

<sup>(a)</sup> All values in this table are the minimum values allowed in each direction except as noted, and are based on Minimum Average Roll Value (MARV).

<sup>(b)</sup> The abbreviation shown as “kN” for the metric unit designates kiloNewtons.

2.04 Trench Filter Fabric shall be furnished and installed in all trench conditions between the bedding and backfill material whenever crushed rock or pea gravel is used as bedding. Trench Filter Fabric shall also be furnished and installed at all other locations required by the Plans.

A. Trench Filter Fabric shall be a nonwoven material type and meet or exceed the specifications presented in Table 3.



**Table 3. Trench Filter Fabric**

Property	ASTM Test Method	NonWoven Minimum <sup>(a)</sup> Average Roll Value (English)	Nonwoven Minimum <sup>(a)</sup> Average Roll Value (Metric)
Grab Tensile Strength	D 4632	112 lbs	500 newtons
Trapezoidal Tear Strength	D 4533	40 lbs	180 newtons
Puncture Strength	D 4833	40 lbs	180 newtons
Permittivity	D 4491	1.5 sec <sup>-1</sup>	1.5 sec <sup>-1</sup>
Apparent Opening Size (AOS)	D 4751	Maximum #70 Sieve	Maximum 0.212 mm
UV after 500 hours	D 4355	70%	70%

<sup>(a)</sup> All values in this table are the minimum values allowed in each direction except as noted, and are based on Minimum Average Roll Value (MARV).

### **PART 3 – EXECUTION**

#### **3.01 PREPARATION**

- A. Subgrade and earthwork as specified in Section 02200.

#### **3.02 PLACEMENT**

- A. Handle geotextile fabric in a manner that will not damage fabric.
- B. When used in trenches for lagoon underdrains, place geotextile in the trench as shown on the Drawings to conform to the shape of the trench with no wrinkles or folds.
- C. On Sideslopes: Secure fabric in anchor trench, and then roll down the slope. Keep the sheet in continual tension to prevent folds and wrinkles.

1. Weight unrolled geotextile fabric with sandbags or equivalent ballast. Do not utilize materials that may tear, puncture, or otherwise damage the geotextile fabric.

### 3.03 INSTALLATION

- A. Overlaps: 36 inches minimum
  1. Sew or heat-tack fabric at overlap or place fill so that overlap does not separate.
  2. Remove fill and reestablish overlap for any seams that separate
- B. Curves: Angle-pleated or cut into short pieces and laid down to overlap a minimum of 18 inches.
- C. Repairs
  1. Remove and replace geotextile sheets that cannot be satisfactorily repaired. Remove and replace geotextile fabric with tears greater than 10 percent of the width of the roll.
  2. Patch any holes or tears with the same geotextile fabric. Patch shall be a minimum of 12 inches larger in all directions than the area to be repaired. Thermally spot bond patch in place.

### 3.04 SUBGRADE SEPARATION FABRIC

- A. Installation
  1. The fabric shall be unrolled and laid smooth without wrinkles or folds on the prepared subgrade in the direction of construction traffic with the following exception, the fabric may be either cut or folded to fit horizontal curvilinear alignment of the roadway.
  2. Adjacent rolls shall be overlapped a minimum of 30” in the longitudinal and transverse directions of the base placement. The fabric may be held in place by pins, staples, or piles of base material.
  3. Unless otherwise allowed by the fabric manufacturer’s published recommendations, which will be furnished to the Engineer by the Contractor a minimum of two (2) working days in advance of the planned installation, the fabric will be installed in strict conformance with these recommendations and the installation shall conform to the criteria identified below:
    - i. The Contractor’s vehicles or equipment shall not be allowed directly onto the fabric.
    - ii. Aggregate base rock shall be placed by end dumping on to the fabric from the edge of the fabric, or over previously placed aggregate base rock.

- iii. Aggregate base rock shall be spread using a motor grader or bulldozer, maintaining a lift thickness of six (6) inches.
  - iv. Vibratory compaction is not permitted on the initial lift of aggregate base rock material.
4. The Contractor shall not cover the fabric until the Engineer has inspected the fabric for proper installation and to ensure that the fabric has not been damaged (i.e. holes, rips, tears). Damaged fabric shall be repaired in accordance with Subsection 1.01 Paragraph F of this Section.

### 3.05 SUBGRADE STABILIZATION FABRIC

- A. Installation of Subgrade Stabilization Fabric shall conform to Subsection 3.01 Paragraph A of this Section.

### 3.06 TRENCH FILTER FABRIC

- A. Installation
- 1. Trench Filter Fabric shall be installed in such a manner to prevent migration of fines.
  - 2. Adjacent rolls shall be overlapped a minimum of 24” in the longitudinal and transverse directions.

**\*\*END OF SECTION\*\***

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## SECTION 02500

### PAVING

#### PART 1 – GENERAL

##### 1.01 DESCRIPTION

This Section specifies paving consisting of aggregate base, asphaltic concrete, and associated materials.

##### 1.02 QUALITY ASSURANCE

###### A. References

This Section contains references to the following documents. They are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by the organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, reference to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued, or replaced.

Reference	Title
ASTM D1557	Test Method for Laboratory Compaction Characteristic of Soil using Modified Effort (56,000 ft-lb/ft <sup>3</sup> (2,700 KN-m/m <sup>3</sup> ))
Caltrans 2006 Standards	State of California Department of Transportation Standard Specifications, May 2006

###### B. Testing

Testing will be conducted by the Engineer to determine compliance with the specified degree of compaction and moisture content.

##### 1.03 PAVING SECTION

The paving system shall be as specified on the Drawings.

1.04 SUBMITTALS

Submittals shall be provided in accordance with Section 01300 Submittals of these Specifications and shall include the following information:

- A. A copy of this Section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the Specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph referenced to a detailed written explanation for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the Specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
- B. Asphalt concrete mix design showing complete aggregate gradings, void content, maximum density, compacted unit weight, and Hveem Stability for each percentage of binder used in the mix design determination.

**PART 2 – PRODUCTS**

2.01 MATERIALS

- A. Aggregate Base

Aggregate base shall be Type A, Class 2 aggregate base, conforming to the following gradation from Caltrans Section 26:

Seive Size	Percent Passing
1”	100
¾”	87-100
No. 4	30-65
No. 30	5-35
No. 200	0-12

B. Asphalt Concrete

1. Asphalt concrete shall be Type A medium asphalt concrete using PG-64-16 asphalt binder, and shall conform to the Drawings and provisions in Caltrans Section 39, "Asphalt Concrete".
2. Aggregate used in asphalt concrete shall conform to the 1/2" maximum, medium grading requirements of Caltrans Section 39-2.02, with a minimum of 2 fractured faces.

C. Asphaltic Tack Coat

PG-64-16 asphalt conforming to Caltrans Section 92. The application rate shall be 0.15 gal/yd<sup>2</sup>.

### **PART 3 – EXECUTION**

#### **3.01 GENERAL**

Construction shall conform to the details, dimensions and grades specified. Maximum variations in finished grade of paving shall be ±0.05 feet.

#### **3.02 AGGREGATE BASE PLACEMENT**

A. Subgrade

Areas to be paved shall be graded and compacted in accordance with Section 02300.

B. Aggregate Base

Placement, moisturizing, spreading, and compacting of aggregate base shall comply with all requirements of Caltrans Sections 26-1.03 through 26-1.05 inclusive, the details on the Drawings, and Section 02300.

#### **3.03 ASPHALT CONCRETE PAVEMENT PLACEMENT**

A. Asphalt concrete shall be placed where indicated on the Drawings. Storing, proportioning, mixing, equipment, spreading, and compacting of asphalt concrete pavement shall comply with Caltrans Sections 39-3 and 39-5 through 39-7, as modified herein.

B. The tack coat shall be applied to all vertical surfaces as required in Caltrans Section 39-4.02.

C. Each layer (lift) of asphalt concrete shall be a minimum of 0.12 foot compacted thickness, and a maximum 0.24 foot compacted thickness. Sections 0.25 foot or thicker shall be placed in equal lifts.

D. Finished asphalt concrete surfaces shall be to the grades indicated on the Drawings.

#### 3.04 RESTORATION OF EXISTING PAVEMENT

The Contractor shall repair/replace all pavement facilities damaged as a result of construction activities, including trench repair. Pavement repair shall be 1" thicker than existing pavement section or a minimum of 4" AC on 12" aggregate base, whichever is greater. Trench resurfacing shall be as indicated.

#### 3.05 EXISTING UTILITIES

The Contractor shall raise all iron to grade, including, but not limited to, manhole frames, valve boxes, electric pull boxes and survey monument boxes.

**\*\*END OF SECTION\*\***



## SECTION 02510

### PIPELINES AND SITE PIPING, GENERAL

#### PART 1 – GENERAL

##### 1.01 SUMMARY

- A. Contractor shall furnish and install all piping systems shown and specified, in accordance with the requirements of the Contract Documents. Each system shall be complete with all necessary fittings, supports, anchors, thrust restraints, thrust blocks, expansion joints, valves, accessories, insulation, lining and coating, testing, disinfection, excavation, backfill, and encasement to provide a complete and functional installation.
- B. This Section contains general requirements for site piping and pipelines, and is applicable to buried pipe outside of structures. For requirements for piping above ground; in structures; and vaults; and piping that is part of or associated with equipment, buildings, mechanical, and process systems, see Section 15010 Mechanical Piping, General.
- C. The piping indicated on the Drawings is intended to define the general layout, configuration, routing, pipe sizes, and pipe types. The Drawings are not pipe construction or fabrication drawings. Not all pipe supports, fittings, reducers, anchorages, and expansion provisions are shown on the Drawings. It is Contractor's responsibility to develop the details necessary to construct all piping systems and to provide and install all piping components for a complete and functional system.

##### 1.02 REFERENCED DOCUMENTS

- A. The following documents are referenced in this Section.

ASME B1.1	Unified Inch Screw Threads (UN and UNR Thread Form)
ASME B1.20.1	Pipe Threads, General Purpose (Inch)
ASME B16.1	Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800
ASME B16.5	Pipe Flanges and Flanged Fittings NPS ½ Through NPS 24
ASME B18.2.1	Square and Hex Bolts and Screws (Inch Series)
ASME B18.2.2	Square and Hex Nuts (Inch Series)

ASTM A 193	Alloy Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 307	Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
ASTM A 325	Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM D 2000	Standard Classification System for Rubber Products in Automotive Applications
AWWA C110	Ductile-Iron and Gray-Iron Fittings, 3 in.-48 in. (76 mm-1,219 mm), for Water
AWWA C111	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115	Flanged Ductile Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
AWWA C207	Steel Pipe Flanges for Waterworks Service-Sizes 4 in. through 144 in. (100 mm through 3,600 mm)
AWWA C606	Grooved and Shouldered Joints
NSF Standard 61	Drinking Water System Components – Health Effects

### 1.03 SUBMITTALS

- A. Contractor shall submit complete shop drawings and certificates, test reports, and affidavits of compliance of all piping systems, in accordance with the requirements of Section 01300 Submittals, and the requirements of the pipe material Technical Specifications.
- B. The shop drawings shall include all necessary dimensions and details on pipe joints, fittings, fitting specials, valves, appurtenances, design calculations, and material lists. The submittals shall include detailed layout, spool and fabrication drawings which show all pipe spools, spacers, adapters, connectors, fittings, valves, and pipe supports necessary to provide complete and functional piping systems.
- C. Contractor shall submit as part of the shop drawings statements from the pipe fabricators certifying that all pipes will be fabricated subject to an established quality control program. An outline of the program shall be submitted to Engineer for review prior to the fabrication of any pipe.
- D. Submit tabulated data resulting from the field investigations, exploratory excavations, and surveying for underground utilities.

#### 1.04 FIELD INVESTIGATIONS, EXPLORATORY EXCAVATIONS, AND SURVEYING FOR EXISTING UNDERGROUND UTILITIES

- A. Prior to preparation of shop drawings for underground piping, and prior to excavation for installation of underground facilities, Contractor shall perform field investigations, exploratory excavations, and surveying for existing underground utilities and other interferences shown on the Drawings, and for facilities where connections will be made as part of the Work. This is a special item of Work, and is in addition to any other provisions in the Contract Documents and any requirements of Laws or Regulations for locating existing underground utilities and interferences. Payment for this item shall be considered payment for locating existing underground utilities and interferences, whether or not the utility interference is shown with reasonable accuracy on the Drawings.
- B. Contractor shall determine the following properties of each existing underground utility and interference.
  - 1. Location, including the design station or coordinates where the existing utility will interfere with the proposed pipeline or structure, and where connections will be made to existing facilities.
  - 2. Elevation of the invert of the existing utility and critical elevations of interfering structures.
  - 3. The utility size, material type, and type of existing backfill.
- C. Surveying shall be performed by a firm or individual that possesses a valid license for land surveying in the State of California. The basis for the surveying shall be that used for the Project.
- D. Explorations shall be excavated, backfilled, and paved with temporary pavement in accordance with the Contract Documents.
- E. Contractor shall use the information obtained from the field investigations for planning construction operations, preparation of shop drawings for proposed pipelines and structures, preparations for connections to existing facilities, and for the record drawings. Where existing underground utilities will otherwise interfere with the design locations of pipelines or structures, Contractor shall propose grade or alignment adjustments to avoid potential conflicts. Such adjustments shall be prominently identified on the shop drawings for review by Engineer.

#### 1.05 QUALITY ASSURANCE

- A. All pipe shall be subject to inspection at the place of fabrication and manufacture. During the manufacture of the pipe, Engineer shall be given access to all areas where manufacturing is in progress and shall be permitted to make all inspections necessary to confirm compliance with the Specifications.

- B. Except where otherwise specified, all materials used in the manufacture of pipe shall be tested in accordance with applicable specifications and standards. Welds shall be tested as specified. Contractor shall perform all tests at no additional cost to Owner.
- C. All expenses incurred in making Samples for certification of tests shall be borne by Contractor.

#### 1.06 MANUFACTURER'S SERVICE REPRESENTATIVE

- A. Where the assistance of a manufacturer's service representative is advisable, to obtain pipe joints, supports, or special connections in compliance with the Contract Documents, Contractor shall furnish such assistance at no additional cost to Owner.

## **PART 2 - PRODUCTS**

### 2.01 GENERAL

- A. All pipes, fittings, and appurtenances shall be furnished in accordance with the requirements of the applicable Technical Specifications and as specified herein.
- B. Pipes, fittings, and appurtenances for raw or potable water service shall be listed by the NSF International as certified drinking water system component in compliance with NSF Standard 61.
- C. Supports for piping shall be per Section 15096 Pipe Hangers and Supports.
- D. All requirements pertaining to thickness, application, and curing of pipe coatings and linings shall be in accordance with the requirements of the applicable Technical Specifications. External ferrous metal surfaces of pipes above ground or in structures shall have surface preparation and prime coatings applied in the shop and finish coatings applied in the field after installation, all in accordance with Section 09900 Painting. Surfaces of field assembled non-ferrous and non-metallic piping above ground or in structures shall have all coatings applied in the field in accordance with Section 09900.
- E. Thrust restraint design pressure shall be 200% of pipe design pressure or the test pressure, whichever is greater. Maximum expected test pressure is defined in Section 02120 Pressure Pipeline Testing.
- F. Piping Expansion and Movement Provisions
  - 1. Sleeve-type couplings and telescoping sleeve couplings shall be provided where indicated on the Drawings to accommodate piping movement and expansion. Contractor shall provide provisions for thrust restraint and movement limitation where couplings are required.

2. If acceptable to Engineer, Contractor may install additional sleeve-type or grooved end mechanical couplings to facilitate piping installation, provided that the installation includes additional pipe supports and hydraulic thrust protection.
- G. Bolts, Nuts, Tie Rods, and Other Fasteners for Steel Pipe, Fittings, Couplings, and Appurtenances
1. Except as specified below, bolts shall be ASME B18.2.1 standard hexagon head bolts with ASME B18.2.2 standard hexagon nuts.
  2. Threads shall be in accordance ASME B1.1, standard coarse thread series. Threads shall be Class 2A for bolts, and Class 2B for nuts.
  3. Bolts and nuts shall be ASTM A307 Grade B Class D flanges. Bolts for Class E and Class F flanges shall be ASTM A193 Grade B7.
  4. Bolts, nuts, tie rods, and other fasteners shall be hot-dip galvanized after fabrication. Do not substitute stainless steel fasteners for galvanized fasteners.
  5. Furnish fasteners for steel pipe in unopened containers with the product labels and alloy type intact and legible.
- H. Bolts, Nuts, Tie Rods, and Other Fasteners for Ductile Iron Pipe, Fittings, Couplings, and Appurtenances
1. Bolts, nuts, and other fasteners shall be high strength, low alloy steel in accordance with AWWA C111. Do not substitute stainless steel fasteners for low alloy steel fasteners.
  2. Furnish fasteners for ductile iron pipe in unopened containers with the product labels and alloy type intact and legible.

## 2.02 PIPE FLANGES

### A. General

1. Flat-faced flanges shall not be bolted to raised-face flanges.
2. All machined faces of metal blind flanges and pipe flanges shall be coated with a temporary rust-inhibitive coating to protect the metal until the installation is completed.
3. Studs and bolts shall extend through the nuts a minimum of 1/4-inch. All-thread studs shall be used only on valve flange connections where space restrictions preclude the use of regular bolts.
4. Insulating flanges shall have bolt holes 1/4-inch diameter greater than the bolt diameter.

### B. Flanges for Steel Pipe and Special Sections

1. Where the design pressure is 150 psi or less, flanges shall conform to either AWWA C207 Class D or ASME B16.5 150-lb class. Where the design pressure is greater than 150 psi, up to a maximum of 275 psi, flanges shall conform to either AWWA C207 Class E, Class F, or ASME B16.5 150-lb class. Where the design pressure is greater than 275 psi up to a maximum of 700 psi, flanges shall conform to ASME B16.5 300-lb class.
2. Flanges shall have flat faces and shall be attached with bolt holes straddling the vertical axis of the pipe unless otherwise shown. Attachment of the flanges to the pipe shall be by welding and conform to the applicable requirements of AWWA C207. Flanges for miscellaneous small pipes shall be in accordance with the standards specified for these pipes.

C. Flanges for Ductile Iron Pipe

1. Flanges shall be ductile iron conforming with AWWA C115.
2. Threaded connections shall be used to connect flanges to pipe, or flanges may be integrally cast with the pipe.
3. Flanges shall be rated for a 250 psi working pressure. Dimensions shall match those of ASME B16.1, Class 125 flanges and ASME B16.5, Class 150 flanges.
4. Where indicated, flanges shall be either threaded or integrally cast to meet the requirements of ASME B16.1, Class 250.

D. Flange Gaskets

1. Gaskets for flanged joints shall be full-faced, compressed sheets of aramid fiber base, with nitrile or neoprene binder and non-stick coating, suitable for temperatures to 700 degrees F, a pH of one to eleven, and pressures to 1,000 psig. Gaskets shall be 1/16-inch thick for flange sizes up to 24 inches, and 1/8-inch thick for flange sizes greater than 24 inches.
2. Blind flanges shall have gaskets covering the entire inside face of the blind flange and shall be cemented to the blind flange.
3. Flange Gasket Manufacturers, or Equal:
  - a. John Crane, Style 2160;
  - b. Garlock, Style 3000 or 3300.
4. Flange gaskets for chemical service shall be as indicated for the respective pipe materials in the Technical Specifications.

## 2.03 INSULATING FLANGE SETS

- A. Insulating flange sets shall be provided where indicated. Each insulating flange set shall consist of an insulating gasket, insulating sleeves and washers, and a steel washer. Insulating sleeves and washers shall be one piece when flange bolt diameter is 1-1/2-inch or smaller and shall be made of acetal resin.
- B. For bolt diameters larger than 1-1/2-inch, insulating sleeves and washers shall be 2-piece and shall be made of polyethylene or phenolic.
- C. Steel washers shall be in accordance with ASTM A 325. Insulating gaskets shall be full-face.
- D. Insulating Flange Set Manufacturers, or Equal:
  - 1. JM Red Devil, Type E
  - 2. Maloney Pipeline Products Co.
  - 3. Pipeline Seal and Insulator, Inc.

#### 2.04 BLIND FLANGES

- A. Blind flanges shall be in accordance with AWWA C207, or as required by the requirements for the respective pipe materials in the Technical Specifications.
- B. All blind flanges for pipe sized 12-inches and over shall be provided with lifting eyes in form of welded or screwed eye bolts.

#### 2.05 THREADED INSULATING CONNECTIONS

- A. Threaded insulating bushings, unions, or couplings, as appropriate, shall be used for joining threaded pipes of dissimilar metals and for piping systems where corrosion control and cathodic protection are indicated.
- B. Threaded insulating connections shall be of nylon, Teflon, polycarbonate, polyethylene, or other non-conductive materials, and shall have ratings and properties to suit the service and loading conditions.

#### 2.06 MECHANICAL COUPLINGS

- A. Prior to assembly, pipe ends for sleeve and mechanical-type couplings shall have the pipe end coating hold-back areas abrasive blasted and coated with epoxy in accordance with Section 09900 Painting.
- B. Grooved End Couplings
  - 1. Cast grooved end couplings shall be provided where indicated. The couplings shall conform to the requirements of AWWA C606.

2. All gaskets for grooved end couplings shall be compatible with the piping service and fluid utilized, in accordance with the coupling manufacturer's recommendations.
3. The wall thickness of all grooved piping shall conform with the coupling manufacturer's recommendations to suit the highest expected pressure. Pipe and fittings shall be cut grooved, and the methods and equipment for grooving shall be in accordance with mechanical pipe coupling manufacturer's specifications. Pipe to be grooved shall have wall thicknesses not less than the minimum recommended by the coupling manufacturer for cut-grooving and AWWA C606.
4. Couplings shall hold in place a composition water-sealing gasket designed so that internal water pressure serves to increase the seal's water tightness. For water and wastewater, sealing gaskets shall be chlorinated butyl rubber in accordance with ASTM D2000, Grade No. 3BA610A15B44Z with special heat-resistance test of 16 hours at 350 degrees F and maximum elongation change of minus 30%.
5. Steel Pipe Couplings Manufacturers, or Equal:
  - a. Gustin-Bacon (banded or grooved)
  - b. Victaulic Style 41 or 44 (banded, flexible)
  - c. Victaulic Style 77 (grooved, flexible)
  - d. Victaulic Style 07 or HP-70 (grooved, rigid)
6. Ductile Iron Pipe Couplings Manufacturers, or Equal
  - a. Gustin-Bacon
  - b. Victaulic Style 31 (flexible or rigid grooving)

Note: Ductile iron pipe couplings shall be furnished with flush seal gaskets. Ductile iron pipe ends require radius cut grooves.
7. PVC Pipe Couplings Manufacturers, or Equal:
  - a. Gustin-Bacon
  - b. Victaulic Style 775

Note: Couplings for PVC pipe shall be furnished with radius cut or standard roll grooved pipe ends.

C. Sleeve-Type Couplings and Flanged Coupling Adapters

1. Construction
  - a. Sleeve-type couplings shall be provided where indicated. The couplings shall be in accordance with AWWA C219 unless otherwise specified, and shall be of steel with steel bolts, without pipe stop, and shall be of sizes to fit the pipe and fittings shown.
  - b. The middle ring shall be not less than 1/4 inch in thickness and shall be either 5 or 7 inches long for sizes up to and including 30-inches and



- 10 inches long for sizes greater than 30-inches. The couplings shall be 16 inches long for long-body sleeve couplings.
- c. The middle ring shall be tested by cold-expanding a minimum of one percent beyond the yield point, to proof-test the weld to the strength of the parent metal. The weld of the middle ring shall be subjected to air test for porosity. The followers shall be a single-piece contoured mill section welded and cold-expanded as required for the middle rings. They shall be of sufficient strength to accommodate the number of bolts necessary to obtain adequate gasket pressures without excessive rolling.
  - d. The shape of the follower shall be of such design as to provide positive confinement of the gasket.
  - e. Sleeve-type couplings shall be fusion bonded epoxy coated at the factory.
  - f. For flanged coupling adapters, provide anchor studs for all sizes up to and including 12-inch.
2. Pipe End Preparation
    - a. The ends of the pipe shall be prepared for sleeve-type couplings as indicated and specified by the coupling manufacturer.
    - b. Plain ends for use with couplings shall be smooth and round for a distance of 12-inches from the ends of the pipe, with outside diameter not more than 1/64-inch smaller than the nominal outside diameter of the pipe.
  3. Gaskets for Water and Wastewater Service
    - a. Gaskets for sleeve-type couplings shall be rubber compound material that will not deteriorate from age or exposure to air under normal storage or use conditions. Gaskets for wastewater and sewerage applications shall be Buna N, grade 60, or equivalent elastomer.
    - b. The rubber gaskets shall meet the following specifications:
      - i. Color - Jet Black
      - ii. Surface - Non-blooming
      - iii. Durometer Hardness - 74±5
      - iv. Tensile Strength - 1,000 psi Minimum
      - v. Elongation - 175% Minimum
    - c. The gaskets shall be immune to attack by impurities normally found in water or wastewater. All gaskets shall meet the requirements of ASTM D 2000, AA709Z, meeting Suffix B13 Grade 3, except as noted above. All gaskets shall be compatible with the piping service and fluid.
  4. Gaskets for chemical service shall be as indicated for the respective pipe materials.
  5. Where insulating couplings are required, both ends of the coupling shall have a wedge-shaped gasket which assembles over a rubber sleeve of an

insulating compound in order to obtain insulation of all coupling metal parts from the pipe.

6. All sleeve-type couplings on pressure lines shall be harnessed unless thrust restraint is provided by other means.
7. Sleeve Type Couplings Manufacturers, or Equal:
  - a. Dresser, Style 38
  - b. Ford Meter Box Co., Inc., Style FC1 or FC3
  - c. Smith-Blair, Style 411
8. Flange Coupling Adapters Manufacturers, or Equal:
  - a. Dresser, Style 127 or 128
  - b. Rockwell, Style 912 or 913
9. Sleeve-type couplings for use with ductile iron pipe shall be as manufactured by the following, or equal. (Thrust ties shall be provided as required to resist the test pressure.)
  - a. Dresser, Style 53 or 153
  - b. Smith-Blair, Style 441
10. Transition sleeve-type couplings used to connect pipes with small differences in outside diameter shall be manufactured by the following, or equal:
  - a. Dresser, Style 53 or 153
  - b. Smith-Blair, Style 413

## 2.07 PIPE THREADS

- A. All pipe threads shall be in accordance with ASME B1.20.

## 2.08 SEGMENTED RUBBER SEALS

- A. Seals shall be modular mechanical type, consisting of interlocking rubber links shaped to continuously fill the annular space between the pipe and wall sleeve. Links shall be assembled with bolts to form a continuous rubber seal around the pipe. Tightening of the bolts shall cause the rubber links to expand and provide a completely watertight seal.
- B. Bolts, nuts, and other metal parts shall be stainless steel.
- C. Seals shall be constructed to provide electrical insulation between the pipe and a metallic wall sleeve when the seals are used in corrosion protection systems.

## 2.09 LATERAL CONNECTION APPURTENANCES

- A. Backwater check valve shall be Clean Check Extendable PVC Backwater Valve by Rectorseal, or approved equal.

- B. Two way cleanout shall be Nibco, Plastic trends or GPK Products.
  - 1. Cleanout riser shall be topped with Sewer Popper Cleanout Relief Valve by Jones Stephens Corp., or approved equal.
- C. Cleanouts and backwater valve riser tops shall be protected with a concrete utility box, model B9 10 inch by 17 inch nominally, with concrete lid by Christy, Oldcastle or equal.
  - 1. Box assembly shall be traffic rated.
  - 2. Lid shall be stamped to read "SEWER."

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  - 1. Box assembly shall be traffic rated.
  - 2. Lid shall be stamped to read "SEWER".

## PART 3 - EXECUTION

### 3.01 GENERAL

- A. All pipe materials, fittings, valves, and accessories shall be delivered in a clean and undamaged condition and stored off the ground, to provide protection against damage and degradation caused by ground contact. All defective or damaged materials shall be replaced with new materials.
- B. Plastic and rubber pipe materials, and pipe materials with tape or paint-type coatings, shall be covered during storage to prevent direct exposure to sunlight.
- C. All pipes, fittings, and appurtenances shall be installed in accordance with the requirements of the applicable Technical Specifications. Buried piping shall be installed in conformance with Section 02300 Earthwork.

- D. After assembly, all exposed pipe threads and joint surfaces at screwed flanges shall be cleaned of all oil and epoxy coated, to provide continuous corrosion protection and serve as a primer for subsequent pipe coatings. All pipe ends at mechanical couplings shall be abrasive blasted and epoxy-coated prior to assembly in accordance with Section 09960 High Performance Coatings.
- E. Where core drilling is required for pipes passing through existing concrete, core drilling locations shall be determined by radiographs of the concrete construction to avoid damage to embedded raceways and reinforcing steel.
- F. For metallic pipes or metallic pipe sleeves that pass through concrete walls, the pipes and sleeves shall be electrically isolated from the reinforcing steel, and shall not be touching the reinforcing steel or connected to it for support.
- G. Where required to prevent joint separation or movement due to internal pressure, piping shall be provided thrust blocks, restrained joints, or other approved joint restraints.
  - 1. If restrained joints are not indicated, thrust blocks shall be installed in accordance with the details on the Drawings. If thrust block details are not included on the Drawings, Contractor shall provide the thrust blocks using details in accordance with the pipe manufacturer's instructions.
  - 2. If restrained joints are indicated, they shall be the following types of joints. The joints shall be provided in accordance with the pipe material Technical Specifications.
    - a. Welded joints designed to resist the thrust loads
    - b. Threaded joints
    - c. Flanged joints
    - d. Soldered joints
    - e. Plastic pipe solvent-welded joints
    - f. Joints specially designed for thrust restraint such as some types of mechanical couplings, and locking-type bell and spigot restrained joints for ductile iron pipe.
    - g. Where indicated, joints that have tie rod-type joint harness assemblies.

### 3.02 FIELD TESTING AND DISINFECTION

- A. Conduct pipeline testing in accordance with Section 02120 Pressure Pipeline Testing, and Section 02130 Non-Pressurized Pipeline Testing, as applicable.
- B. Disinfect potable water pipelines in accordance with AWWA B300.

### 3.03 CORROSION PROTECTION

- A. Where indicated, buried piping shall be provided with corrosion protection or monitoring systems.
- B. All buried metallic surfaces of piping, valves, couplings, and appurtenances shall be protected with coating systems as indicated in the appropriate pipe material Technical Specification.
- C. All buried pipe joints in metallic piping systems that are not welded or soldered shall be bonded for electrical continuity using details indicated. Joints indicated to be insulating or dielectric shall not be bonded.

### 3.04 PIPE IDENTIFICATION

- A. Plastic Tracer Tape
  - 1. Where plastic tracer tape is indicated, it shall be installed 2 feet above the crown of each pipe.
  - 2. For pipes with cover of 8 feet or greater, a second tape shall be buried 12 inches below finished grade directly above the pipe centerline.
- B. Magnetic Tracer Tape
  - 1. Where magnetic tracer tape is indicated, it shall be installed 2 feet above the crown of each pipe.
  - 2. For pipes with cover of 8 feet or greater, a second tape shall be buried 12 inches below finished grade directly above the pipe centerline.
- C. Tracer Tape and Wires
  - 1. Tracer tape shall be 12 inches wide, colored the same as the background colors specified for the project piping systems, or as acceptable to Engineer if colors have not been specified.
  - 2. Printed on the tapes at 2 foot intervals shall be a caution statement plus words that identify the pipe fluid, such as "Raw Water", "Treated Water", "Sanitary Sewer", etc.
  - 3. The material shall be an inert plastic material suitable for direct burial and capable of stretching to twice its original length. The tape shall be as manufactured by Allen Systems, W. H. Brady, or equal.
  - 4. Magnetic tracer tape shall meet the requirements for plastic tracer tape, but shall be a 3-inch wide plastic tape in combination with an integral metallic tape.
  - 5. Tracer wire shall be single strand No. 12, TW electrical wire, UL listed.
  - 6. Where tracer wire is indicated, it shall be laid on the top of the pipe and taped at 10-foot intervals to the pipe. Wire shall be installed in continuous

lengths with no splices except at valve operator boxes, fire hydrants, and other above-ground appurtenances.

7. At valve operator boxes, fire hydrants, and other appurtenances, tape shall be brought to the surface and terminated in the boxes by running up the box exterior, then terminating through a penetration in the box wall 2"-6" below the surface. At hydrants and appurtenances, tape shall be terminated above ground. At the ends of pipelines tape shall be brought to the ground surfaces and terminated in valve boxes as noted above.
8. During pipeline testing, continuity of all tracer wire, connections and splices shall be checked and repaired as necessary.

**\*\*END OF SECTION\*\***

## SECTION 02605

### PRECAST CONCRETE UTILITY STRUCTURES

#### PART 1 – GENERAL

##### 1.01 SUMMARY

- A. This Section includes precast concrete manholes, utility vaults, and grease interceptors.

##### 1.02 SUBMITTALS

- A. Prepare and submit in accordance with Section 01300.
- B. Product Data
  - 1. Manhole frames and covers.
  - 2. Rubber boot-type pipe connectors for connecting piping to manholes.
- C. Utility Structure Details:
  - 1. Manufacturer's standard shop drawings for each size and type of precast utility structure.
    - a. Provide dimensions of structure.
    - b. Identify location of each type of insert cast into the structure.
  - 2. Illustrate construction details related to joints between precast sections, method of connecting pipe to the structure, size and location of pipe penetrations, reinforcement details and concrete mix design.
- D. Structural Design
  - 1. Laboratory results verifying compressive strength of concrete mix design used in the manufacture of precast concrete utility structures.
  - 2. Calculations and related sketches prepared, stamped and signed by a civil or structural Professional Engineer licensed to practice in the State of California.

##### 1.03 DESIGN REQUIREMENTS

- A. Concrete Mix Design for products covered by this Section
  - 1. Minimum Compressive Strength: 4,000 psi at 28 days.
  - 2. Cement: Type II low alkali Portland cement meeting requirements of ASTM C150.
  - 3. Fly Ash: Class C or Class F meeting requirements of ASTM C618, not to exceed 25% by weight.

4. Aggregates: Conform to requirements of ASTM C33.
- B. Manhole Risers, Conical Tapered Sections and Grade Rings
1. Comply with design requirements specified in ASTM C478.
- C. Manholes
1. Conform to ASTM C858.
  2. Base design and manufacture A-16 (HS 20-44) loading in accordance with ASTM 857.
- D. Utility Vaults
1. Base design and manufacture to A-16 (HS 20-44) loading with 30% impact in accordance with ASTM C 857.
  2. Traffic Loads
    - a. Utility Vaults in Roadways: H-20 structural load rating according to AASHTO HB 17.
    - b. Utility Vaults in Driveways, Parking Lots and other Off-Roadway Locations: H-10 structural load rating according to AASHTO HB 17.
  3. Earth Loads: Design for lateral earth pressure of 85 pounds per cubic foot and equivalent fluid pressure of 60 pounds per cubic foot applied at a depth of  $1/3 H$  below the ground surface where H is the height of the utility vault.
  4. Seismic Loads: Design in accordance with the requirements of Seismic Zone 4 per California Building Code.
  5. Buoyancy: Select wall and slab thicknesses to provide sufficient weight against buoyancy due to groundwater elevations.
    - a. Consider groundwater elevation at the ground surface.
    - b. Utilize a safety factor of 1.5.
    - c. Do not take credit for friction forces that may develop between the soil backfill and concrete walls of the utility vault.
  6. Access Hatch Loading Criteria
    - a. Access hatches subject to wheel loads from vehicular traffic: H-20 structural load rating according to AASHTO HB 17.
    - b. Access hatches not subject to wheel loads from vehicular traffic: 300 pounds per square foot with a deflection not to exceed  $1/150$  of the span.
- E. Grease Interceptor
1. Base design and manufacture to H-20 structural load rating with earth loads 3.0' to 5.0' soil cover.



2. Earth Loads: Design for lateral earth pressure of 85 pounds per cubic foot and equivalent fluid pressure of 60 pounds per cubic foot applied at a depth of  $\frac{1}{3} H$  below the ground surface where H is the height of the utility vault.
3. Seismic Loads: Design in accordance with the requirements of Seismic Zone 4 per California Building Code.
4. Buoyancy: Select wall and slab thicknesses to provide sufficient weight against buoyancy due to groundwater elevations.
  - a. Consider groundwater elevation at the ground surface.
  - b. Utilize a safety factor of 1.5.
  - c. Do not take credit for friction forces that may develop between the soil backfill and concrete walls of the utility vault.
5. Access Hatch Loading Criteria
  - a. Access hatches subject to wheel loads from vehicular traffic: H-20 structural load rating according to AASHTO HB 17.

#### 1.04 COORDINATION

- A. Coordinate layout and installation of utility structures with the final arrangement of other utilities, site grading, and surface features as determined in the field.

### **PART 2 – PRODUCTS**

#### 2.01 PRECAST CONCRETE MANHOLES

- A. Manufacturers: One of the following or equal:
  1. Old Castle Precast.
  2. Jensen Precast.
- B. Conform to the requirements of ASTM C478.
- C. Construct precast reinforced concrete manholes in accordance with design, size, shape, form and details indicated on the Drawings and specified.
  1. Minimum Diameter: 48 inches.
- D. Conical Tapered Sections: Use eccentric type cones with same wall thickness and reinforcement as riser sections.
- E. Accessories
  1. Rubber Boot Pipe Connectors
    - a. Manufacturers: One of the following or equal:

- i. “Kor-N-Seal” flexible rubber boot with stainless steel accessories as manufactured by NPC, Inc.
    - ii. “Z-LOK XP” or “A-LOK” flexible connector as manufactured by A-LOK Products, Inc.
  - 2. Joint Sealing Compound: Preformed cold-applied ready-to-use plastic joint sealing compound.
    - a. Manufacturers: One of the following or equal:
      - i. Quikset Utility Vaults, Quik-Seal.
      - ii. K. T. Snyder Company, Ram-Neck.
  - 3. Manhole Frame and Cover Sets
    - a. Cast Iron: ASTM A 48, Class 30B.
    - b. Type, size:
      - i. Sewer manhole: 24” diameter, closed pick hole, taper frame and lid with four equally spaced grout holes,. D&L Foundry model A1024, or equal
      - ii. Sampling Manhole: 36-inch diameter with 10-inch center port with cover, Neenah R-1900-E, or equal.
      - iii. Sewer and Force Main Manholes: 24-inch hinged Pamrex Cover as manufactured by Certainteed, no equal.
    - c. Grind mating surfaces of cover and frame to ensure flat, true fit and even seating.
  - 4. Grade Rings
    - a. Manufacturer: Jensen 24-ID-5 model 2434, 3” or 6”, or equal
  - 5. Fast Setting Mortar
    - a. Manufacturer: Quickrete FastSet, CTS Rapid Set, or equal
  - 6. Waterproof Coating
    - a. Manufacturer: ThoroThoro Seal, or equal

## 2.02 PRECAST CONCRETE UTILITY VAULTS

- A. Manufacturers: One of the following or equal:
  - 1. Old Castle Precast.
  - 2. Jensen Precast.
- B. Description
  - 1. Factory-fabricated, reinforced concrete vault with cover and accessories.
  - 2. Open or integral closed bottom as indicated on the Drawings or as scheduled.
  - 3. Monolithically poured walls and bottom, unless open-bottom vaults are indicated on the Drawings or scheduled.

## 2.03 GREASE INTERCEPTOR

- A. Manufacturers: One of the following or equal:
  - 1. Old Castle Precast.
  - 2. Jensen Precast.
- B. Description
  - 1. Capacity 2,000 gallons.
  - 2. Factory fabricated, reinforced concrete.
  - 3. Construct precast reinforced concrete great interceptor to be water tight.
- C. Accessories
  - 1. Rubber Boot Pipe Connectors
    - a. Manufacturers: One of the following or equal:
      - i. “Kor-N-Seal” flexible rubber boot with stainless steel accessories as manufactured by NPC, Inc.
      - ii. “Z-LOK XP” or “A-LOK” flexible connector as manufactured by A-LOK Products, Inc.
    - 2. Joint Sealing Compound: Preformed cold-applied ready-to-use plastic joint sealing compound.
      - a. Manufacturers: One of the following or equal:
        - i. Quikset Utility Vaults, Quik-Seal.
        - ii. K. T. Snyder Company, Ram-Neck.
    - 3. Manhole Frame and Cover Sets
      - a. Cast Iron: ASTM A 48, Class 30B.
      - b. Type, size:
        - i. Manway Cover: 24” diameter cast iron gaslating ring and cover.
- D. Use 24” diameter grade rings as specification drawings.

## PART 3 – EXECUTION

### 3.01 MANUFACTURE

- A. Utilize a central batching facility to ensure accurate weighing and mixing of materials to consistently obtain a suitable concrete mix.
- B. Concrete Batching: Properly proportion sand, aggregate and cement with sufficient water to produce a concrete mix of uniform quality and slump.
- C. Concrete Compaction: Use either external or internal mechanical vibration during placement of the concrete mix within the forms.
- D. Curing: Steam cure concrete while still in the forms and after an initial set has taken place.

1. Steam temperature: Not to exceed 160 degrees F, nor raised from normal ambient temperature at a rate exceeding 40 degrees F per hour.
  2. Terminate steam curing after sufficient time has elapsed to produce adequate strength to withstand any structural strain that may occur during the form stripping operation.
  3. Additional curing may be applied by means of water spraying or membrane curing compound to reach the ultimate strength requirements.
- E. Reinforcing Steel: Position within the forms as required for design loads. Tie reinforcing steel sufficiently to withstand displacement during the pouring operation.

### 3.02 INSTALLATION

#### A. Concrete Manholes

1. Manhole Bases: May be pre-cast or cast-in-place at Contractor's option. If cast-in-place base is used:
  - a. Form that portion of base above invert elevation of sewer pipe to provide smooth channel section as indicated on the Drawings.
  - b. Place base concrete as a monolith.
2. Manhole Invert: Construct with smooth transitions to provide an unobstructed flow path through the manhole. Remove sharp edges and rough sections.
  - a. When a full section of pipe is laid through the manhole, break out the top portion of the pipe. Cover the exposed edge of pipe with mortar and trowel smooth.
3. Manhole Sections
  - a. Set each manhole section plumb.
  - b. Use sections of various heights and adjustment rings in order to bring top of manhole ring and cover to required elevation.
4. Joints in Manhole Sections
  - a. Seal joints with joint sealing compound.
  - b. Clean joints with brush, prime and apply sealing compound in accordance with manufacturer's printed instructions.
  - c. Remove silicon treated protective paper from one side of preformed rope and lay preformed rope, paper side up, on cleaned joint surface. Press surface firmly end-to-end around entire joint, making minimum 1-inch laps where necessary. Remove protective paper from preformed rope and lower next section into place.
  - d. Seal joints watertight. Cut away excess joint sealant from inside of interceptor.

- e. Seal all interior seams with fast setting mortar (aka red sack mortar).
- f. Apply water proof coating to entire manhole interior.

B. Manhole Frame and Cover Sets

- 1. Location and Grade
  - a. In Paved Areas: Set cover flush with pavement.
- 2. Setting Frames
  - a. Clean bearing surfaces and provide uniform contact.
  - b. Set manhole frames at required grade and securely attach to top of precast manhole shaft unit or on adjustment rings, using fast setting cement mortar.
- 3. Setting Covers: After frames are securely set in place, install covers and perform necessary cleaning and scraping of foreign materials from frames and covers as required to assure proper fit. Replace frames and covers that create noise when passed over by traffic.

C. Utility Vaults

- 1. Comply with ASTM C 891.
- 2. When vaults are provided in sections, install vault sections level and plumb and with orientation and depth coordinated with connecting pipes.
- 3. Support vault on a level bed of aggregate base material, 6 inches deep and compacted to 95% of maximum density.
- 4. Seal joints with joint sealing compound. Clean joints and apply sealing compound in accordance with the manufacturer's requirements.
- 5. Finish Elevations of Utility Vaults
  - a. Paved Areas, Roadway Shoulders and Other Areas of Vehicular Traffic: Set structure so that cover is flush with finished pavement elevation.
  - b. Other Locations: Set utility vault so that cover is 4 inches above finished grade.

D. Grease Interceptor

- 1. Install grease interceptor on concrete slab as indicated on the Drawings.
- 2. Set grease interceptor plumb and level in accordance with manufacturer instructions.
- 3. Anchor slab to grease interceptor with stainless steel hardware and fasteners.
- 4. Use grade rings to bring manways to grade.
- 5. Joints in Manhole Sections
  - a. Seal joints with joint sealing compound.

- b. Clean joints with brush, prime and apply sealing compound in accordance with manufacturer's printed instructions.
- c. Remove silicon treated protective paper from one side of preformed rope and lay preformed rope, paper side up, on cleaned joint surface. Press surface firmly end-to-end around entire joint, making a minimum 1-inch laps where necessary. Remove protective paper from preformed rope and lower next section into place.
- d. Seal joints watertight. Cut away excess joint sealant from inside of interceptor.

### 3.03 PIPE CONNECTIONS

- A. Install connecting pipe at the required alignment and grade.
- B. Set connecting pipes through the full thickness of the structure wall, flush with the inner face of the wall.
- C. Use standard flexible pipe connector boots, specifically manufactured for the intended service, to connect pipe to the manhole. Grout pipe to the manhole so that the connection is watertight.

### 3.04 CLEANING

- A. Upon completion, clean each structure of all silt, debris, and foreign matter.

### 3.05 TESTING

- A. Test manholes for leakage.
- B. Test grease interceptor for leakage as per manufacturer instructions.

**\*\*END OF SECTION\*\***

## SECTION 03301

### CAST-IN-PLACE CONCRETE

#### PART 1 – GENERAL

##### 1.01 SECTION INCLUDES

- A. Requirements for cast-in-place concrete work.

##### 1.02 SUBMITTALS

###### A. Shop Drawings

1. Reinforcing Steel: Prepare shop fabrication and field installation drawings in accordance with CRSI Manual of Standard Practice and ACI SP.
2. Layout drawings for construction joints.

###### B. Product Data: Waterstops, curing compound data.

###### C. Concrete Mix Design: Data on the concrete mix, including aggregate gradations and admixtures, in accordance with ASTM C94.

###### D. Quality Control Submittals

1. Manufacturer's application instructions for curing compound.
2. Ready-mix delivery tickets for each truck in accordance with ASTM C94.

##### 1.03 QUALITY ASSURANCE

###### A. Supplier Qualifications: A firm experienced in manufacturing ready-mixed concrete and that complies with ASTM C94 requirements for production facilities and equipment.

###### B. Source Limitations: Use the same brand of cement from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

###### C. Concrete and Reinforcement: Unless otherwise specified, meet the requirements of ACI 301 and 318.

###### D. Hot Weather Concreting: Conform to ACI 305R.

## **PART 2 – PRODUCTS**

### **2.01 FORMWORK**

- A. Exposed Areas: Use hard plastic finished plywood.
- B. Unexposed Areas: Use new ship lap or plywood.
- C. Earth cuts may be used for forming footings.

### **2.02 CONCRETE**

- A. Ready-mixed meeting ASTM C94, Option A.
- B. Portland Cement: ASTM C150, Type II.
- C. Aggregates: Furnish from one source.
  - 1. Natural Aggregates
    - a. Free from deleterious coatings and substances in accordance with ASTM C33, except as modified herein.
    - b. Free of materials and aggregate types causing pop outs, discoloration, staining, or other defects on surface of concrete.
  - 2. Non-Potentially Reactive: In accordance with ASTM C33, Appendix XI, paragraph X1.1.
  - 3. Aggregate Soundness: Test for fine and coarse aggregates in accordance with ASTM C33 and ASTM C88 using sodium sulfate solution.
  - 4. Fine Aggregates
    - a. Clean, sharp, natural sand.
    - b. ASTM C33.
    - c. Materials Passing 200 Sieve: 4 percent maximum.
    - d. Limit deleterious substances in accordance with ASTM C33, Table 1 with material finer than 200 sieve limited to 3 percent, coal and lignite limited to 0.5 percent.
  - 5. Coarse Aggregate
    - a. Natural gravels, combination of gravels and crushed gravels, crushed stone, or combination of these materials containing no more than 15 percent flat or elongated particles (long dimension more than five times the short dimension).
    - b. Materials Passing 200 Sieve: 0.5 percent maximum.



D. Admixtures: Do not use admixtures that contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Air-Entraining: ASTM C260.
2. Water-Reducing: ASTM C494, Type A or D.
3. Superplasticizers: ASTM C494, Type F or G.
4. Fly Ash: ASTM C618, Class C or F.
5. Color Pigments: Inert mineral or metal oxide pigments, natural or synthetic; resistant to lime and other alkalies.

E. Concrete Mix Design

1. Minimum Compressive Field Strength: 4,000 psi at 28 days when cured and tested in accordance with ASTM C31 and C39.
2. Coarse Aggregate Size: 1½ inches and smaller.
3. Slump Range: 3 to 5 inches.
4. Air Entrainment: Between 3 and 6 percent by volume.
5. Water Reducers: Use in concrete without plasticizers.

F. Proportions

1. Design mix to meet aesthetic and structural concrete requirements.
2. Water-cement ratio (water-cement plus fly ash ratio) shall control amount of total water added to concrete as follows:

Coarse Aggregate Size	W/C Ratio
1½ inch	0.50
1 inch	0.45

3. Minimum Cement Content (Combined Cement Plus Fly Ash Content):
  - a. 517 pounds per cubic yard for concrete with 1½ inch maximum size aggregate.
  - b. 540 pounds per cubic yard for 1 inch maximum size aggregate.
4. Increase cement content (combined cement plus fly ash content), as required meeting strength requirements and water-cement ratio.
5. Fly Ash Content: minimum 20 percent, maximum 50 percent by weight of total cement content.

G. Mixing: Minimum 70 and maximum 270 revolutions of mixing drum. Non-agitating equipment is not allowed.

## 2.02 REINFORCING STEEL

- A. Deformed Bars: ASTM A615, Grade 60.
- B. Welded Wire Reinforcement: ASTM A185, fabricated from as-drawn steel wire into flat sheets.
- C. Bar Supports:
  - 1. For Slab Rebar: Concrete blocks or plastic bar supports.
  - 2. For Rebar in Walls, Beams, Columns, and Slabs Exposed to View: Galvanized steel chairs with plastic tips or plastic bar supports and side form spacers.

## 2.03 ANCILLARY MATERIALS

- A. Curing Compound
  - 1. Material: Solvent based containing chlorinated rubber solids in accordance with ASTM C309, with additional requirement that the moisture loss not exceed 0.030 gram per centimeter squared per 72 hours.
  - 2. Manufacturers and Products
    - a. Master Builders Co.; Masterkure CR
    - b. Euclid Chemical Co.; Euco Super Floor Coat
- B. Epoxy Bonding Agent and Adhesives (for Binding New Concrete to Existing Concrete)
  - 1. Epoxies: Two component material for use on dry or damp surfaces and conforming to the requirements of ASTM C881.
  - 2. Apply in accordance with manufacturer's recommendations.
  - 3. Manufacturers: One of the following or equal:
    - a. Sika Armatec 110 EPOCEM; Sika Chemical Corporation.
    - b. CCS Bonder Paste LWL; Chemco Systems.
- C. Waterstops
  - 1. General: Place hydrophilic and/or rubber dumbbell type or center bulb type waterstops at construction joints and other joints as specified and indicated on the Drawings.
  - 2. Hydrophilic Waterstops:
    - a. Use: For concrete repairs or when attaching new concrete to existing structures.

- b. Manufacturers: One of the following or equal:
    - 1) Greenstreak, Hydrotite CJ.
    - 2) Tremco, Parastop II.
  - c. Installation: As indicated on the Drawings and in accordance with manufacturer's instructions.
3. Rubber Waterstops
- a. Use: At new construction joints where indicated on the Drawings.
  - b. Material: PVC or rubber waterstops manufactured by one of the following, or equal:
    - 1) Greenstreak.
    - 2) Progress Unlimited.
    - 3) Williams Products.
  - c. Size:
    - 1) Construction and Contraction Joints. 6-inch flat dumbbell type.
    - 2) Expansion Joints: 9-inch wide dumbbell with hollow center bulb.
- D. Vapor Barrier
- 1. Material: 15 mil, multilayer plastic, 0.01 minimum permeance rating.
  - 2. Manufacturers: One of the following or equal:
    - a. StegoWrap, Stego Industries.
    - b. Premoulded Membrane Vapor Seal with Plasmatic Corel, W. R. Meadows.

## **PART 3 – EXECUTION**

### **3.01 FORMWORK**

- A. Design, construct, erect, brace and maintain formwork in accordance with ACI 301.
- B. Form Ties
  - 1. Fixed conical or spherical type inserts that remain in contact with forming material and allow for dry packing of form tie holes.
  - 2. Space ties to withstand pressures and to limit deflection of forms to acceptable limits.
  - 3. Wire ties are not acceptable.

C. Construction

1. In accordance with ACI 347.
2. Make joints tight to prevent escape of mortar and to avoid formation of fins.
3. Brace as required to prevent distortion during concrete placement.
4. On exposed surfaces locate form ties in uniform pattern or as shown.
5. Construct so ties remain embedded in the wall with no metal within 1-inch of concrete surface when forms, inserts, and tie ends are removed.

D. Form Removal

1. Remove after concrete has attained 28 day strength, or approval is obtained in writing from Engineer.
2. Remove forms with care to prevent scarring and damaging the surface.

### 3.02 PLACING REINFORCING STEEL

A. Place reinforcing steel in accordance with CRSI Recommended Practice for Placing Reinforcing Bars.

B. Field bending or welding of reinforcing bars will not be allowed.

C. Bar Supports: Provide in sufficient quantity to prevent sagging and to support bars during concrete placement.

D. Splices and Laps

1. Top Bars: Horizontal bars placed such that 12 inches of fresh concrete is cast below in single placement.
2. Horizontal wall bars are considered top bars.
3. Bar lap splices shall conform to General Structural Notes on the Drawings.
4. Tie splices with 18-gauge annealed wire as specified in CRSI Standard.

### 3.03 PLACING CONCRETE

A. Place concrete in accordance with ACI 301.

B. Before placing concrete:

1. Check reinforcing steel for proper placement and correct discrepancies.
2. Remove excessive rust, mill scale, dirt, oil and other material from rebar that may adversely affect bonding to concrete.
3. Remove water from excavation and debris and foreign material from forms.

- C. Before depositing new concrete on existing concrete, clean surface using sandblast or other mechanical means to obtain a ¼ inch rough profile, and apply epoxy bonding agent in accordance with the manufacturer's instructions.
- D. Place concrete as soon as possible after leaving mixer, without segregation or loss of ingredients, without splashing forms or steel above, and in layers not over 2 feet deep. Place within 1½ hours after adding cement to mix.
- E. Placement Limitations: 8 feet maximum vertical drop to final placement, when not guided with chutes or other devices to prevent segregation due to impact with reinforcing.
- F. Hot Weather
  - 1. Prepare ingredients, mix, place, cure, and protect in accordance with ACI 305R.
  - 2. Maintain concrete temperature below 80 degrees F at time of placement, or furnish test data or provide other proof that admixtures and mix ingredients do not produce flash set plastic shrinkage, or cracking due to heat of hydration. Ingredients may be cooled before mixing to maintain fresh concrete temperatures at 80 degrees F or less.
  - 3. Make provisions for windbreaks, shading, fog spraying, sprinkling, ice, or wet cover, or other means to provide concrete with temperature specified.
  - 4. Maximum allowable temperature differential between reinforcing steel and concrete: Not greater than 20 degrees F at the time of concrete placement.

### 3.04 COMPACTION

- A. Vibrate concrete as follows:
  - 1. Apply approved vibrator at points spaced not farther apart than vibrator's effective radius.
  - 2. Apply close enough to forms to vibrate surface effectively but not damage form surfaces.
  - 3. Vibrate until concrete becomes uniformly plastic.
  - 4. Vibrator must penetrate fresh placed concrete and into previous layer of fresh concrete below.

### 3.05 CONSTRUCTION JOINTS

- A. Locate as shown or as approved.
- B. Maximum Spacing Between Construction Joints: 40 feet.

### 3.06 FINISHING FLOORS AND SLABS

- A. Unexposed Slabs: Screed to true surface, bull float with wood float, and wood trowel to seal surface and to provide a uniform surface.
- B. Exposed Slabs to Receive Grout: Screed to indicated elevation and leave without special finish.
- C. Exposed Floors and Slabs: Screed to true surface and use bull float to form a uniform surface with minor texture then apply final surface finish.
- D. Final Surface Finishes for Exposed Floors and Slabs: Apply final surface finish as scheduled.
  - 1. Top Slabs shall receive a Walkway finish: Apply to concrete surfaces that will be used for foot traffic such as walkways around basins and sidewalks. Apply steel trowel surface, then a light hairbroom finish to produce a profile that is parallel to the slab drainage.
- E. Tolerances: Exposed surfaces shall not vary from level or true plane more than ¼ inch in 10 feet when measured with a straightedge.

### 3.07 FINISHING AND PATCHING FORMED SURFACES

- A. Unexposed Surfaces: Provide rough-formed concrete texture as imparted by form-facing material, fill form tie holes with nonshrink grout and grind off projections, fins, and rough spots.
- B. Exposed Surfaces: Provide smooth-formed concrete texture as imparted by form-facing material, arranged in an orderly and systematic manner with a minimum number of seams. Fill form tie holes with nonshrink grout and grind off projections, fins, and rough spots. Where scheduled, apply rubbed surface as follows:
  - 1. Smooth Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive to produce a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
  - 2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes.
    - a. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces.
    - b. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.

3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout.
  - a. Mix one part Portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white
  - b. Portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces.
  - c. Compress grout into voids by grinding the concrete surface in a swirling motion, then finish the surface with a cork float.:
- C. Patching Defective Areas: Patch *defective* areas and repair rough spots resulting from form release agent failure or other reasons to provide smooth uniform appearance.
  1. Cut out honeycombed and defective areas.
  2. Cut edges perpendicular to surface at least 1-inch deep. Do not feather edges. Soak area with water for 24 hours.
  3. Finish surfaces to match adjacent concrete.
  4. Keep patches damp for minimum 7 days or spray with curing compound to minimize shrinking.

### 3.07 PROTECTION AND CURING

- A. Protect fresh concrete from direct rays of sunlight, drying winds, and wash by rain.
- B. Keep concrete slabs continuously wet for a 7 day period. Intermittent wetting is not acceptable.
- C. Use curing compound only where approved by Engineer. Cure formed surfaces with curing compound applied in accordance with manufacturer's directions as soon as forms are removed and finishing is complete.
  1. Do not use curing compound on concrete surfaces that will be painted.
- D. Remove and replace concrete damaged by freezing.

### 3.08 FIELD QUALITY CONTROL

- A. Concrete Samples:
  1. Provide concrete for making composite samples for testing slump, air content, and for making cylinders for determination of compressive strength.
  2. Prepare samples in accordance with ASTM C172. Select trucks or batches of concrete on a random basis.
  3. Samples may be obtained at the discharge chute of the truck or at the point of discharge into forms.

- B. Sampling Frequency: One composite sample for each 100 cubic yards of structural concrete, or fraction thereof, of each concrete mixture placed in any one day.
- C. Evaluation will be in accordance with ACI 301, Chapter 17 and Specifications.
- D. Slump tests and concrete cylinders shall be made by the Contractor. Contractor shall handle cured test cylinders, transport to the testing laboratory and pay testing costs.
- E. Enforcement of Compressive Strength Requirements:
  - 1. Compressive strength of concrete will be considered acceptable if the following conditions are satisfied:
    - a. Averages of all sets of 3 consecutive strength test results are greater or equal to the specified compressive strength.
    - b. No individual strength test (average of 2 cylinders) falls below specified compressive strength by more than 500 pounds per square inch.
  - 2. Whenever one, or both, of 2 conditions stated above is not satisfied, provide additional curing of affected portion of structure, then obtain test cores from the affected area.
    - a. Obtain 3 test cores in accordance with ASTM C 42 and ACI 318.
    - b. Concrete will be considered acceptable if the average compressive strength of the 3 test cores is equal to at least 90 percent of the specified 28-day compressive strength and no single core is less than 80 percent of the specified 28-day compressive strength.
    - c. Concrete will be designated as defective when the specified conditions are not achieved.
    - d. Fill core holes with concrete.
  - 3. Engineer may require the Contractor to strengthen defective concrete by means of additional concrete, additional reinforcing steel, or replacement of defective concrete, all of the Contractor's expense.

**\*\*END OF SECTION\*\***



## SECTION 03600

### GROUT

#### PART 1 – GENERAL

##### 1.01 SUMMARY

- A. Contractor shall furnish, install, cure, repair, finish, and perform all other work as required to produce finished grout.

##### 1.02 REFERENCED DOCUMENTS

- A. The following documents are referenced in this section.

Reference	Title
ASTM C109	Compressive Strength of Hydraulic Cement Mortars
ASTM C230	Flow Tables for Use in Tests of Hydraulic Cement
ASTM C404	Aggregates for Masonry Grout
ASTM C531	Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfaces, and Polymer Concretes
ASTM C579	Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing and Polymer Concretes
ASTM C882	Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear
ASTM C1107	Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C1181	Standard Test Methods for Compressive Creep of Chemical-Resistant Polymer Machinery Grouts
ASTM E96	Moisture Vapor Transmission of Materials

##### 1.03 SUBMITTALS

- A. Contractor shall make the following submittals.
1. Manufacturer's literature certifying compliance with the specified properties for Class I, II, and III grouts.
  2. Certified testing lab reports for ASTM C 1107, Grade C (as revised herein) requirements for Class I and II grouts tested at a fluid consistency for temperatures of 45, 73.4, and 90 degrees F with a pot life of 30 minutes at fluid consistency.

3. A twenty-four hour grout evaluation of Class I grout performed by an independent testing laboratory and dated within the last 18 months.
4. Test results and manufacturer's service report from the demonstration and training session verifying the compressive strength and summarizing the activities covered in the pre-installation demonstration and training session for each grout.
5. Certifications that all grout used on the project are free of chlorides or other chemicals that may cause corrosion.
6. Manufacturer's literature containing instructions and recommendations on the mixing, handling, placement and appropriate uses for each type of grout used in the Work.
7. The name and phone number of the grout manufacturer's representative, who will give jobsite service, demonstrations, and training. The representative shall have at least one year of experience with the chosen grouts.
8. Manufacturer's certification of installation, including all job service reports, certifying the grouts used on the job were used in accordance with manufacturer's recommendations.

#### 1.04 QUALITY ASSURANCE

##### A. Field Tests

1. Compression test specimens will be taken during construction from the first placement of each type of grout, and at intervals thereafter as selected by Engineer to insure continued compliance with these specifications. The specimens will be made by Engineer or its representative.
2. Compression tests and fabrication of specimens for cement grout and non-shrink grout will be performed as specified in ASTM C 109 at intervals during construction as selected by Engineer. A set of three specimens will be made for testing at 7 days, 28 days, and each additional time period as appropriate.
3. Compression tests and fabrication of specimens for epoxy grout will be performed as specified in ASTM C 579, Method B, at intervals during construction as selected by Engineer. A set of three specimens will be made for testing at 7 days, and each earlier time period as appropriate.
4. All grout which fails to meet the requirements of these Specifications is subject to removal and replacement at the cost of Contractor.
5. The cost of all laboratory tests on grout will be borne by Owner, but Contractor shall assist Engineer in obtaining specimens for testing. However, Contractor shall be charged for the cost of any additional tests and investigation on work performed which does not meet the specifications. Contractor shall supply all materials necessary for fabricating the test specimens.

B. Pre-installation Demonstration and Training

1. The grout manufacturer shall give a demonstration and training session for Class I, II, and III grouts to be used on the Project, before any installation of grout is started.
2. Contractor shall have the employees who will be doing the actual work participate in this training and demonstration session. The manufacturer shall train Contractor's employees in how to perform the work and cure the grout.
3. Test specimens (6 cubes total) shall be made for compression testing at 1, 3, and 28 days for each class of grout to be used.
4. The training session shall use a minimum of one bag of Class I grout mixed to fluid consistency. Tests shall be conducted for flow cone and bleed tests. The remaining grout shall be mixed, placed, and curing initiated, on actual project placements such as baseplates and tie holes to provide on-the-job training for Contractor.
5. The manufacturer shall mix enough Class II and III grout for a minimum of one base plate and a set of 6 test specimens.
6. If the project includes placement in formwork throughbolt holes and blockouts, the manufacturer shall also train Contractor's employees in mixing and curing of each of these applications.
7. Contractor shall transport the test cubes to an independent test laboratory, obtain the test reports, and report these demonstration and training test cube strengths to Engineer.

**PART 2 – PRODUCTS**

2.01 APPLICATION

- A. Unless indicated otherwise, grouts shall be provided as listed below whether called for on the Drawings or not.

<u>Application</u>	<u>Type of Grout</u>
Reinforcing steel set in grout	Non-Shrink Class III
Beam and column (1 or 2 story) base plates less than 16 inches in the smallest dimension	Non-Shrink Class II
Column base plates (greater than 2 story or larger than 16 inches in the least dimension)	Non-Shrink Class I
Storage tanks, bins, hoppers, and other non-driven equipment	Per Section 11050, Equipment Baseplates, Supports, and Foundations
Filling blockout spaces for embedded items such as railing posts, gate guide frames, etc.	Non-Shrink Class II (Class I where placement time exceeds

	10 minutes)
Under precast concrete elements	Non-Shrink Class I
Toppings and concrete fill less than 4 inches thick	Topping grout
Toppings and concrete fill greater than 4 inches thick	Structural concrete
Any application not listed above, where grout is called for on the Drawings	Non-Shrink Class I, unless noted otherwise

## 2.02 PREPACKAGED NON-SHRINK GROUTS

### A. Classes I and II Non-Shrink Grouts

1. All non-shrink grouts shall be a prepackaged, preblended, inorganic, flowable, non-gas-liberating, non-metallic, portland cement-based grout requiring only the addition of water. Manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation for each class of non-shrink grout specified herein shall be that recommended by the manufacturer for the particular application.
2. Class I Non-Shrink Grout
  - a. Class I non-shrink grouts shall have a minimum 28 day compressive strength of 7000 psi.
  - b. The grout shall meet the requirements of Corps of Engineers Standard CRD-C621 and ASTM C 1107 Grade C or Grade B (as modified below) when tested using the amount of water needed to achieve the following properties.
    - i. Fluid consistency (20 to 30 seconds) per CRD-C611
    - ii. At temperatures of 45, 73.4, and 95 degrees F.
  - c. The length change from placement to time of final set shall not be a shrinkage amount greater than the amount of expansion measured at 3 or 14 days. The expansion at 3 or 14 days shall not exceed the 28-day expansion.
  - d. The non-shrink property shall not be based on a chemically generated gas or gypsum expansion.
  - e. Fluid grout shall pass through the flow cone, with a continuous flow, 1 hour after mixing.
3. Class II Non-Shrink Grout
  - a. Class II non-Shrink grouts shall have a minimum 28-day compressive strength of 7000 psi.
  - b. The grout shall meet the requirements of ASTM C1107 and the following requirement when tested using the amount of water needed to achieve the following properties.

- i. Flowable consistency (140 percent flow on ASTM C 230, five drops in 30 seconds.)
  - ii. Flowable for 15 minutes.
  - iii. Fluid working time of at least 30 minutes.
- c. The grout when tested shall not bleed at maximum allowed water content.
  - d. The non-shrink property shall not be based on a chemically generated gas or gypsum expansion.

B. Class III Non-Shrink Epoxy Grout

1. Epoxy grout shall be a pourable, non-shrink, 100 percent solids system. The epoxy grout system shall have three components; resin, hardener, and specially blended aggregate, all premeasured and prepackaged. The resin component shall not contain any non-reactive diluents. Resins containing butyl glycidyl ether (BGE) or other highly volatile and hazardous reactive diluents shall not be used. Component ratios shall not be varied unless specifically recommended by the manufacturer. Manufacturer's instructions shall be printed on each container in which the materials are packaged. Epoxy grout shall be Five Star Epoxy Grout by Five Star Products, Inc., Ceilcote 648 by Master Builders, or equal.
2. The vertical volume change at all times before hardening shall be between 0.0 percent shrinkage and 4.0 percent expansion when measured according to ASTM C 827 (modified for epoxy grouts by using an indicator ball with a specific gravity between 0.9 and 1.1). Alternatively, grouts which maintain an effective bearing area of at least 95 percent are acceptable
3. The length change after hardening shall be negligible (less than 0.0006 in/in) and the coefficient of thermal expansion shall be less than 0.00003 in/in/F when tested according to ASTM C 531.
4. The compressive creep at one year shall be negligible (less than .001 in/in) when tested under a 400 psi constant load at 140 degrees F according to ASTM C 1181.
5. The 7-day compressive strength shall be a minimum of 14,000 psi when tested according to ASTM C 579.
6. The grout shall be capable of maintaining at least a flowable consistency for a minimum of 30 minutes at 70 degrees F.
7. The shear bond strength to portland cement concrete shall be greater than the shear strength of the concrete when tested according to ASTM C 882.

## 2.03 TOPPING AND FILL GROUT

- A. Grout for topping of slabs and fill for built-up surfaces of tank, channel, and basin bottoms shall be composed of cement, fine aggregate, coarse aggregate, water, and admixtures proportioned and mixed as specified herein. All materials and

procedures specified for normal concrete in Section 03300, Cast-In-Place Concrete, shall apply except as noted otherwise herein.

- B. Topping and fill grout shall contain a minimum of 564 pounds of cement per cubic yard with a maximum water cement ratio of 0.45. Where concrete fill is thicker than 3 inches, structural concrete, as specified in Section 03300, may be used when accepted by Engineer.
- C. Coarse aggregate shall be graded as follows.

<u>Sieve Size</u>	<u>Percentage Passing</u>
1/2-inch	100
3/8-inch	90-100
No. 4	20-55
No. 8	5-30
No. 16	1-10
No. 30	0

- D. Final mix design shall be as determined by trial mix design under supervision of the approved testing laboratory.
- E. Minimum compressive strength of topping and fill grout at the end of 28 days shall be 4,000 psi.

#### 2.04 CURING MATERIALS

- A. Curing materials shall be as specified in Section 03300 for topping and fill grouts and as recommended by the manufacturer of prepackaged grouts.

#### 2.05 CONSISTENCY

- A. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is such that the grout is plastic and moldable but will not flow.
- B. The slump for topping grout and concrete fill shall be adjusted to match placement and finishing conditions but shall not exceed 4 inches.

### **PART 3 – EXECUTION**

#### 3.01 GENERAL

- A. The manufacturers of prepackaged non-shrink grouts shall provide on-site technical assistance upon request.
- B. Base concrete or masonry must have attained its design strength before grout is placed, unless authorized by Engineer.

- C. When cementitious grouts are used on concrete surfaces, the concrete surface shall be saturated with water for 24 hours prior to placement of the grout. Upon completion of saturation period excess water shall be removed prior to grouting with clean (oil free) compressed air. Concrete substrate shall not be wet prior to placement of epoxy grout.

### 3.02 GROUTING PROCEDURES

- A. All mixing, surface preparation, handling, placing, consolidation, curing, and other means of execution for prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer. Grouts shall be machine-mixed in a mortar mixer.
- B. Baseplate grouting for equipment shall be in accordance with Section 11050, Equipment Supports and Foundations.
- C. Grouting for Non- Equipment Baseplates
  1. For base plates, the original concrete shall be blocked out or finished off a sufficient distance below the plate to provide for a one-inch thickness of grout or a thickness as shown on the Drawings.
  2. All surfaces that will be in contact with grout shall be free of grease, oil, dirt, loose rust, curing compounds, laitance, loose concrete and other deleterious materials.
  3. The base plate shall be set in position at the proper elevation by steel wedges or double nuts on the anchor bolts. Where the plate size or configuration dictates, air relief holes shall be drilled in the base plate to minimize the potential for trapped air. Liquid tight forms shall then be placed around the baseplate with pouring clearance provided on one side and 45 degrees slopes formed on the other sides. Forms shall be coated as recommended by the grout manufacturer for easy form release. The grout shall be placed in a flowable or fluid consistency from one side only allowing the grout to flow to the opposite side and completely fill the space up to the bottom of the base plate. Techniques and procedures shall follow those presented in the pre-installation demonstration.
  4. Column and beam base plates, grouted with Class II grout, which are less than 200 square inches in area, may be grouted by the dry pack method. The grout shall be of a trowel able consistency and tamped or ridded solidly into the space between the plate and the base concrete.
  5. Cementitious grouts shall be trimmed to form a uniform 45 degrees smooth fillet from the bottom edge of the base plate on each side prior to final set.
- D. Topping and Fill Grout
  1. All mechanical, electrical, and finish work shall be completed prior to placement of topping or fill grout. The base slab shall be given a roughened textured surface by sandblasting or hydroblasting to expose the aggregates

and produce a 3/16-inch amplitude roughness. Jackhammers or chipping hammers shall not be used.

2. The minimum thicknesses shall be one inch for topping grout and 1-1/2 inches for fill grout. Where the finished surface of grout is to form an intersecting angle of less than 45 degrees with the concrete surface it is to be placed against, a key shall be formed in the concrete surface at the intersection point. The key shall be a minimum of 3-1/2-inches wide by 1-1/2-inches deep so as to maintain a minimum thickness of 1-1/2-inches.
3. The base slab shall be thoroughly cleaned and wetted to a saturated surface dry condition, prior to placing topping and fill. No grout shall be placed until the slab is completely free from standing pools or ponds of water. A thin coat of Type II cement slurry shall be broomed into the surface of the slab just before topping or fill placement. The cement slurry shall not be allowed to dry before topping placement. If it does dry, it must be immediately removed using wet stiff brooms and reapplied. The topping and fill grouts shall be compacted by rolling or tamping, brought to established grade, and floated. Fill grouts for tank and basin bottoms where scraping mechanisms are to be installed shall be screeded by blades attached to the revolving mechanism of the equipment in accordance with the procedures outlined by the equipment manufacturer after the grout is brought to the established grade. Coat surface with evaporation retardant to prevent plastic shrinkage cracks.
4. Topping grout placed on sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the placement.
5. The surface shall be tested with a straight edge to detect high and low spots which shall be immediately eliminated. When the topping and fill has hardened sufficiently, it shall be steel troweled to a smooth surface free from pinholes and other imperfections. An approved type of mechanical trowel may be used as an assist in this operation, but the last pass over the surface shall be by hand-troweling. During finishing, no water, dry cement or mixture of dry cement and sand shall be applied to the surface.
6. As soon as topping or fill finishing is completed, coat surface with curing compound. After the topping is set and sufficiently hard in clarifiers and where required by Engineer, the tank shall be filled with sufficient water to cover the entire floor for 14 days.

### 3.03 CONSOLIDATION

- A. Grout shall be placed in such a manner, for the consistency necessary for each application, so as to assure that the space to be grouted is completely filled.
- B. Following the curing period, conduct a soundness test in the presence of Engineer, by tapping a hammer against all grout surfaces to detect areas with weak adhesion to the base slab. Areas found to have weak adhesion or voids between the grout and base slab shall have the defective grout chipped out, removed, and replaced to obtain grout with strong adhesion and no voids.

**\*\*END OF SECTION\*\***



## SECTION 05501

### ANCHOR BOLTS

#### PART 1 – GENERAL

##### 1.01 SUMMARY

- A. Contractor shall select, furnish, and install anchor bolts in accordance with the Contract Documents.

##### 1.02 REFERENCED DOCUMENTS

- A. The following documents are referenced in this section.

Reference	Title
ANSI B18.2.1	Square and Hex Bolts and Screws (Inch Series)
ANSI B18.2.2	Square and Hex Nuts (Inch Series)
ASTM A 36	Carbon Structural Steel
ASTM A 307	Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
ASTM A 320	Alloy-Steel Bolting Materials for Low-Temperature Service

##### 1.03 CONTRACTOR SUBMITTALS

- A. Provide submittals in accordance with 01300, “Submittals” of these Specifications.
- B. Submittals shall include product data for all materials, ICBO testing reports, and installation instructions from manufacturers.
- C. For cast in place anchor bolts, submittals shall include Shop Drawings for each set of anchor bolts, complete with material designations, dimensions, and details for sleeves.
- D. For anchor bolts installed into core drilled cavities for retrofit or modification installations, submit details of the proposed anchor bolts, sleeves, and other items.

##### 1.04 QUALITY ASSURANCE

- A. For applications that require special inspection in accordance with the Technical Specifications or applicable building codes, Contractor shall coordinate the inspection activities to ensure that the special inspector is present for the required operations. Contractor shall provide at least 7 days prior written notice to Engineer and the special inspector for operations that require special inspection.

- B. During special inspection, Contractor shall provide access, lighting, safety equipment, and scaffolding, as necessary for the inspections. If scaffolding is required for the inspections, Contractor shall provide workers to move and relocate the scaffolding as required to provide access to all areas for inspection purposes.

## **PART 2 - PRODUCTS**

### **2.01 GENERAL**

- A. Contractor shall provide anchor bolts using design data provided in accordance with the requirements in Section 11000, Equipment General Requirements, the requirements in the Technical Specifications, and as indicated on the Drawings.
- B. Anchor Bolt Type Requirements
  - 1. Anchor bolts for the following service shall be cast in place with concrete foundations, slabs, walls, or other structure components.
    - a. Engine-driven equipment.
    - b. Pumps, blowers, and mechanical equipment.
    - c. Anchor bolts that are embedded in structural elements other than foundations, slabs, and walls. Such locations include, but are not limited to, pedestals, beams, columns, and other similar structural elements.
    - d. Locations where anchor bolts are likely to have service temperatures greater than 120 degrees F, where equipment or structural systems are required to resist heat from normal or abnormal operation, where the supported items are components of a fire protection system, or where the supported items are required to function during potential fire conditions.
    - e. Locations where anchor bolts are inside chemical containment areas.
    - f. Locations where anchor bolts are exposed to splash, spillage, and vapors from chemicals.
    - g. Locations where anchor bolts can be exposed to grease, oil, fuel, solvents, or other chemicals.
    - h. Locations indicated in the Contract Documents.
  - 2. Cast In Place Anchor Bolt Details
    - a. Provide a steel pipe sleeve with an inside diameter at least 2 inches greater than the bolt diameter. The sleeve shall be at least 6 inches long for anchor bolts up to size 1 3/8-inch and at least 12 inches long for greater sizes.
    - b. At the bottom of the sleeve weld a square plate of minimum thickness 1/4 inch. The anchor bolt shall be inserted through a drilled, concentric hole in the plate and welded to the plate.

- c. The embedment anchor bolt length shall be at least 10 inches for sizes up to 7/8 inch size, 18 inches for sizes up to 1 3/8 inches, and 24 inches for greater sizes.
  - d. Fill the cavity between the anchor bolt and sleeve with a polyurethane filler material foamed into place. Apply tape or putty to the anchor bolt threads to prevent bond with the baseplate grout.
  - e. Cast anchor bolts into the structural slabs or members to provide the total embedment lengths required for each application.
  - f. On retrofit or modification installations, core drill a cavity for the anchor bolt and sleeve assembly and grout the assembly into the base slab using Class III non-shrink grout per Section 03600, Grout. Submit details of grouted anchor bolts for review by Engineer.
  - g. For cast in place anchor bolts, the bolts shall be threaded only on the top ends, as necessary for the installation. Rod threaded for its entire length shall not be used.
- 3. Adhesive anchor bolts may be used for any service or location not indicated as required for cast in place anchor bolts in the above list.
  - 4. Expansion anchor bolts may be used for support of heating, cooling, and other air ducts; support for piping of size 8-inch and less; support for electrical conduit and cable trays; and support for equipment that weighs less than 400 pounds.
  - 5. Where indicated to be a specific type in the Technical Specifications or Drawings, those specific types shall be provided.
  - 6. The minimum anchor bolt sizes shall be 5/8-inch for equipment, 1/2-inch for pipe supports, and 3/8-inch for light duty applications such as conduit supports and small channel supports for small piping.

## 2.02 MATERIALS

- A. Materials for anchor bolts shall be in accordance with the following requirements.
  - 1. Anchor bolts for this Project shall be stainless steel in accordance with ASTM A 320, Type 316.
- B. Bolt Requirements
  - 1. The nuts shall be capable of developing the full strength of the bolts. All bolts and cap screws shall have hexagon heads.
  - 2. Bolts shall be ANSI B18.2.1 hexagon bolts with ANSI B18.2.2 heavy hexagon nuts.
  - 3. The length of all bolts shall be such that after joints are made up, each bolt shall extend through the entire nut, but in no case more than 1/2-inch beyond the nut.
- C. Adhesive Anchors

1. Epoxy adhesive systems shall be ITW Ramset/Redhead Epcon System or Masterbuilders Concreseive Epoxy Cartridge Dispensing System and Concreseive Paste LPL.
  2. For adhesive anchor bolts, the anchor bolt rods shall be threaded for their entire length.
- D. Expanding-Type Anchors
1. Expanding-type anchors shall be steel wedge-type ITW Ramset/Redhead anchors, McCulloch Industries Kwick-Bolt, or equal. Lead caulking anchors or other types of non-structural anchors shall not be used.

## **PART 3 – EXECUTION**

### **3.01 CONSTRUCTION REQUIREMENTS**

- A. Install anchor bolts in accordance with the manufacturer's printed instructions. In addition, review the applicable ICBO reports to determine if there are any limitations associated with installation procedures.
- B. Use equipment Shop Drawings to determine anchor bolt layout dimensions. Install anchor bolts using accurate templates. At least 16 hours in advance of concrete placement, notify Engineer to obtain observation of the anchor bolt layout checking procedure by Contractor. Any required corrections to anchor bolt locations shall be made before the end of the day in advance of concrete placement.
- C. Support anchor bolts firmly in the correct positions and check bolt positions as concrete is placed and finished.
- D. For adhesive anchor bolts, install the bolts in holes drilled using percussion drilling equipment to produce holes with roughened surfaces.

**\*\*END OF SECTION\*\***

## SECTION 08600

### ALUMINUM ACCESS HATCHES

#### PART 1 – GENERAL

##### 1.01 SECTION INCLUDES

- A. Access hatches
- B. Provide fall protection grates where indicated.

##### 1.02 SUBMITTALS

- A. Product Data
  - 1. Manufacturer's standard catalog information, drawings, specifications and accessories.
  - 2. Storage, handling and installation instructions.
  - 3. Anchorage details to the surrounding concrete, details of the recessed locking mechanism, safety grate details, and details of the compression spring lifting mechanism.

##### 1.03 PERFORMANCE REQUIREMENTS

- A. Structural Design:
  - 1. Standard Weight Design Requirements: Design access hatch with ¼- inch aluminum plate, reinforced to withstand a live load of 300 pounds per square foot with a maximum deflection of 1/150 of the span.
  - 2. Traffic Loading Design Requirements: Design access hatch with ¼-inch aluminum diamond pattern plate, reinforced to withstand an H-20 highway load with a maximum deflection of 1/150 of the span.
- B. Operation: Smooth and easy opening and closing with controlled operation throughout the entire arc of opening and closing, regardless of ambient temperature. Provide lifting mechanism that retards downward motion of the cover when closing to prevent quick closing and slamming.

#### PART 2 – PRODUCTS

##### 2.01 MANUFACTURERS

- A. Manufacturers: One of the following or equal:
  - 1. Bilco.

2. Flygt.
3. Halliday Products, Inc.

## 2.02 ACCESS HATCHES

- A. Sizes and Design Loading Requirements: As indicated on the Drawings. Sizes indicated reflect the clear opening required for each access hatch.
- B. Access Hatches
  1. Double leaf or single leaf as indicated on the Drawings.
  2. Provide each leaf with a minimum of two compression spring lifting mechanisms designed to prevent the entry of dirt and foreign matter into compression spring housing.
  3. Provide recessed padlock hasp covered by flush hinged lid.
  4. Leafs: Diamond pattern, milled aluminum, ¼-inch thickness, ASTM B 221, Alloy 5086. Reinforce as necessary to comply with design loading requirements.
  5. Leaf Gaskets: EPDM or neoprene gasket, mechanically attached to the access hatch frame.
  6. Type 316 stainless steel hardware throughout.
- C. Hatch Hinges
  1. Heavy forged aluminum with ¼-inch diameter stainless steel hinge pins provided, designed to pivot so the cover does not protrude into the channel frame.
  2. Specifically designed for horizontal installation.
  3. Through bolted to the covers with tamperproof Type 316 stainless steel lock bolts and through bolted to the frame with Type 316 stainless steel bolts and locknuts.
- D. Lifting Mechanisms: Compression spring-type mechanism within a telescoping tube. Provide automatic hold-open arms with release handles. Attach lower tube of lifting mechanism to a flanged support shoe fastened to a formed 1/4" gusset support plate.
- E. Locking Mechanisms:
  1. Exterior: Provide recessed padlock hasp covered by flush hinged lid (padlock to be supplied by Owner) and removable turn/lift handle with spring loaded ball detent to open the cover. Protect latch release by a flush, gasketed, removable screw plug.
  2. Interior: Provide Type 316 stainless steel snap lock with fixed handle mounted on the underside of the cover.

- F. Frame: Aluminum channel frame, ¼-inch thickness, ASTM B221 alloy 6063-T5, with a perimeter anchor flange with anchor tabs around the perimeter.
- G. Provide a 1-1/2 inch drainage coupling, zinc plated and chromate sealed, in a corner of the channel frame.
- H. Finish
  - 1. Mill-finish with one of the following applied to the exterior of the frame:
    - a. Carboline “Bitumastic Super Service Black,”
    - b. Tnemec “46-499 Heavy Duty Black”.
    - c. Valspar “High-Build Bitumastic Coating 35-T-10”.

## 2.03 FALL PROTECTION GRATE

- A. Underlying aluminum or fiberglass safety grates to allow inspection of the wet well while providing fall-through protection. Safety grates:
  - 1. Designed to withstand a live load of 300 lb/ft<sup>2</sup> with a maximum deflection of 1/150 of the span.
  - 2. Fabricated from aluminum flat bars.
  - 3. Openings between flat bars shall be not less than 4” x 4” to facilitate visual inspection.
  - 4. Provided with a hinging system that will lock the grate in the 90° open position.
  - 5. Provide an aluminum open arm with red vinyl grip.
  - 6. Paint safety grates safety orange.

## PART 3 – PRODUCTS

### 3.01 INSTALLATION

- A. Install in accordance with the manufacturer’s instructions.
- B. Install access hatch with frame set level and flush with the surrounding surface.
- C. Coat the exterior surfaces of hatch frames with a bituminous paint.
- D. Connect a 1-½ inch diameter copper drain pipe to the drainage coupling on the hatch frame and route the drain pipe to the nearest drain.

3.02 ACCESS HATCH SCHEDULE

Location	Quantity	Opening Size	Design	Safety Grates	Style
1. Anchor Pump Station Wet Well	1	2.5' x 3'	H-20	Required	Single Leaf
2. Anchor Pump Station Valve Vault	1	5' x 5''	H-20	Not Required	Double Leaf
3. Anchor Pump Station Flow Meter Vault	1	4' x 6'	H-20	Not Required	Double Leaf
4. Package Lift Station Wet well	1	2-5' x 3'	300 lb/ft <sup>2</sup>	Required	Single Leaf
5. Package Lift Station Wet well	1	2-5' x 3'	300 lb/ft <sup>2</sup>	Not Required	Single Leaf
6. Package Lift Station	1	2'x2'	300 lb/ft <sup>2</sup>	Not Required	Single Leaf

**\*\*END OF SECTION\*\***



## SECTION 09900

### PAINTING

#### PART 1 – GENERAL

##### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Division 1 Specification Sections, apply to this Section.

##### 1.02 SUMMARY

- A. This Section includes surface preparation and field painting of the following:
  - 1. Exposed exterior items and surfaces.
  - 2. Exposed interior items and surfaces.
  - 3. Surface preparation of new and existing surfaces, priming, and finish coats specified in this Section are in addition to prepping, shop priming and surface treatment specified in other Sections.
- B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Engineer will select from standard colors and finishes available.
  - 1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.
- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
  - 1. Prefinished items include the following factory-finished components:
    - a. Finished mechanical and electrical equipment.
    - b. Light fixtures.
    - c. Distribution cabinets.
  - 2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
    - a. Furred areas.
    - b. Ceiling plenums.

- c. Utility tunnels.
- d. Pipe spaces.
- 3. Finished metal surfaces include the following:
  - a. Anodized aluminum.
  - b. Stainless steel.
  - c. Chromium plate.
  - d. Copper.
  - e. Bronze and brass.
- 4. Operating parts include moving parts of operating equipment and the following:
  - a. Valve and damper operators.
  - b. Linkages.
  - c. Sensing devices.
  - d. Motor and fan shafts.
- 5. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

### 1.03 RELATED SECTIONS

- A. Section 09960 “High-Performance Coatings” for special paint coatings.

### 1.04 DEFINITIONS

- A. General: Standard coating terms defined in ASTM D 16 apply to this Section.

### 1.05 SUBMITTALS

- A. All finishes requiring color shall be submitted in one complete package. Partial submittals will not be allowed in accordance with section 01300, Submittals.
- B. Product Data: For each paint system specified. Include block fillers and primers.
  - 1. Material List: Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
  - 2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
  - 3. Certification by the manufacturer that products as supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

- C. Samples for Verification: Of each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.
  - 1. Provide Samples of each color defining each separate coat, including block fillers and primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and texture are achieved.
- D. At completion of Work of this Section, submit manufacturer's or distributor's numbered invoices showing type and quantity of products used on this Project.

#### 1.06 QUALITY ASSURANCE

- A. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.
- B. Coordination of Work: Review other sections in which primers are provided to ensure compatibility of the total systems for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
  - 1. Notify Engineer of problems anticipated using the materials specified.
- C. Field Samples, Interior: Provide a full-coat benchmark finish sample of each type of coating and substrate required on the Project. Comply with procedures specified in PDCA P5. Duplicate finish of approved prepared samples.
  - 1. The Project Inspector or Engineer will select one room or surface to represent surfaces and conditions for each type of coating and substrate to be painted. Apply coatings in this room or surface in accordance with the schedule or as specified. After finishes are accepted, this room or surface will be used for evaluation of coating systems of a similar nature.
- D. Material Quality: Provide the manufacturer's best quality, top of the line paint material of the various coating types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
  - 1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

## 1.08 PROJECT CONDITIONS

- A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 deg F.
- B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 deg F.
- C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
  - 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

## 1.09 EXTRA MATERIALS

- A. Furnish extra paint materials from the same production run as the materials applied in the quantities described below. Package paint materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to the Owner.
  - 1. Quantity: Furnish the Owner with 5 gallons of each color or type applied. Containers must be delivered unopened

## **PART 2 – PRODUCTS**

### 2.01 MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
  - 1. Benjamin Moore
  - 2. Dunn-Edwards Paints.
  - 3. Frazee Paints.
  - 4. ICI Dulux Paint.
  - 5. PPG Industries, Inc. (PPG).
  - 6. Sherwin Williams.
- B. Basis of Design: Products listed within this specification section are manufactured by Frazee Paint Company San Diego, CA tel: (800) 477-9991, web: [www.frazeepaint.com](http://www.frazeepaint.com), and have been established as the basis of design for esthetics purposes and performance standards

## 2.02 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

## PART 3 – EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.
  - 1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
  - 2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

### 3.02 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.
  - 1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
  - 2. Clean all existing exterior and interior surfaces to be refinished of all dirt, dust, oil, grease, oxidized loose and scaly paint film, mildew, rust on metal and other foreign substances by combination of the following methods:
- C. Repairs: Repair all cracks, holes and voids in surfaces to be refinished with suitable and matching repair compounds to insure permanency to the surfaces compatible to the painting systems to follow. Fill, float, sand and texture to match adjacent surfaces. Allow repair compounds to fully dry prior to priming and applying final coats of paint.
  - 1. Prepare wood surfaces in a similar procedure as noted above, and else within this section.

- D. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
1. Cementitious Materials: Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
    - a. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's written instructions.
  2. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.
    - a. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
    - b. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.
  3. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- E. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
  2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
  3. Use only thinners approved by paint manufacturer and only within recommended limits.

### 3.03 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
1. Paint colors, surface treatments, and finishes are indicated in the schedules.
  2. Provide finish coats that are compatible with primers used.

3. The number of coats and film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where sanding is required to produce an even smooth surface in accordance with the manufacturer's directions.
  4. Apply additional coats when undercoats, stains, or other conditions show through final coat of paint until paint film is of uniform finish, color, and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.
  5. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
  6. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
  7. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
  8. Paint back sides of access panels and removable or hinged covers to match exposed surfaces, unless finish is stainless steel.
  9. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
- B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
- C. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer and specified.
- D. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.
- E. Mechanical items to be painted include, but are not limited to, the following:
1. Piping, pipe hangers, and supports.
  2. Heat exchangers.
  3. Tanks.
  4. Ductwork.
  5. Insulation.
  6. Motors and mechanical equipment.
  7. Accessory items.

- F. Electrical items to be painted include, but are not limited to, the following:
  - 1. Conduit and fittings.
  - 2. Switchgear.
  - 3. Panelboards.
- G. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.
- H. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- I. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specified requirements.

### 3.04 CLEANING

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
  - 1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

### 3.05 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Project Engineer.
- B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
  - 1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA Standard P1-92 "Touch-Up Painting and Damage Repair – Financial Responsibility".



### 3.06 EXTERIOR PAINT SCHEDULE

- A. Ferrous Metals in immersion or/and corrosive environment (wet well, pump pits, valve vault, meter vault) – Refer to Section 09960 High-Performance Coatings.
- B. Galvanized Metals – Refer to Section 09960 High-Performance Coatings.

**\*\*END OF SECTION\*\***

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## SECTION 09960

### HIGH-PERFORMANCE COATINGS

#### PART 1 - GENERAL

##### 1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

##### 1.02 SUMMARY

- A. This Section includes surface preparation and painting of the following:
  - 1. Exposed metals (ferrous and non-ferrous).

##### 1.03 SUBMITTALS

- A. All finishes requiring color shall be submitted in one complete package. Partial submittals will not be allowed.
- B. Product Data: For each coating system indicated. Include block fillers and primers.
  - 1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference the specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
  - 2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each material specified.
- C. Certification by manufacturer that products supplied comply with requirements indicated that limit the amount of VOCs in coating products.
- D. Samples for Verification: Of each color and material to be applied, with texture to simulate actual condition, on representative samples of the actual substrate.
  - 1. Submit samples on the following substrates for Engineer's review of color and texture:
    - a. Ferrous and Nonferrous Metal: Provide two 4-inch square samples of flat metal and two 8-inch long samples of solid metal for each color and finish.
    - b. Concrete: Provide two 4-inch- (100-mm-) square samples for each color and finish.

- E. At completion of Work of this Section, submit manufacturer's or distributor's numbered invoices showing type and quantity of products used on this Project.

#### 1.04 QUALITY ASSURANCE

- A. **Applicator Qualifications:** Engage an experienced applicator who has completed high-performance coating system applications similar in material and extent to those indicated for Project and whose work has a record of successful in-service performance.
- B. **Source Limitations:** Obtain primers and undercoat materials for each coating system from the same manufacturer as the finish coats.

#### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label with the following information:
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
  - 1. Protect materials from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and applying coatings.

#### 1.06 PROJECT CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 45 and 95 deg F or manufacturers recommendations.
- B. Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
  - 1. Allow wet surfaces to dry thoroughly and attain temperature and conditions specified before proceeding with or continuing coating operation.

#### 1.07 EXTRA MATERIALS

- A. Furnish extra high-performance coating materials from the same production run as materials applied and in quantities described below. Package coating materials in unopened, factory-sealed containers for storage and identify with labels describing contents.

1. Quantity: Furnish an additional 5 gallons, as appropriate, of each material and color applied. Contractor shall furnish two copies of the mixing formula to the Engineer in addition to the instructions attached to paint containers.

## **PART 2 - PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Products: Subject to compliance with requirements, provide one of the products indicated in the coating system descriptions.
  1. Carboline Company (Carboline).
  2. Frazee ; Ameron International
  3. ICI Dulux Paints; Devoe Coatings (ICI).
  4. Pittsburgh Paint; PPG Industries, Inc. (PPG).
  5. Tnemec Company, Inc.
  6. Dunn-Edwards Paints; International Coatings

### **2.02 COATINGS MATERIALS, GENERAL**

- A. Material Compatibility: Provide primers, undercoats, and finish-coat materials that are compatible with one another and substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Material Quality: Provide manufacturer's highest grade of the various high-performance coatings specified. Materials not displaying manufacturer's product identification are not acceptable.
  1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
- C. VOC Classification: Provide high-performance coating materials, including primers, undercoats, and finish-coat materials, that have a VOC classification of 450 g/L or less.

### **2.03 COLORS**

- A. Colors: To be selected by Engineer if not noted on drawings.

### **2.04 HIGH-PERFORMANCE COATING SYSTEMS**

- A. All exterior exposed metals (ferrous and non-ferrous) shall be painted with products specified above in this Section 09960.

- B. Specification is based on products manufactured by International Coatings and distributed by Dunn-Edwards Paints.
1. Ferrous Metal (pipes, valves, supports): Provide the following finish system in dry mil thicknesses as shown, over exterior ferrous-metal surfaces:
 

1 coat	Int'l INTERSEAL 670 HS High-build surface tolerant epoxy primer	(min. 4 dry mils)
1 coat	Int'l INTERTHANE 990 HS Acrylic polyurethane enamel	(max. 3 dry mils)
  2. Non-Ferrous and Galvanized Metal (where indicated on the Plans for coating): Provide the following finish system in dry mil thicknesses as shown, over exterior non-ferrous-metal surfaces:
 

1 coat	Int'l INTERSEAL 670 HS High-build surface tolerant epoxy primer	(min. 4 dry mils)
1 coat	Int'l INTERTHANE 990 HS Acrylic polyurethane enamel	(max. 3 dry mils)

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. With Applicator present, examine substrates and conditions under which high-performance coatings will be applied, for compliance with coating application requirements.
1. Apply coatings only after unsatisfactory conditions have been corrected and surfaces to receive coatings are thoroughly dry.
  2. Start of application is construed as Applicator's acceptance of surfaces within that particular area.
- B. Coordination of Work: Review other Sections in which primers or other coatings are provided to ensure compatibility of total systems for various substrates. On request, furnish information on characteristics of specified finish materials to ensure compatible primers.

### **3.02 PREPARATION**

- A. General: Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
1. After completing coating operations, reinstall items that were removed; use workers skilled in the trades involved.

- B. **Cleaning:** Before applying high-performance coatings, clean substrates of substances that could impair bond of coatings. Remove oil and grease before cleaning.
1. Schedule cleaning and coating application so dust and other contaminants from cleaning process will not fall on wet, newly coated surfaces.
- C. **Surface Preparation:** Clean and prepare surfaces to be coated according to manufacturer's written instructions for each substrate condition and as specified.
1. Provide barrier coats over incompatible primers or remove primers and reprime substrate.
  2. **Ferrous-Metal Substrates:** Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC recommendations.
  3. **Nonferrous-Metal Substrates:** Clean nonferrous and galvanized surfaces according to manufacturer's written instructions for the type of service, metal substrate, and application required.
  4. **Cementitious Substrates:** Prepare concrete, brick, concrete masonry block, and cement plaster surfaces to be coated. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods to prepare surfaces.
    - a. Use abrasive blast-cleaning methods if recommended by coating manufacturer.
    - b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not coat surfaces if moisture content exceeds that permitted in manufacturer's written instructions
- D. **Material Preparation:** Carefully mix and prepare coating materials according to manufacturer's written instructions.
1. Maintain containers used in mixing and applying coatings in a clean condition, free of foreign materials and residue.
  2. Stir materials before applying to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into the material. Remove film and, if necessary, strain coating material before using.
  3. Use only the type of thinners approved by manufacturer and only within recommended limits.
  4. Coating colors, surface treatments, and finishes are indicated in the coating system descriptions.
  5. Provide finish coats compatible with primers used.

6. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, grilles, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
    - a. Coat surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
    - b. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
- E. Scheduling Coating: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for coating as soon as practicable after preparation and before subsequent surface deterioration.
1. The number of coats and film thickness required is the same regardless of application method.
    - a. Omit primer on metal surfaces that have been shop primed and touchup painted.
    - b. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer.
    - c. Where manufacturer's written instructions require sanding, sand between applications to produce a smooth, even surface.
    - d. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until coating has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat does not cause undercoat to lift or lose adhesion.
  2. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance. Give special attention to edges, corners, crevices, welds, exposed fasteners, and similar surfaces to ensure that they receive a dry film thickness equivalent to that of flat surfaces.
- F. Application Procedures: Apply coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. Brush Application: Use brushes best suited for material applied and of appropriate size for the surface or item being coated.
    - a. Apply primers and first coats by brush unless manufacturer's written instructions permit using roller or mechanical applicators.
    - b. Brush out and work brush coats into surfaces in an even film.
    - c. Eliminate cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Neatly draw glass lines and color breaks.



2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by manufacturer for the material and texture required.
  3. Spray Equipment: Use mechanical methods to apply coating if permitted by manufacturer's written instructions and governing regulations.
    - a. Use spray equipment with orifice size recommended by manufacturer for material and texture required.
    - b. Apply each coat to provide the equivalent hiding of brush-applied coats.
    - c. Do not double back with spray equipment building-up film thickness of two coats in one pass, unless recommended by manufacturer.
- G. Minimum Coating Thickness: Apply each material no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness of the entire system as recommended by manufacturer.
- H. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
- I. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by manufacturer, to material required to be coated or finished that has not been prime coated by others.
  1. Recoat primed and sealed substrates if there is evidence of suction spots or unsealed areas in first coat, to ensure a finish coat with no burn-through or other defects caused by insufficient sealing.
- J. Insert requirements for electrostatically applying coatings on metal substrates if process is acceptable to manufacturer.
- K. Completed Work: Match approved Samples for color, texture, and coverage. Remove, refinish, or recoat work that does not comply with specified requirements.
- L. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

### 3.03 APPLICATION

- A. General: Apply high-performance coatings according to manufacturer's written instructions.
  1. Use applicators and techniques best suited for the material being applied.
  2. Do not apply high-performance coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to forming a durable coating film.
  3. Apply second coat only after the first coat is thoroughly dry.

### 3.04 CLEANING

- A. Cleanup: At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
  - 1. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

### 3.05 PROTECTION

- A. Protect work of other trades, whether being coated or not, against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Engineer, and leave in an undamaged condition.
  - 1. Provide "Wet Paint" signs to protect newly coated finishes. After completing coating operations, remove temporary protective wrappings provided by others to protect their work.
  - 2. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces. Comply with procedures specified in PDCA P1.

**\*\*END OF SECTION\*\***

## SECTION 09962

### WET WELL LINING

#### PART 1 – GENERAL

##### 1.01 DESCRIPTION OF WORK

- A. This section specifies rehabilitating concrete wet well walls and coating for the wet wall walls, bottom slab and underside of the top slab.

##### 1.02 SUBMITTALS

- A. The Contractor shall provide submittals in accordance with Section 01300 - Submittals.
- B. The Contractor shall at minimum submit the following:
  - 1. Submit product technical data acknowledging that products meet requirements of standards referenced.
  - 2. Submit shop drawings and catalog cuts for underlayment, filler compounds and epoxy top coat surfacing.
    - a. Include application equipment.
  - 3. Submit experience requirement documentation and experience references.

##### 1.03 QUALITY ASSURANCE

- A. Manufacturer: Shall have a minimum of 5 years experience manufacturing products for rehabilitating manholes.
- B. Contractor/Applicator: Shall have a minimum of 2 years experience or 3 projects applying the manufacturer's product.
- C. All materials must comply with Placer County Air Pollution Control District requirements and restrictions.
- D. Spark testing of rehabilitated manholes will be required. Successful spark testing (i.e. no pinholes/holidays) will be required for payment.

#### PART 2 – MATERIALS

##### 2.01 GENERAL

- A. Manufacturer: The products indicated are manufactured by Sauereisen to indicate the character and quality of material to be provided. Similar products manufactured by Con-Tec or equal may be provided subject to review and approval by the Engineer.

## 2.02 UNDERLAYMENT

- A. Type: Hydraulic cement based.
- B. Strength:
  - 1. 28-day compressive strength: 3,500 psi, minimum.
- A. Material:
  - 1. Sauereisen F-120;
  - 2. Con-tec equivalent;
  - 3. or equal.

## 2.03 FILLER COMPOUND

- A. Type: Epoxy.
- B. Strength: Compressive Strength: 10,000 psi (ASTM C579), Flexural Strength: 4,000 psi (ASTM C580)
- C. Material:
  - 1. Sauereisen 209;
  - 2. Con-tec equivalent;
  - 3. or equal.

## 2.04 TOP COAT

- A. Type: Aggregate filled epoxy.
- B. Strength: Compressive: 6,800 psi (ASTM C579).
- C. Material:
  - 1. Sauereisen 210 or 210S;
  - 2. Hydro Pox by Cont-Tec;
  - 3. or approved equal.

## **PART 3 – EXECUTION**

### 3.01 PREPARATION

- A. Cut off and remove existing manhole steps.
- B. Shotblast, abrasive blast or high pressure water blast existing concrete to solid material.

- C. Spent abrasives, concrete and debris shall be captured within the structure and removed for proper disposal. Debris shall not be allowed to be carried into the piping where it could block sewage flow.

### 3.02 SEALING

- A. Seal active leaks with quick setting hydraulic current grout (Hydro Plug, Sauereisen Insta Plug or equal).
- B. Fill/patch cracks, holes and voids with filler compound.

### 3.03 WALL BUILD UP

- A. Build up wall thickness removed during blasting/jetting of deteriorated surfaces.
- B. Build up material shall be underlayment compound.
- C. Build out to make a smooth, firm surface for top coat application. Minimum thickness ½-inch.
- D. Trowel or spray apply.

### 3.04 TOP COAT

- A. Allow underlayment compound to cure.
- B. Spray/trowel to 60 mil dry film thickness.

### 3.01 QUALITY ASSURANCE

- A. Top coat shall be spark tested after fully covered.
  - 1. Ventilate manhole. Provide air testing equipment to verify air within the manhole is outside lower explosive limits for methane and hydrogen sulfide.
  - 2. Spark test apparatus shall be Tinker Razor Holiday Detector, Model AP/W or equal.
  - 3. Test voltage shall be 100 volts per mil of coating thickness, and no less than 6,000 volts.
  - 4. Pinholes and holidays identified shall be marked and repaired per coatings manufacturer's recommendations.

**\*\*END OF SECTION\*\***

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## SECTION 10100

### PORTABLE RESTROOM

#### PART 1 – GENERAL

##### 1.01 SECTION INCLUDES

Requirements for temporary relocation of portable restroom, as shown on the Drawings.

##### 1.02 PERFORMANCE REQUIREMENTS

- A. Coordinate relocation of modular restroom with supplier (Mobile Modular, Stephanie Beecher, 925-453-3168) and as shown on the drawings. Mobile Modular will move the trailer. Provide 1 week minimum notice to Mobile Modular to schedule the move.
- B. Contractor to disconnect all piping and power connection prior to Mobile Modular arriving on-site.
- C. Move and install restroom without damaging existing buildings, pavements, utilities, and other improvements adjacent to site.
- D. Provide five (5) 250 gallon sewage holding tanks and pump out service from a professional sanitation company. Connect tanks with watertight piping to create one large tank.
- E. Provide water and power utility connections in accordance with local and national codes including, California Building Code Title 24. Installation of restroom and ramps shall comply with Americans with Disabilities Act (ADA) requirements.
- F. Contractor to reconnect piping and power after restroom has been moved.
- G. Return restroom to its original location at the completion of the project.

##### 1.03 SUBMITTALS

- A. Prepare and submit in accordance with Section 01300.
- B. Submit information as a complete package. Include all items required by the Contract Documents. Incomplete submittals will not be reviewed and will be returned for resubmittal as a complete package.
- C. Service Provider
  - 1. Submit name and contact information for sewage pump out service provider.
- D. Materials:
  - 1. Submit data for holding tank.

2. Submit data for water piping.
3. Submit data for drain piping.

#### 1.04 SCHEDULING

- A. Restroom shall be moved and placed back into service within 2 days for each move. Restroom shall not be out of service for more than 4 days total. Restrooms shall not be out of service on Friday, Saturday, or Sunday.

### **PART 2 – PRODUCTS**

- A. To be selected by the Contractor within the guidelines described in this Section.

### **PART 3 – EXECUTION**

#### 3.01 PREPARATION

- A. Prior to moving the restroom, survey the proposed location for any conflicts with existing utilities or surface features. Determine any areas of conflict and revise the location of the restroom to eliminate these conflicts.
- B. Prior to moving the restroom, flush the drain line with clean water to minimize odors during transport

#### 3.02 MOVING RESTROOM

- A. Disconnect water, sewer, and electrical utilities. Temporarily cap drain lines to prevent water from dripping onto street.
- B. Install wheels and tires onto trailer.
- C. Route new water piping and new electrical wiring to the temporary location.
- D. Coordinate with Mobile Modular to haul restroom to the location shown on the Drawings. Comply with all vehicle codes.
- E. Install restroom at a height to accommodate existing ramp.
- F. When re-installing the restroom, reconnect water supply, drain, and electrical connections.
- G. Repair or replace adjacent property damaged by moving the portable restroom.

#### 3.03 CLEANING

- A. Provide sewage pump out by professional sanitation company twice per week. Pump out shall be performed prior to 8:00 AM on the scheduled day. Coordinate pump out schedule with the City.
- B. City to provide janitorial service for the inside of the restrooms

**\*\*END OF SECTION\*\***



## SECTION 11000

### GENERAL REQUIREMENTS FOR EQUIPMENT

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

###### A. SCOPE

This section specifies general requirements which are applicable to all mechanical equipment. The Contractor is responsible for ensuring that all mechanical equipment meets the requirements of this section in addition to the specific requirements of the individual equipment specification section.

###### B. EQUIPMENT LISTS

Equipment lists, presented in these specifications and as specified on the drawings, are included for the convenience of the Engineer and Contractor and are not complete listings of all equipment, devices and material to be provided under this contract. The Contractor agrees to prepare his own material and equipment takeoff lists as necessary to meet the requirements of this project manual.

##### 1.02 QUALITY ASSURANCE

###### A. ARRANGEMENT

The arrangement of equipment shown on the drawings is based upon information available to the Owner at the time of design and is not intended to show exact dimensions peculiar to a specific manufacturer. The drawings are, in part, diagrammatic, and some features of the illustrated equipment installation may require revision to meet actual equipment installation requirements. Structural supports, foundations, connected piping, valves, and electrical conduit specified may have to be altered to accommodate the equipment provided. No additional payment will be made for such revisions and alterations.

###### B. REFERENCES

This section contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ABMA Std 9	Load Ratings and Fatigue Life for Ball Bearings
ABMA Std 11	Load Ratings and Fatigue Life for Roller Bearings
ANSI B1.1	Unified Inch Screw Threads (UN and UNR Thread Form)
ANSI B1.20.1	Pipe Threads, General Purpose (Inch)
ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800
ANSI B18.2.1	Square and Hex Bolts and Screws (Inch Series)
ANSI B18.2.2	Square and Hex Nuts (Inch Series)

C. UNIT RESPONSIBILITY

1. Equipment systems made up of two or more components of different manufacturers shall be assembled as a unit by a single manufacturer who shall be responsible for the entire unit. The responsible manufacturer shall select all components of the system to assure compatibility, ease of construction and efficient maintenance. The responsible manufacturer shall coordinate selection and design of all system components such that all equipment furnished under the specification for the equipment, including equipment specified elsewhere but referenced in the specification, is compatible and operates properly to achieve the specified performance requirements. Unless otherwise specified, the responsible manufacturer shall be the manufacturer of the driven equipment. Agents, representatives or other entities who are not a direct component of the manufacturing corporation will not be acceptable as a substitute for the manufacturer's corporation in meeting this requirement. This requirement for unit responsibility shall in no way relieve the Contractor of his responsibility to the Owner for performance of all work associated with the Contract as provided in Section 00700.
2. The Contractor shall assure that all equipment provided for the project are products for which unit responsibility has been accepted by the responsible manufacturer. Failure to provide acceptable proof that the unit responsibility requirement has been satisfied will result in withholding approval of progress payments for the subject equipment *even though the equipment may have been installed in the work.*

## D. BALANCE

Unless specified otherwise, all rotating elements in motors, pumps, blowers and centrifugal compressors shall be fully assembled, including coupling hubs, before being statically and dynamically balanced. All rotating elements shall be balanced to the following criteria:

ISO 1940/1 Balance Grade Code: G6.3

Permissible unbalance shall be no greater than as determined by the ISO 1940 nomograph or by the following equation:

$$U = 9549 \times G \times m/\text{rpm}$$

Where:

U= permissible unbalance, g\*mm

G= balance grade code, 6.3

m= rotating mass, Kg

rpm= maximum service speed of rotation, revolutions per minute

Balancing reports, demonstrating compliance with this requirement, shall be submitted as product data.

## PART 2 - PRODUCTS

### 2.01 FLANGES AND PIPE THREADS

- A. Flanges on equipment and appurtenances provided under this section shall conform in dimensions and drilling to ANSI B16.1, Class 125. Pipe threads shall conform in dimension and limits of size to ANSI B1.1, coarse thread series, Class 2 fit.
- B. Threaded flanges shall have a standard taper pipe thread conforming to ANSI B1.20.1. Unless otherwise specified, flanges shall be flat faced.
- C. Flange assembly bolts shall be heavy pattern, hexagonal head, carbon steel machine bolts with heavy pattern, hot pressed, hexagonal nuts conforming to ANSI B18.2.1 and B18.2.2. Threads shall be Unified Screw Threads, Standard Coarse Thread Series, Class 2A and 2B, ANSI B1.1.

### 2.02 BEARINGS

- A. Unless otherwise specified, equipment bearings shall be oil or grease lubricated, ball or roller type, designed to withstand the stresses of the service specified. Each bearing shall be rated in accordance with the latest revisions of ABMA Methods of Evaluating Load Ratings of Ball and Roller Bearings. Unless otherwise specified, equipment bearings shall have a minimum L-10 rating life of 50,000 hours. The rating life shall be determined using the maximum equipment operating speed.

- B. Grease lubricated bearings, except those specified to be factory sealed and lubricated, shall be fitted with easily accessible grease supply, flush, drain and relief fittings. Extension tubes shall be used when necessary. Grease supply fittings shall be standard hydraulic alemite type.
- C. Oil lubricated bearings shall be equipped with either a pressure lubricating system or a separate oil reservoir type system. Each oil lubrication system shall be of sufficient size to safely absorb the heat energy normally generated in the bearing under a maximum ambient temperature of 60 degrees C and shall be equipped with a filler pipe and an external level indicator gage.
- D. All bearings accessible to touch and located within 7 feet measured vertically from floor or working level or within 15 inches measured horizontally from stairways, ramps, fixed ladders or other access structures shall either incorporate bearing housings with sufficient cooling to maintain surface temperature at 65 degrees C or less for continuous operation at bearing rated load and a 50 degrees C ambient temperature or appropriate shielding shall be provided that will prevent inadvertent human contact.

## 2.03 V-BELT ASSEMBLIES

- A. Unless otherwise specified, V-belt assemblies shall be Dodge Dyna-V belts with matching Dyna-V sheaves and Dodge Taper-lock bushings, Wood's Ultra V-belts with matching Ultra-V sheaves and Wood's Sure-Grip bushings, or equal.
- B. Sheaves and bushings shall be statically balanced. Additionally, sheaves and bushings which operate at a peripheral speed of more than 5500 feet per minute shall be dynamically balanced. Sheaves shall be separately mounted on their bushings by means of three pull-up grub or cap tightening screws. Bushings shall be key seated to the drive shaft.
- C. Belts shall be selected for not less than 150 percent of rated driver horsepower and, where two sheaves sizes are specified, shall be capable of operating with either set of sheaves. Belts shall be of the antistatic type where explosion-proof equipment is specified.

## 2.04 PUMP SHAFT SEALS

### A. GENERAL

Unless specified otherwise, seals for water and wastewater pump shafts shall be mechanical seals. Unless specified otherwise, mechanical seals or stuffing boxes shall conform to the requirements set forth in this paragraph.

## B. MECHANICAL SEALS

1. Mechanical seals shall be of a nondestructive (nonfretting) type which requires no wearing sleeve for the shaft. Shafts for pumps specified with mechanical seals shall be furnished with no reduction in size through the seal area. Mechanical seals shall be the cartridge type, requiring no field assembly, other than insertion into the pump. Metal parts shall be Type 316 or 316L stainless steel. Springs shall be Hastelloy C. Rotary faces shall be tungsten carbide or silicon carbide. Stationary faces shall be ceramic, tungsten carbide, or silicon carbide.
2. Unless otherwise specified, mechanical seals for overhung shaft, constant speed pumps and split case, centrifugal pumps shall be self-aligning, single, rotary type, Chesterton 155, Crane 5610, or equal.
3. Unless otherwise specified, mechanical seals for variable speed, overhung shaft pumps shall be double, balanced, self-aligning type, Crane 5620, Chesterton 222 or 255, or equal.
4. Boxes for mechanical seals on pumps for contaminated water service (sludge, grit, wastewater, scum, reclaimed water, etc.) shall be drilled and tapped for installation of clean water barrier fluid supply piping.

## C. SHAFT PACKING

1. Where shaft packing is specified, stuffing boxes shall be tapped to permit introduction of seal liquid and shall hold a minimum of five rows of packing. Stuffing boxes shall be face attached. Stuffing box and shaft shall be suitable for field installation, without machining or other modifications, of the mechanical seal specified in paragraph 11000-2.04 B for the applicable pump and operating conditions.
2. Unless otherwise specified, lantern rings shall be bronze or Teflon, packing shall be die-molded packing rings of nonasbestos material suitable for the intended service and as recommended by the manufacturer, and glands shall be bronze, two piece split construction. Lantern rings shall be of two-piece construction and shall be provided with tapped holes to facilitate removal. Lantern rings shall be drilled and tapped 1/4 NC-20. Threaded lantern ring removal tools shall be provided with spare parts for each pump.

## 2.05 COUPLINGS

- A. Unless otherwise specified in the particular equipment sections, equipment with a driver greater than 1/2 HP, and where the input shaft of a driven unit is directly connected to the output shaft of the driver, shall have its two shafts connected by a flexible coupling which can accommodate angular misalignment, parallel misalignment and end float, and which cushions shock loads and dampens torsional vibrations. The flexible member shall consist of a tire with synthetic tension members bonded together in rubber. The flexible member shall be attached to flanges by means of clamping rings and cap

screws, and the flanges shall be attached to the stub shaft by means of taperlock bushings which shall give the equivalent of a shrunk-on fit. There shall be no metal-to-metal contact between the driver and the driven unit. Each coupling shall be sized and provided as recommended by the coupling manufacturer for the specific application, considering horsepower, speed of rotation, and type of service.

- B. Where torque or horsepower capacities of couplings of the foregoing type is exceeded, Thomas-Rex, Falk Steel Flex, or equal, couplings will be acceptable provided they are sized in accordance with the equipment manufacturer's recommendations and sizing data are submitted. They shall be installed in conformance to the coupling manufacturer's instructions.

## 2.06 GUARDS

Exposed moving parts shall be provided with guards which meet the requirements of OSHA. Guards shall be fabricated of 14-gage steel, 1/2-13-15 expanded metal screen to provide visual inspection of moving parts without removal of the guard. Guards shall be galvanized after fabrication and shall be designed to be readily removable to facilitate maintenance of moving parts. Reinforced holes shall be provided. Lube fittings shall be extended through guards.

## 2.07 CAUTION SIGNS

Equipment with moving parts which operates automatically or by remote control shall be identified by signs reading "CAUTION - EQUIPMENT STARTS AUTOMATICALLY ". Signs shall be constructed as specified in Section 10431. Signs shall be installed near the moving parts.

## 2.08 GAGE TAPS, TEST PLUGS AND GAGES

Gage taps shall be provided on the suction and discharge sides of pumps, blowers and compressors. Pressure and vacuum gages shall be provided where specified. Gage taps, test plugs, and gages shall be as specified in Divisions 15.

## 2.09 NAMEPLATES

Nameplates shall be provided on each item of equipment and shall contain the specified equipment name or abbreviation and equipment number. Equipment nameplates shall be engraved or stamped stainless steel and fastened to the equipment in an accessible location with stainless steel screws or drive pins.

## 2.10 LUBRICANTS

The Contractor shall provide for each item of mechanical equipment a supply of the lubricant required for the commissioning period. Lubricants shall be of the type recommended by the equipment manufacturer and shall be products of the City of Vacaville's current lubricant supplier. The Contractor shall limit the various types of lubricants by consolidating them, with the equipment manufacturer's approval, into the least number of different types. Not less than 90 days before the date shown in his construction schedule for starting, testing and adjusting equipment, the Contractor shall provide the Owner with three copies of a list showing the required lubricants, after consolidation, for each item of mechanical equipment. The list shall show estimated quantity of lubricant needed for a full year's operation, assuming the equipment will be operating continuously.

## 2.11 ANCHOR BOLTS

Anchor bolts shall be designed for lateral forces for both pullout and shear in accordance with the provisions of Section 05501. Unless otherwise stated in the detailed specification, anchor bolt materials shall conform to the provisions of Section 05501.

## 2.12 SPARE PARTS

- A. Spare parts, wherever required by detailed specification sections, shall be stored in accordance with the provisions of this paragraph. Spare parts shall be tagged by project equipment number and identified as to part number, equipment manufacturer, and subassembly component (if appropriate). Spare parts subject to deterioration such as ferrous metal items and electrical components shall be properly protected by lubricants or desiccants and encapsulated in hermetically sealed plastic wrapping. Spare parts with individual weights less than 50 pounds and dimensions less than 2 feet wide, or 18 inches high, or 3 feet in length shall be stored in a wooden box with a hinged wooden cover and locking hasp. Hinges shall be strap type. The box shall be painted and identified with stenciled lettering stating the name of the equipment, equipment numbers, and the words "spare parts." A neatly typed inventory of spare parts shall be taped to the underside of the cover.
- B. The Contractor shall provide for each item of mechanical, electrical, and instrumentation equipment a supply of the spare parts and special tools required for the starting, testing and adjustment of equipment, the testing and reliability testing of completed portions of the work, and the testing and reliability testing of the completed project in accordance with Section 01660.

## **PART 3 – EXECUTION**

Installation of equipment accessories included in this section shall be as recommended by the equipment manufacturer unless otherwise specified in the individual equipment specification section.

**\*\*END OF SECTION\*\***

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## SECTION 11310

### PACKAGE SEWAGE LIFT STATION

#### PART 1 – GENERAL

##### 1.01 DESCRIPTION

Work Included: Furnish and install all materials and perform all labor necessary for the complete, tested, and operating duplex fiberglass body package sewage lift station with valve box as indicated on the Drawings and herein specified. Cast-in-place concrete or pre-cast concrete lift stations will not be acceptable.

The Contractor shall include costs to handle, transport, install, startup and test, troubleshoot, provide installation certification, and train City personnel. Contractor shall also be responsible for all bypass pumping necessary to maintain sanitary sewer flows during demolition of existing facilities and construction of the work.

The Work also includes providing and installing 208 volt, 3-phase power (or other as required by the package lift station manufacturer for a fully working system) including coordinating with and making service application with Pacific Gas & Electric. The Contractor shall be responsible for providing a complete working system, including appurtenant electrical requirements per Division 16 (one-line diagrams, interconnection diagrams, pedestals, metering, disconnects, etc.) compliant with NEC as well as state and local codes.

##### 1.02 LIFT STATION COMPONENTS

Components of the package sewage lift station shall include, but not be limited to:

- A. Fiberglass lift station wet well body with integral anti-floatation measures, and pipe inlets as shown on the drawings.
- B. Fiberglass valve box with 4-inch nominal integral inlet and outlet, and a drain to lift station wet well with a check valve.
- C. Sewage Pumps
- D. Pump discharge piping and valves as indicated on the Plans. Pump discharge shall have a cast-iron guiderail base elbow and Schedule 80 PVC discharge piping.
- E. Bulkhead fittings for inlets, outlets, and other fiberglass lift station and valve box penetrations.
- F. Anti-tension supports as shown on the electrical drawings.
- G. Components and appurtenances required for connection to lift station electrical service and controls.

- H. Lockable access covers as indicated on the Drawings.
- I. Stainless Steel upper guide bar brackets.
- J. Stainless Steel intermediate guide bar brackets.
- K. Stainless Steel safety cable hooks.
- L. Stainless steel cable holders.
- M. Cable support grips.
- N. Stainless steel anchor bolts.
- O. Stainless steel lifting chain or cable.
- P. Spare parts.
- Q. Operation and Maintenance Manuals.
- R. Electrical pedestal shall be provided under Division 16.
- S. Instrumentation will be provided by Others.

### 1.03 SUBMITTALS

- A. Submittals required under this Section shall be in accordance with Section 01300.
- B. Submit all items of equipment included in this section in one package.
- C. Shop Drawings: Submit shop drawings for approval of all package lift station components specified in this Section and other appurtenances provided by the manufacturer.

Certified shop and installation drawings and data regarding pump and motor characteristics and performance. The data shall include performance curves, based on actual shop test, for head, capacity, efficiency, and horsepower. Indicate separately the minimum submergence required at the guarantee point.

- 2. Make, model, weight, and horsepower of each equipment assembly.
- 3. Materials of construction of individual items.
- 4. Complete motor nameplate data, as defined by NEMA, motor manufacturer, and including any motor modifications.
- 5. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.

6. Detailed mechanical and electrical drawings showing the equipment dimensions, size, and locations of connections, and weights of associated equipment.
  7. Power and control wiring diagrams, including terminals and numbers.
  8. Shop coating systems.
- D. Quality Control Submittals
1. The following quality control Submittals shall be provided by the Contractor:
    - a. Manufacturer's printed installation instructions.
    - b. Special shipping, storage and protection, and handling instructions.
    - c. Factory Functional Test Report.
    - d. Field Test Procedures.
    - e. Manufacturer's Certificate of Proper Installation.
    - f. Suggested spare parts list to maintain the equipment in service for a period of one year. Include a list of special tools required for checking, testing, parts replacement, and maintenance with current price information.
    - g. Warranty for one year after Project acceptance date.

## **PART 2 – PRODUCTS**

### **2.01 DUPLEX FIBERGLASS LIFT STATION COMPONENTS**

Acceptable manufacturers include Yeomans Chicago Corporation Easy-Lift, Flygt Top Station, or equal.

#### **A. WET WELL**

1. The wet well shall be of the size and configurations shown on the Drawings and specified herein.
2. The wet well shall be a duplex pump station configuration.
3. The wet well shall be of the laminated fiberglass type constructed of commercial grade resin and glass fiber reinforcing material. Fiberglass wet well shall be a minimum of  $\frac{3}{4}$  inch thick. The wet well manufacturer shall design the wet well, taking into account all normally imposed loads arising from floatation, soil pressures, normal backfill, handling loads, operating loads and static loads imposed by equipment used in hoisting the pumps in and out the station, with a safety factor of two (2). The manufacturer shall provide design calculations bearing the stamped of a registered professional engineer for review.
4. The wet well shall be furnished with an integral bottom plate or anti-flotation flange near the bottom of the wet well and sufficient to withstand the forces acting upon the station due to the subsoil conditions and water

pressure. Contractor shall install the bottom plate or anti-floatation flange in accordance with the manufacturer's recommendations and the Drawings.

5. Locations and orientations of well penetrations for inlets/outlets, drains, and electrical/controls shall be confirmed and coordinated between the Contractor and the wet well manufacturer and shall be located and sized to consider connection appurtenances, inlet/outlet pipe materials, inlet/outlet pipe outer diameters, and other work.
6. Integral lifting lugs shall be required as appropriate per manufacturer's recommendations.

#### B. VALVE BOX

1. The package lift station shall include a valve box fabricated in a manner identical to the wet well and shall be large enough to allow entry for routine maintenance and inspection.
2. The valve box shall serve the duplex pump station configuration discharge piping and valves.
3. The valve box may be either attached or separate from the wet well. The Contractor shall make all necessary coordination and provide ancillary materials to construct the package lift station for either attached or separate valve box configuration.
4. The valve box shall be furnished with an integral drain and check valve assembly to provide drainage from the valve box to the main basin.
5. Locations and orientations of valve box penetrations for inlets and/or outlets shall be confirmed and coordinated between the Contractor and the valve box manufacturer and sized to consider connection appurtenances, inlet/outlet pipe materials, inlet/outlet pipe outer diameters, and other work.
6. Integral lifting lugs shall be required as appropriate per manufacturer's recommendations.

#### C. VALVES

1. CHECK VALVES – Per Section 15220
2. PLUG VALVES – Per Section 15190

#### D. PUMP DISCHARGE PIPING

Shall be Schedule 80 PVC. Connections shall be per fiberglass package lift station manufacturer's recommendations and per the Drawings.

#### E. BULKHEAD FITTINGS

Shall be installed in the wet well and valve box walls as indicated on the Drawings and specified herein.

F. GUIDE RAIL SYSTEM

Shall be of stainless steel materials and designed by the package lift station manufacturer and installed per the package lift station manufacturer's recommendations.

G. LIFTING CHAIN

Shall be stainless steel material.

H. SAFETY CABLE HOOKS

Shall be provided by the Contractor.

2.02 SEWAGE PUMPS

A. PUMPS

1. Two single stage submersible, solids handling pump/motor units shall be supplied and installed in the lift station.
2. Submersible sewage pumps shall be installed in a circular fiberglass wet well. A fiberglass vault shall be provided for the plug valves and check valves as indicated on the Drawings.

B. PUMP PERFORMANCE

The pumps shall be submersible, solids handling, Flygt NP3085 MT 3 - 462, or equal, with characteristics that meet the following conditions:

Performance Data	Requirement
Number of Pumps	2
Capacity (each), gpm	220
Total Dynamic Head, feet	22
Minimum Shutoff Head, feet	36
Pump Speed, rpm	1,750
Horsepower, Hp	3
Voltage, volts/Phase	208/3
Minimum efficiency (at design condition)	50%

## C. PUMP CONSTRUCTION

1. The pump system including the pump, motor and power cable shall be approved for use in areas classified as hazardous locations in accordance with NEC, Class 1, Division 1, Group C & D Service. The pump unit shall be explosion proof.
2. Casings shall be ASTM A48, Class 30, cast iron with 4" horizontal discharge and shall provide for 3" unobstructed flow for any solids that can be passed by the impeller. Rotating wear ring of 304 stainless steel and fixed ring of nitrile rubber shall be provided.
3. Impellers shall meet the physical and tensile strength requirements of ASTM A48, Class 30 cast iron. Impeller shall be cast in one piece single or double vane design and shall be statically and dynamically balanced. The design of the impeller and the shape of the blades shall be such that rags or similar materials will not clog the pump to seriously affect the efficiency. The impeller shall be keyed to the shaft and firmly held in place by a stainless steel socket head bolt. The arrangement shall be such that the impeller cannot be loosened by torque from either forward or reverse rotation.
4. Pump bearings shall be of the ball or roller type. Each motor pump shaft shall be supported by two ball bearings arranged for grease lubrication. Bearing shall be designed in accordance with the Anti Friction Bearing Manufacturers Association, Inc. Standards Class M2, B 10 rating life of 20,000 hours.  
Anti-friction bearings that are prelubricated shall be protected in accordance with the bearing manufacturer's recommendations against the formation of rust during a period of storage while awaiting the completion of installation and startup.
5. Each pump shall be provided with a tandem double mechanical shaft seal running in an oil reservoir, composed of two separate lapped face seals. Lower seal shall consist of one stationary and one rotating tungsten carbide ring. The upper seal shall contain one stationary tungsten carbide ring and one driven rotation carbon ring with each pair of rings held in contact by a separate spring. The seals shall not require regular maintenance or adjustment and shall be easily inspected and replaceable. Conventional double mechanical seals, with a single or double spring between rotation faces that require a constant differential pressure to effect sealing and subject to opening and penetration by pumping forces, will not be acceptable.
6. All nuts and bolts exposed to sewage or corrosive atmosphere shall be Type 316 stainless steel.
7. Pump motor shall be housed in as air filled, watertight casting of NEMA B design and shall have Class F insulated windings, which shall be moisture resistant. Pump motors shall be capable of continuous operation in a totally, partially, or nonsubmerged condition, including a minimum of 6 starts per hour. The pumps shall be capable of running dry in a totally dry condition without damage for 24 hours. The power cable shall be of

adequate length to reach the furthest end of the motor control center plus ten feet. Provide motors with single cables of submersible pump application with p.122 MSHA approval.

8. Equip motors with three normally closed thermal switches embedded in the end coils of the stator winding (one per phase). These switches shall be set to open at 260°F.
9. Provide leakage sensor to detect water in the stator chamber. When leakage sensor is activated, stop the motor and send an alarm. The leakage sensor shall operate on 120VAC. The use of voltage sensitive solid state sensors and trip temperature above 125°C (260° F) is not allowed.
10. The thermal switches and float switches shall be connected to a Flygt Mini-CAS, or equal, control and status monitoring unit. The monitoring unit shall be designed to be mounted in the pump control panel.
11. Sealing of the pumping unit to the discharge connection shall be accomplished by a simple linear downward motion of the pump along the guide rails with the entire weight of the pumping unit pressing tightly against the discharge connection. No portion of the pump shall bear directly on the floor of the wet well and no rotary motion of the pump shall be required for sealing. Maximum leakage allowable to be less than 0.005 times total flow at design point.
12. Cable entry design shall preclude specific torque requirements. The cable entry shall have single grommet, washers, compressed by the entry body containing a strain relief function. The cable entry junction chamber and motor shall be separated by a full terminal board. Epoxies or other secondary sealing systems are not considered acceptable.
13. Package Lift Station shall be provided with the following accessories, installed as indicated on the Drawings or as recommended by the pump manufacturer:
  - a. Access cover size and reinforcement as indicated on the Drawings and specified in the Contract.
  - b. Upper guide bar brackets.
  - c. Intermediate guide bar brackets.
  - d. Safety cable hooks.
  - e. Cable holders.
  - f. Cable support grips.
  - g. Anchor bolts, Type 316 stainless steel.
  - h. Stainless steel lifting chain or cable.
  - i. Pump discharge piping.
  - j. Fiberglass lift station body and valve box.
  - k. Valving as indicated on the Plans.
  - l. Bulkhead fittings for connection of inlets and outlets to fiberglass package lift station body in the amounts and sizes shown in the Plans.

## **PART 3– EXECUTION**

### **3.01 INSTALLATION**

Equipment and accessories shall be installed in accordance with approved written procedures submitted with the shop drawings, and as indicated on the Drawings, secure in position and alignment, and neat in appearance.

A factory representative, who has complete knowledge of proper installation and maintenance of the equipment furnished shall be provided for two (2) working days (exclusive of travel time) to assist with the installation and startup of the equipment.

The factory representative shall provide a Manufacturer's Certificate of Proper Installation indicating that the pump installation conforms to pump manufacturer's requirements.

### **3.02 INSPECTION AND TESTING**

After installation but prior to acceptance of the pumping equipment, each unit shall be given a running test during which it shall demonstrate its ability to operate within vibration limits set forth in the Hydraulics Institute Standards, and without overheating and to meet the performance data listed herein. Tests shall include electrical, head and discharge measurements sufficient to duplicate the head discharge and efficiency curves submitted with the shop drawings.

Submit a test plan to the Engineer for approval prior to final performance tests.

Two weeks after completion of tests, the Contractor shall submit the Pump Performance Test results showing satisfactory performance of each unit.

All defects revealed by the tests shall be corrected at the Contractor's expense and the tests shall be repeated until satisfactory results are obtained.

The Contractor shall furnish all labor, piping, equipment, pressure gauges and materials necessary for conducting the tests, including necessary clean water.

### **3.03 TRAINING AND INSTRUCTION**

A factory representative, who has complete knowledge of proper operation and maintenance of the equipment furnished shall be provided for a minimum of four (4) hours to train representatives of the City on the proper operation and maintenance of the equipment. It shall not be assumed that this instruction will occur on the same day as the inspection of the installation for certification purposes and/or field testing required by the Contract. Operation and maintenance training shall be provided following successful performance and operational testing and following approval of the operating and maintenance manuals by the Engineer.

**\*\*END OF SECTION\*\***



## SECTION 11315

### SUBMERSIBLE WASTEWATER PUMP AND ACCESSORIES

#### PART 1 – GENERAL

##### 1.01 DESCRIPTION

- A. Work included: Contractor shall furnish all materials, equipment, labor, and incidentals necessary to provide and place in the accessories for the existing submersible pumps, including all auxiliary equipment and accessories as indicated on the Drawings and specified below.
- B. There are two existing pumps. Each will receive new paint, temperature and moisture switches, Mini-CAS unit, a new discharge elbow, and new guide rails with mounting brackets. The existing pumps with the new accessories shall be installed as indicated on the Plans.
- C. The existing pumps are Flygt C 3085.
- D. The Contractor shall include costs to handle, transport, install, startup and test, troubleshooting, and installation certification in its bid.

##### 1.02 SUBMITTALS

- A. Submittals required under this Section shall be in accordance with Section 01300 of these technical specifications.
- B. Shop Drawings: Submit shop drawings for approval of: pumps and related equipment specified in this Section.
  - 1. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
  - 2. Detailed mechanical drawings showing the equipment dimensions, size, and locations of connections and weights of associated equipment.
  - 3. Mounting requirements and anchorage calculations. The anchorage calculations shall bear the stamp of a profession engineer registered in California. The anchorage calculations shall reflect siesmic Zone 4 requirements.
  - 4. Shop painting system.
  - 5. Submit a test plan to the Engineer for approval prior to final performance tests.
- C. Manuals: Furnish manufacturer's installation, lubrication, operation and maintenance manuals, bulletins, and parts lists. Operation and maintenance manuals shall be provided.

D. Quality Control Submittals:

1. The following quality control Submittals shall be provided by the Contractor:
  - a. Special shipping, storage and protection, and handling instructions.
  - b. Manufacturer's printed installation instructions.
  - c. Field Test Procedures
  - d. Manufacturer's Certificate of Proper Installation.
  - e. Suggested spare parts list to maintain the equipment in service for a period of one year. Include a list of special tools required for checking, testing, parts replacement, and maintenance with current price information.
  - f. Warranty for one year after equipment Manufacturer's Certificate of Proper Installation.

**PART 2 – PRODUCTS**

2.01 DISCHARGE ELBOW

ASTM A 48 Grade B cast iron designed to mate with a metal-to-metal contact with the pump. Discharge connection shall be bolted to the floor of the wet well and so designed as to receive the pump connecting flange without the need of any bolts, gaskets, or nuts. The discharge elbow shall have a 4-inch inlet and 4-inch outlet.

2.02 GUIDE RAILS

The guide rails shall be Schedule 40 Type 316 stainless steel, 2 inches in diameter. Provide joint couplings and mounting brackets per pump manufacturer requirements.

2.03 TEMPERATURE SWITCH

- A. Use Flygt standard temperature switch in conjunction with external motor overload protection. Temperature switch shall signal an alarm when opened.

2.04 MOISTURE SWITCH (FLS)

- A. Provide to detect moisture in the stator chamber.
- B. When leakage sensor is activated, stop the motor and send an alarm.
- C. Operate on 120 VAC.
- D. Use of voltage sensitive solid state sensors and trip temperature above 125°C (260°F) is not allowed.

2.05 FLYGT MINI-CAS (FLS)

- A. Provide new Flygt Mini-CAS II/FUS for each pump.

## 2.06 PAINT

A. See Section 09960 for surface preparation and coating requirements.

## **PART 3 – EXECUTION**

### 3.01 INSTALLATION

Equipment and accessories shall be installed in accordance with approved written procedures submitted with the shop drawings, and as indicated on the Drawings, secure in position and alignment, and neat in appearance.

### 3.02 INSPECTION AND TESTING

After installation but prior to acceptance of the pumping accessories equipment, each unit shall be given a running test during which it shall demonstrate its ability to operate. Tests shall include electrical, head and discharge measurements sufficient to document the head discharge and efficiency curves submitted with the shop drawings.

Submit a test plan to the Engineer for approval prior to final performance tests.

Two weeks after completion of tests, the Contractor shall submit the Pump Performance Test results showing satisfactory performance of each unit.

All defects revealed by the tests shall be corrected at the Contractor's expense and the tests shall be repeated until satisfactory results are obtained.

The Contractor shall furnish all labor, piping, equipment, pressure gauges and materials necessary for conducting the tests, including necessary clean water.

**\*\*END OF SECTION\*\***

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**SECTION 15062**

**DUCTILE IRON PIPE**

**PART 1 – GENERAL**

1.01 DESCRIPTION

A. SCOPE

This section specifies ductile iron pipe, ductile fittings, and gaskets.

B. TYPES OF SERVICE

Piping specified in this section shall be used for the service applications described in Section 15100.

C. DEFINITION

Where cast iron pipe is specified, the term and symbol shall mean ductile iron pipe.

1.02 REFERENCES

This section contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by the organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, reference to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued, or replaced.

Reference	Title
ANSI A21.14	Ductile-Iron Fittings 3-Inch through 24-Inch, for Gas
ANSI A21.52	Ductile-Iron Pipe, Centrifugally Cast, for Gas
ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings
ANSI B16.5	Pipe Flanges and Flanged Fittings
ASTM A716	Ductile Iron Culvert Pipe
ASTM C150	Portland Cement
AWWA C104 (ANSI A21.4)	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

Reference	Title
AWWA C110	Ductile-Iron and Gray-Iron
AWWA C116	Protective Fusion-Bonded Epoxy Coatings
ANSI A21.10	Fittings, 3 In. Through 48 In. (75 mm Through 1200 mm), for Water and Other Liquids
AWWA C111 (ANSI A21.11)	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115 (ANSI A21.15)	Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges
AWWA C150 (ANSI A21.50)	Thickness Design of Ductile-Iron Pipe
AWWA C151 (ANSI A21.51)	Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
AWWA C153 (ANSI A21.53)	Ductile-Iron Compact Fittings, 3 In. Through 24 In. (76 mm Through 610 mm) and 54 In. Through 64 In. (1,400 mm Through 1,600 mm), for Water Service
AWWA C600	Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C606	Grooved and Shouldered Joints

### 1.03 SUBMITTALS

The following data shall be provided in accordance with Section 01300, Submittals.

- A. Shop drawings, product data sheets, and information for linings and coatings.
- B. Alignment drawings.
- C. Certifications specified in the following documents:

- ANSI A21.14, Paragraph 14-4.2
- ANSI A21.52, Paragraph 52-4.2
- ASTM A716, Paragraph 4.2
- AWWA C110, Paragraph 10-5.3
- AWWA C111, Paragraph 11-7.1
- AWWA C115, Paragraph 15-4.2
- AWWA C151, Paragraph 51-5.2
- AWWA C153, Paragraph 53-6.3
- AWWA C606, Paragraph 4.1.1.1

## PART 2 – PRODUCTS

### 2.01 GENERAL

Pipe design, materials and manufacture shall comply with the following documents:

Item	Document
Thickness design	AWWA C150
Manufacturing requirements	
Water or other liquid	AWWA C151
Gas	ANSI A21.52
Gravity service pipe	ASTM A716
Joints	
Rubber gasket	AWWA C111
Threaded flange	AWWA C115
Fittings	
Water or other liquid	AWWA C110/AWWA C153
Gas	ANSI A21.14
Cement mortar lining	AWWA C104

## 2.02 PIPE

Unless otherwise specified, ductile iron pipe shall be minimum pressure Class 150 and have nominal laying lengths of 18' or 20'. For grooved-end or flanged pipe, wall thickness shall be minimum Thickness Class 53 except where the specified pressure requires heavier pipe.

## 2.03 GASKETS

Unless otherwise specified, gasket stock shall be a synthetic rubber compound in which the elastomer is nitrile or neoprene. The compound shall contain not less than 50% by volume nitrile or neoprene and shall be free from factice, reclaimed rubber and other deleterious substances. Gaskets shall, in addition, comply with AWWA C111 for push-on and mechanical joints and with AWWA C606 for grooved end joints.

## 2.04 FITTINGS

Unless otherwise specified, fittings shall conform to AWWA C110. Ends shall be flanged, restrained mechanical joint, restrained push-on, or grooved to suit the conditions specified. The AWWA C153 compact ductile iron fittings in sizes 3-12" are an acceptable substitute for standard fittings unless otherwise specified. Long-radius elbows shall be provided where specified. To assure uniformity and compatibility of piping components, fittings and couplings for grooved end piping systems shall be furnished by the same manufacturers.

## 2.05 JOINTS

### A. UNRESTRAINED JOINTS (NOT USED)

### B. RESTRAINED JOINTS

1. **GENERAL:** Unless otherwise specified, restrained joints are required for all exposed and buried piping. Unless otherwise specified, restrained joints shall be flanged or grooved end for exposed service and push-on or grooved end for buried service.
2. **PUSH-ON JOINTS:** Restrained push-on joints shall be as specified in Paragraph 15060-2.05 A.1., modified for restraint. Joints shall be the Flex-Ring or Lok-Ring Joint as manufactured by American Cast Iron Pipe Company, TR Flex Joint as manufactured by US Pipe, or equal. Restrained joints shall be capable of being deflected after full assembly. Joint assembly shall be in strict conformance with AWWA C600 and manufacturer's recommendations. No field cuts of restrained pipe are permitted without prior approval of the Engineer.
3. **FLANGE ASSEMBLIES:**
  - a. Unless otherwise specified, flanges shall be ductile iron and shall be threaded-on flanges conforming to ANSI/AWWA A21.15/C115 or cast-on flanges conforming to ANSI/AWWA A21.10/C110. Flanges shall be adequate for 250 psi working pressure. Bolt circle and bolt holes shall match those of ANSI B16.1, Class 125 flanges and ANSI B16.5, Class 150 flanges. Where specified, flanges shall be threaded-on or cast-on flanges conforming to ANSI B16.1, Class 250.
  - b. Unless otherwise specified, bolts and nuts for flange assemblies shall conform with Paragraph 15120-2.01 C. Gaskets shall be as specified in Paragraph 15120-2.01 B.
4. **GROOVED END JOINTS**

Grooved end couplings shall conform to AWWA C606 and shall be Gustin-Bacon 500 Series, Victaulic Style 31, or equal with flush seal type gasket designed for ductile iron pipe. Unless otherwise specified, grooved end couplings shall be rigid joint for exposed service and flexible joint for buried service. Unless otherwise specified, bolts and nuts shall comply with Paragraph 15062-2.05 C.
5. **MECHANICAL JOINTS**
  - a. Where specified, restrained mechanical joints shall be the positive restraint type. Mechanical joints with retainer glands are not acceptable.
  - b. Locked mechanical hydrant tees, bends and adapters are an acceptable substitute for anchoring fire hydrants and valves to the pipe main.



## C. BOLTS AND NUTS

Corrosion-resistant bolts and nuts for use with ductile iron joints shall be high-strength, low-alloy steel as specified in ANSI/AWWA C111/A21.11.

## 2.06 PIPE COATING

- A. Unless otherwise specified, pipe and fittings shall be coated with asphaltic material as specified in AWWA C151.
  - 1. Piping in the wet well shall be coated with epoxy in accordance with Section 09960.
  - 2. Exposed ductile iron pipe in the valve vault and the meter vault shall be coated with a minimum of 5 mils of polyamidoamine epoxy primer, ready to receive field coating as specified in these Specifications.

## 2.07 PIPE LINING

### A. CERAMIC EPOXY LINING

- 1. Pipe and fittings shall be ceramic epoxy lined with Protecto 401 ceramic epoxy to a thickness of 40 mils, minimum.
- 2. Surface preparation of ductile iron pipe, application of lining, inspection and certification of lining, and handling of finished product shall be in accordance with manufacturer's standard specifications.

## 2.08 POLYETHYLENE WRAP

- A. One sheet, continuous 8-mil per ANSI/AWWA C105/A21.5-99, linear low density polyethylene (LLDPE) and shall be marked at two foot intervals with manufacturer's name, year of manufacture, AWWA C105, film thickness and material, pipe size, and repair warning. Secured in place with 10-mil polyethylene tape.

## **PART 3 – EXECUTION**

### 3.01 INSTALLATION

#### A. GENERAL

- 1. Piping runs specified on the drawings shall be followed as closely as possible. Proposed deviations shall be submitted in accordance with Section 01300 of the technical specifications.
- 2. Pipe shall be installed in accordance with AWWA C600.
- 3. Connections to existing structures and manholes shall be made so that the finished work will conform as nearly as practicable to the requirements specified for the new manholes, including necessary concrete work,

cutting and shaping. Concrete mortar shaping within any structure and manhole shall be as specified.

4. Polyethylene Wrap: Installation per Method A requirements of ANSI/AWWA C105/A21.5. Excess slack width in the polyethylene tube shall be taken up to make a snug, but not a tight fit, around the pipe barrel and secured with adhesive tape in a fold on the top of each pipe length at the quarter points. Any rips, punctures or other damage to the polyethylene sleeve shall be repaired with adhesive tape or a short length of polyethylene tube cut open, wrapped around the pipe and secured in place.
5. All buried metal parts such as valves and bolt-ups not cement mortar coated shall be coated with two coats of bitumastic, and encased with one sheet of 8-mil minimum thickness polyethylene to form a continuous and all-encompassing layer of polyethylene between the protected metal and surrounding earth. All polyethylene shall be secured in place with 10-mil polyethylene tape. Bitumastic shall consist of two coats of Carboline Bitumastic Super Service Black, or equal, 10 mils each coat. Apply only to clean, dry surfaces. Remove rust, paint and other foreign matter by wire brushing or scraping.

B. INSULATING SECTIONS (NOT USED)

C. ANCHORAGE

Anchorage shall be provided as specified. Calculations and drawings for proposed alternative anchorage shall be submitted in accordance with Section 01300.

3.02 ACCEPTANCE TESTING

Hydrostatic pressure tests shall be conducted in accordance with Section 4 of AWWA C600 except that test pressures and allowable leakage shall be as listed in Section 02120. The Contractor shall conduct the tests in the presence of the Engineer.

**\*\*END OF SECTION\*\***

## SECTION 15064

### POLY-VINYL CHLORIDE PIPE (PVC)

#### PART 1 – GENERAL

##### 1.01 SUMMARY

###### A. SCOPE

1. This section specifies polyvinylchloride pipe and fittings.

###### B. PIPE DESIGNATIONS:

Designation	Definition
PVC	Poly-vinyl chloride

##### 1.02 REFERENCES

- A. This section contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
- B. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by the organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, reference to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued, or replaced.

Reference	Title
AASHTO M278	Class PS 50 Polyvinyl Chloride (PVC) Piping Systems Subsurface Drainage of Transportation Facilities
ASTM D1784	Rigid Polyvinylchloride (PVC) Compounds and Chlorinated Polyvinylchloride (CPVC) Compounds
ASTM D1785	Polyvinylchloride (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D2241	Polyvinylchloride (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D2321	Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe
ASTM D2467	Socket-Type Polyvinylchloride (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2564	Solvent Cements for Polyvinylchloride (PVC) Plastic Piping Systems
ASTM D2665	Polyvinylchloride (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings

Reference	Title
ASTM D3034	Type PSM Polyvinylchloride (PVC) Sewer Pipe and Fittings
ASTM F402	Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings
ASTM F477	Elastomeric Seals (Gaskets) for Joining Plastic Pipe

### 1.03 SUBMITTALS

- A. Manufacturer's data certificates of compliance with the specified standards.
- B. Provide information on materials, pipe dimensions, fittings, gaskets and solvent cement.

### 1.04 QUALITY ASSURANCE

To assure uniformity and compatibility of piping components, fittings and couplings for plastic piping systems shall be furnished by the same manufacturer.

## PART 2 – PRODUCTS

### 2.01 PVC PIPE

#### A. NON-PRESSURE PIPE

Flexible pipe, fittings, and joint materials specified herein consist of polyvinyl chloride pipe, hereinafter referred to as PVC unless noted otherwise. All materials incidental to flexible pipe installations such as gaskets, joint lubricants, cements, etc., shall be supplied by the pipe manufacturer. All flexible pipe required in odd lengths shall be cut using a proper cutting tool and guide that insures true-line cut on planes perpendicular to the pipe axis. No bevel cuts for pipeline alignment adjustments will be permitted.

PVC pipe for buried gravity service shall have a solid cross section rubber ring gasket. The gasket shall be securely attached to the pipe to prevent displacement of the gasket when installed in the field. All rubber-ring gaskets shall be in accordance with ASTM F477. Lubricant used for field assembly of gasketed PVC pipe shall have no detrimental effect on the gasket, joint, fitting, or pipe and shall be as recommended by the manufacturer. Provide rubber waterstops at the entry of all PVC pipe into manhole bases.

All PVC pipe shall be joined by compression joints unless otherwise indicated in the Contract Documents and shall conform to the following requirements:

1. Pipe and fittings for non-buried building drain shall PVC material shall conform to ASTM D1784, Class 12454-B. Pipe and fittings shall be in accordance with ASTM D1785, Schedule 40 DWV .
  - a. Schedule 40 PVC socket type DWV fittings shall conform to ASTM D2467. PVC solvent weld cement for socket connections shall meet the requirements of ASTM D2564.
2. Polyvinyl-chloride pipe (PVC) laterals shall conform to the requirements of ASTM D 3034, Class SDR 26. Material for PVC pipe shall conform to the requirements of ASTM D 1784, cell Class 12454-B or 12454-C, as defined therein.
3. Where Polyvinyl-chloride pipe (PVC) (greater than 4-inches) is indicated on the Drawings, furnish and install PVC pipe conforming to AWWA C900 Pressure Class PVC Pipe, referred to herein as C900 PVC Pipe. C900 PVC Pipe shall conform to ASTM D2241, with a minimum pressure class of 150 and maximum standard dimension ratio (SDR) of 21.”
- 4.

#### B. PRESSURE PIPE

1. Material: Conform to ASTM D1784, Class 12454-B.
2. As specified in Section 15100 for pipe systems, comply with standards below.
  - a. ASTM D1785 (Schedule 40, 80, and 120)
3. Schedule Pipe Fittings
  - a. Schedule 80: Comply with ASTM D2467.
  - b. Schedule 40: Comply with ASTM D2466.
  - c. PVC solvent weld cement for socket connections: Comply with ASTM D2564.
  - d. Schedule 80 PVC threaded fittings: Comply with ASTM D2464.

#### 2.02 BEDDING MATERIAL

As indicated on the Drawings.

#### 2.03 FLEXIBLE COUPLINGS

Flexible couplings shall be rubber, full-circle, clamp-on type provided with stainless steel shear ring and two stainless-steel band, screw clamps to secure the coupling tightly to entering and exiting pipes. All screw-clamp hardware shall be Type 316 stainless steel.

Rubber material shall be suitable for sewage service. Use Mission Rubber ARC couplings only; no equal.

### **PART 3 – EXECUTION**

#### **3.01 PRODUCT DELIVERY, STORAGE, AND HANDLING**

##### **A. Handling**

1. Use wide fabric choker slings.
2. Do not drop pipe or fittings even on cushions.
3. Do not use hooks.
4. Polyvinyl chloride pipe has reduced flexibility and impact resistance as temperatures approach and drop below freezing. Extra care should be used in handling and installing PVC pipe during cold weather.

##### **B. Storage**

1. Store and use lubricants in a manner that will avoid contamination.
2. Store loose rubber gaskets in a cool, dark location away from grease, oil, and ozone producing electric motors.
3. Store pipe on a surface that provides even support for the pipe barrel. Do not store pipe supported by the bell.
- 4.

#### **3.02 PIPE CUTTING**

Pipe shall be cut smooth, straight, and at right angles to the pipe axis with saws or pipe cutters designed specifically for the material. Burrs and dust shall be removed from the jointing surfaces. Cut ends shall be beveled in accordance with manufacturer's recommendations.

#### **3.03 INSTALLATION**

- A. Unless otherwise specified, PVC pipe 4" in diameter and greater shall be joined by means of gasketed push-on joints.
- B. Connections to different types of pipe shall be by means of an elastomeric rubber coupling with stainless steel bands and tightening bolts, appropriate to the sizes of the pipes to be joined. Where such couplings are used, bolts shall be uniformly torqued in accordance with pipe manufacturer's recommendation. Foreign material shall be removed from the pipe interior prior to assembly.
- C. Join pipe and fittings to the tolerances recommended by the manufacturer. Do not disturb previously completed joints during the joining operation.

- D. Install buried pipe in accordance with the Contract Drawings and the manufacturer's recommendations.
- E. Pipe shall be inspected both prior to and after installation in the ditch, and all defective lengths shall be rejected and immediately removed from the working area.

### 3.04 INSPECTION AND TESTING

The Contractor shall conduct the tests in the presence of the Engineer. PVC pipe, which has any of the following defects, will not be accepted:

- A. Pipe which is sufficiently out-of-round to prohibit proper joining or that is visibly out-of-round.
- B. Improperly formed ends.
- C. Fractured, cracked, chipped, dented, abrasions, or otherwise damaged pipe.
- D. Pipe that has been damaged during shipment or handling. Acceptance of the pipe at point of delivery will not relieve the Contractor of full responsibility for any defects in material of the completed pipeline.

### 3.05 PERFORMANCE REQUIREMENTS

- A. Gravity flow sanitary sewers and drainage pipelines are required to have a straight alignment and uniform grade between manholes. Foul air pipe shall have straight alignment and uniform grade between fittings.
- B. Test pipe with low pressure air. Fill to 5 psi, allow 3 minutes to stabilize pressure and temperature. If the pressure drops below 3.5 psi in the first 3 minutes, add air until the pressure reaches 3.5 psi then commence the test. After the 3-minute stabilization period, the Contractor shall test the pipe for 2 minutes. If the pressure drops 1 psi or less in the 2-minute test period, the pipe will be considered to have passed.
- C. Sections of pipelines and manholes that fail any test shall be repaired or replaced, as acceptable to Engineer, and retested until the test is passed.

**\*\*END OF SECTION\*\***

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**SECTION 15070**

**HIGH DENSITY POLYETHYLENE (HDPE) PIPE**

**PART 1 – GENERAL**

1.01 SUMMARY

A. This Section specifies high density polyethylene (HDPE) pipe and fittings.

1.02 QUALITY ASSURANCE

A. Referenced Standards: This Section incorporates by reference the latest revisions of the following documents. They are part of this Section insofar as specified and modified herein. In case of conflict between the requirements of this Section and the listed documents, the requirements of this Section shall prevail.

Reference	Title
ASTM D1248	Polyethylene Plastics Molding Extrusion Compounds
ASTM D2321	Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D2657	Heat Fusion Joining of Polyolefin Pipe and Fittings
ASTM D2837	Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials
ASTM D3350	Polyethylene Plastic Pipe and Fittings Material
ASTM F714	Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
ASTM F2620	Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings
AWWA C906	Polyethylene (PE) Pressure Pipe and Fittings, 4-inch through 63-inch for Water Distribution and Transmission
PPI TR3	Policies and Procedures for Developing Recommended Hydrostatic Design Stresses for Thermoplastic Pipe Materials
PPI TR4	Recommended Hydrostatic Strengths and Design Stresses for Thermoplastic Pipe and Fittings Compounds

B. Inspection and Testing: All HDPE materials, pipe and fittings shall be inspected and tested in accordance with the requirements of AWWA C906.

1.03 SUBMITTALS

A. Procedures: Section 01300.

- B. Furnish shop drawings in conformance with the requirements of this Section, and the following:
  - 1. Fully detailed shop drawings showing each type and size of pipe section and fitting to be furnished. All materials of construction shall be identified.
  - 2. Detail drawings, which show the type and location of all fittings and joints.
- E. A report containing a copy of all manufacturer's test results for all tests conducted in accordance with Paragraph 1.02 B.
- F. System used to measure the interior deflection of the pipes.
- G. Butt-fusion welder's qualifications.
- H. Manufacturer's certification that the pipe meets all the specifications.
- I. Pipe manufacturer's installation instructions.
- J. Any deviations from the specifications and the reasons therefor.

#### 1.04 QUALITY ASSURANCE PROGRAM

##### A. Resin Evaluation:

All incoming resin shall be sampled and checked against test results supplied by the manufacturer. Samples shall be taken from the top and bottom of each compartment from every hopper car received.

All resin samples will undergo the following specification verifications:

- 1. Melt index ASTM D-2138.
- 2. Stress exponent.
- 3. Moisture content.
- 4. Thermal stability ASTM D-3350.
- 5. Density ASTM D-1505.

The results of these tests shall become part of the manufacturer's permanent quality control records.

##### B. Finished Goods Evaluation:

Each length of pipe produced shall be checked by production staff for the items listed below. The results of all measurements shall be recorded on production sheets which become part of the manufacturer's permanent records.

1. Pipe in process is checked visually, inside and out for cosmetic defects (grooves, pits, hollows, etc.) which are cause for rejection.
2. Pipe outside diameter is measured using a suitable periphery tape to ensure conformance with ASTM F714.
3. Pipe wall thickness is measured at 12 equally spaced locations around the circumference at both ends of the pipe to ensure conformance with ASTM F714.
4. Pipe length is measured.
5. Pipe marking is examined and checked for accuracy.
6. Pipe ends are checked to ensure they are cut square and clean.
7. Subject inside surface to a “reverse bend test” to ensure the pipe is free of oxidation (brittleness).

#### 1.05 DELIVERY, STORAGE, AND HANDLING

Delivery, storage, and handling shall conform to the requirements of Section 15010.

### **PART 2 - PRODUCTS**

#### 2.01 GENERAL

- A. HDPE materials, pipe and fittings shall be manufactured, inspected, sampled and tested in accordance with the requirements of AWWA C906 and this Section. In case of conflict between the requirements of this Section and AWWA C906, the requirements of this Section shall prevail.

#### 2.02 MATERIALS

- A. HDPE piping components shall be manufactured from materials that meet or exceed the requirements of the Plastic Piping Institute designation PE3408 and that conform to the requirements of ASTM D3350 for a cell classification of PE 345464C. The pipe shall contain no recycled compound except that generated in the manufacturer’s own plant from resin of the same specification from the same raw material pipe.
- B. The pipe shall be homogeneous throughout and free of visible cracks, bubbles, holes, foreign inclusions or other injurious defects. It shall be uniform in color, opacity, density, and other physical properties and produced to the dimensions and tolerances specified in ASTM F714. The inside and outside surfaces shall be semi-matte or glossy in appearance. Any pipe not meeting these criteria shall be rejected.
- C. The polyethylene pipe manufacturer shall provide certification that stress regression testing has been performed on the specific product. The said certification shall include a stress life curve per ASTM D2837. The stress regression testing shall have been done in accordance with ASTM D2837, and the manufacturer shall provide a product supplying a minimum Hydrostatic Design basis (HDR) of 1,600 psi, as

determined in accordance with ASTM D2837. The manufacturer's certification shall state that the pipe was manufactured from one specific resin in compliance with these specifications. The certification shall state the specific resin used, its source, and list its compliance to these specifications.

- D. The material shall be listed by PPI (the Plastics Pipe Institute, a division of the Society of the Plastics Industry) in PPI TR-4 with a 73° F hydrostatic design stress rating of 400 psi. The PPI listing shall be in the name of the pipe manufacturer, and shall be based on ASTM D1827 and PPI TR-3 testing and validation of samples of the pipe manufacturer's production pipe.

## 2.03 PIPE

- A. HDPE pipe to be installed indicated on the Drawings. HDPE pipe shall have nominal inside diameters and minimum DR 17. Nominal inside diameters indicate the minimum required hydraulic requirement for the pipe. The field installed diameter shall be determined by the Contractor.
- B. The dimensions and tolerances shall be as specified in AWWA C906. Pressure class shall be as indicated below:
  - 1. Pressure class in accordance with AWWA C906: minimum of 160 psi.
  - 2. Maximum deflection in installed condition of the average inside diameter of the pipe: 5 percent of vertical diameter.

## 2.04 FITTINGS

- A. Fittings shall conform to the applicable requirements of AWWA C906 for the joining methods specified in Paragraph 3.02 B.

## 2.05 PIPE MARKINGS:

- A. The following shall be continuously indent printed on the pipe, or spaced at intervals not exceeding five feet:
  - 1. Name and/or trademark of the pipe manufacturer.
  - 2. Nominal pipe size.
  - 3. Dimension ratio.
  - 4. The letters PE followed by the polyethylene grade in accordance with ASTM D1248, followed by the hydrostatic design basis in 100's of psi, e.g., PE 3408.
  - 5. Manufacturing standard reference, e.g., ASTM F714-97.
  - 6. A production code from which the date and place of manufacture can be determined.

## 2.06 JOINTS

- A. Thermal butt fusion type. Internal weld beads shall be removed.

## 2.07 MITERED FITTINGS

Mitered fittings shall be provided by the factory using butt fusion from pipe the same size and DR rating as the main pipeline.

## PART 3 - EXECUTION

### 3.01 PIPE HANDLING AND STORAGE

- A. Use care in handling and storage of the pipe. Store pipe on clean, level ground to prevent scratching or gouging of the pipe. If the pipe is stacked for storage, stack the pipe in accordance with the pipe manufacturer's recommendations. Handle the pipe in such a manner that it is not damaged by dragging over sharp objects or cut by chokers or lifting equipment. Cover the storage area to prevent sun exposure which may cause pipe ovality.
- B. Sections of pipe with cuts, gouges, or scratches on the outside diameter (OD) surface shall not be allowed for pipe trench installation. The inside diameter (ID) surface shall be free of cuts, gouges, and/or scratches. Pipe ends shall not be cracked, scratched, or gouged.
- C. Sections of pipe with cuts, gouges, or scratches that exceed allowable limits shall be removed completely and the ends of the pipeline rejoined.

Acceptable limits for cuts, gouges, or scratches are as follows:

Outer surface: maximum allowable depth of cut, scratch, or gouge shall be 5 percent of wall thickness.

Inner surface: shall be free of cuts, gouges, and/or scratches.

Pipe, fittings and accessories shall be carefully inspected before and after installation and those found defective shall be rejected. Before being placed in position, pipe, fittings, and accessories shall be cleaned, and shall be maintained in a clean condition. Proper facilities shall be provided for lowering sections of pipe into trenches. Under no circumstances shall pipe, fittings or any other material be dropped or dumped into trenches.

### 3.02 INSTALLATION

- A. Install HDPE pipe in accordance with manufactures recommendations, the requirements of Section 15100, and the requirements of this Section.

- B. Contractor shall confirm that existing pipe is free of debris and will allow installation of HDPE prior to installation. Any obstructions shall be removed by Contractor prior to installation of HDPE within existing pipe.
- C. Unless otherwise specified, install the piping system in accordance with ASTM D2321, AWWA C906 and the manufacturer's recommendations.
- D. Joining:
  - 1. Join pipe and fittings into continuous lengths on the job site above ground. Unless otherwise specified, join pipes by the butt-fusion method performed in accordance with the pipe manufacturer's recommendations and ASTM D2657. Socket fusion, extrusion welding and hot gas welding shall not be used. Be solely responsible for producing sound welds which will withstand stress occurring during HDD installation and sliplining and that contain no excess joint material.
  - 2. Consult the pipe supplier to obtain machinery and expertise for the joining by butt-fusion of HDPE pipe and fittings. No pipe or fittings shall be joined by fusion by any of the Contractor's personnel unless they have a minimum of two years experience in the techniques involved and have performed the work on at least two previous, similar projects. Butt fusion joining shall yield a joint strength equal to or greater than the tensile strength of the pipe.
  - 3. Remove interior and exterior weld bead prior to pressure testing the pipe.
- E. Excavation and Access Pits
  - 1. Access pit length shall be such that the minimum bending radius for the HDPE pipe, per the pipe supplier is maintained. Sheeting, shoring and bracing requirements shall be in accordance with these specifications and applicable jurisdictional standards.
  - 2. Access pit excavations shall be performed at all points where the HDPE pipe will be inserted into the existing pipeline as shown on Plans. Access pit excavations shall coincide with host pipe lateral connection points or other appurtenance installations.
- F. Pulling Equipment
  - 1. The pulling mechanism shall be properly connected to the end of the HDPE pipe via a pulling head or arrangement approved by the pipe supplier.
  - 2. The maximum pulling tension on the HDPE pipe shall not exceed the pipe supplier's safe pulling force as submitted for this project.
- G. Annular Space Grouting

1. The annular space between the outside of the HDPE pipe and the inside of the existing host pipe shall be filled with a flowable grout in accordance with the contract documents.
2. Samples of grout shall be obtained in accordance with ASTM C495. One set of four standard cylinders shall be cast for each batch. Special handling and sampling procedures shall be followed if indicated by the grout manufacturer. The samples must meet the design compressive strength of the grout as outlined in this specification and per the grout manufacturer. Samples shall be tested in accordance with ASTM C495.
3. Grouting of the annular space shall be done in such a manner as to prevent damage, floating, or collapse of the HDPE pipe. Grouting operations shall be properly vented. If the distance between grout points exceeds the Contractor's pumping capability additional grouting points shall be excavated.
4. The HDPE pipe shall be filled with water prior to the grouting procedure. This shall aid in keeping the fusible polyvinylchloride pipe from floating or collapsing during grouting operation and also aid in dissipating the heat of hydration and its effects on the HDPE pipe as the grout cures. This can be done in coordination with the testing performed on the HDPE pipe.

#### H. Preparation Prior to Making Connections into Existing Piping Systems

1. Approximate locations for existing piping systems are shown in the construction documents. Prior to making connections into existing piping systems, the Contractor shall:
  - i) Field verify location, size, piping material and piping system of the existing pipe.
  - ii) Obtain all required fittings, which may include saddles, sleeve type couplings, flanges, tees, or others as shown in the construction documents.
  - iii) Have installed all temporary pumps and/or pipes in accordance with established connection plans.
2. Unless otherwise approved, new piping systems shall be completely assembled and successfully tested prior to making connections into existing pipe systems.

#### I. Pipe System Connections

1. Pipe connections shall be installed per applicable standards and regulations, as well as per the connection manufacturer's guidelines and as indicated in the construction documents. Pipe connections to structures shall be installed per applicable standards and regulations, as well as per the connection manufacturer's guidelines.

### 3.03 TESTING

#### A. Deflection Testing:

1. General: Perform deflection testing on the entire length of installed HDPE pipe and pipe liner after completion of hydrostatic pressure tests. Deflection of pipe shall not exceed the maximum deflection specified in Paragraph 2.03 B.
2. Deflection Device: Determine whether the allowable deflection has been exceeded by use of a deflection measuring device.
  - a. Deflection Measuring Device: This device shall be sensitive to 1.0 percent of the diameter of the pipe being tested and accurate to 1.0 percent of the indicated dimension.
  - b. Deflection Measuring Device Procedure: Measure deflections through each run of installed pipe. If deflection readings in excess of the maximum allowable specified in Paragraph 2.03 B are obtained, retest pipe by a run from the opposite direction.
  - c. At deflections in the pipeline that exceed the maximum allowable deflection, provide the Engineer with the following information:
    - (1) Location of deflection along pipe length.
    - (2) Length of pipeline affected by deflection.
    - (3) Accurate measurement to  $\pm 1.0$  percent of deflection.

#### B. Hydrostatic Testing and Leakage Testing or Pressure Piping

1. Hydrostatic and leakage testing for piping systems that contain mechanical jointing as well as butt fused HDPE jointing shall comply with AWWA C605.
2. Unless agreed to or otherwise designated by the owner or engineer, for a simultaneous hydrostatic and leakage test following installation, a pressure equal to 150% of working pressure at point of test, but not less than 125% of normal working pressure at highest elevation shall be applied. The duration of the pressure test shall be for two (2) hours.
3. If hydrostatic testing and leakage testing are performed at separate times, follow procedures as outlined in AWWA C605.
4. In preparation for pressure testing the following parameters must be followed:
  - a. All air must be vented from the pipeline prior to pressurization. This may be accomplished with the use of the air relief valves or corporation stop valves, vent piping in the testing hardware or end caps, or any other method which adequately allows air to escape the pipeline at all high points. Venting may also be accomplished by



‘flushing’ the pipeline in accordance with the parameters and procedures as described in AWWA C605.

- b. The pipeline must be fully restrained prior to pressurization. This includes complete installation of all mechanical restraints per the restraint manufacturer’s guidelines, whether permanent or temporary to the final installation. This also includes the installation and curing of any and all required thrust blocking. All appurtenances included in the pressure test, including valves, blow-offs, and air-relief valves shall be checked for proper installation and restraint prior to the beginning of the test.
  - c. Temporary pipeline alignments that are being tested, such as those that are partially installed in their permanent location shall be configured to minimize the amount of potentially trapped air in the pipeline.
- C. If the pipe does not pass the hydrostatic test and/or the deflection test, repair and/or replace the defective pipe.

**\*\*END OF SECTION\*\***

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## SECTION 15096

### PIPE HANGERS AND SUPPORTS

#### PART 1 – GENERAL

##### 1.01 DESCRIPTION

###### A. SCOPE

This section specifies hangers and supports for all piping systems specified in Section 15010. This section does not include pipe supports for pipe anchors, guides or seismic restraints.

###### B. OPERATING CONDITIONS

The hangers and supports specified in this section are provided to resist pipe loads occurring primarily in the downward (gravity) direction. For the purpose of pipe hanger and support selection, this section establishes pipe support classifications based on the operating temperatures of the piping contents. Pipe support classifications are as follows:

1. Hot Systems: A. 120°F to 450°F
2. Ambient Systems: B. 60°F to 119°F
3. Cold Systems: C-1. 33°F to 59° F, C-2. -20°F to 32° F

###### C. HANGER AND SUPPORT SELECTION

1. The Contractor shall select pipe hangers and supports as specified in the project manual. Selections shall be based upon the pipe support classifications specified in this section, and any special requirements, which may be specified in the project manual.
2. The Contractor shall review the piping layout in relation to the surrounding structure and adjacent piping and equipment before selecting the type of support to be used at each hanger point.
3. Hangers and supports shall withstand all static and specified dynamic conditions of loading to which the piping and associated equipment may be subjected. As a minimum, consideration shall be given to the following conditions:
  - a. Weights of pipe, valves, fittings, insulating materials, suspended hanger components, and normal fluid contents.
  - b. Weight of hydrostatic test fluid or cleaning fluid if normal operating fluid contents are lighter.

- c. Reaction forces due to the operation of safety or relief valves.
  - d. Wind, snow, or ice loadings on outdoor piping.
4. Hangers and supports shall be sized to fit the outside diameter of pipe, tubing, or, where specified, the outside diameter of insulation.
  5. Where negligible movement occurs at hanger locations, rod hangers shall be used for suspended lines, wherever practical. For piping supported from below, bases, brackets or structural cross members shall be used.
  6. Hangers for the suspension of size 2½ inches and larger pipe and tubing shall be capable of vertical hanger component adjustment under load.
  7. The supporting systems shall provide for and control the free or intended movement of the piping including its movement in relation to that of connected equipment.
  8. Where there is horizontal movement at a suspended type hanger location, hanger components shall be selected to allow for swing. The vertical angle of the hanger rod shall not, at any time, exceed 4°.
  9. There shall be no contact between a pipe and hanger or support component of dissimilar metals. Prevent contact between dissimilar metals when supporting copper tubing by use of copper-plated, rubber, plastic or vinyl coated, or stainless steel hanger and support components.
  10. Unless otherwise specified, existing pipes and supports shall not be used to support new piping.
  11. Unless otherwise specified, pipe support components shall not be attached to pressure vessels.
  12. Stock hanger and support components shall be used wherever practical.

## 1.02 REFERENCES

This section contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between this section and the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by the organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, reference to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued, or replaced.

Reference	Title
AISC Manual of Steel Construction	American Institute of Steel Construction, Manual of Steel Construction, Allowable Stress Design - 9th Edition
FEDSPEC WW-H-171e	Hangers and Supports, Pipe
MFMA-2	Metal Framing Manufacturer's Association, Metal Framing Standards Publication
MSS SP-58	Pipe Hangers and Supports—Materials, Design and Manufacture
MSS SP-69	Pipe Hangers and Supports—Selection and Application

### 1.03 SUBMITTALS

Submittals shall be made in accordance with Section 01300, Submittals. Hanger and support locations, load calculations, and manufacturer drawings shall be provided as part of the submittals for equipment and piping coordination and installation drawings required in Section 15010 PIPING SYSTEMS.

## PART 2 – PRODUCTS

### 2.01 ACCEPTABLE PRODUCTS

Standard pipe supports and components shall be manufactured by B-Line, Carpenter & Patterson, Kin-Line, Grinnell, Michigan, Pipe Shields Incorporated, Superstrut, Unistrut, or equal. Pipe support components shall conform to the requirements of MSS SP-69 and FEDSPEC WW-H-171e. Pipe support materials shall conform to the requirements of MSS SP-58. Metal framing system components shall MFMA-2.

### 2.02 MATERIALS

#### A. GENERAL

1. For moist and corrosive service conditions and where specified or indicated, pipe hangers and supports, structural attachments, fittings and accessories, nuts, bolts, washers, and other fasteners shall be Type 316 stainless steel.
2. Moist and corrosive service is defined as the following:
  - a. Inside enclosed water and wastewater hydraulic structures
  - b. Submerged, intermittently submerged in water or wastewater
  - c. Less than 2 feet above liquid in open water and wastewater hydraulic structures
  - d. Within chemical storage and feeding containment areas and concrete pipe trenches
  - e. As indicated in the Drawings and Specifications.

3. All materials for other service conditions shall be hot-dip galvanized after fabrication.

## B. PIPE HANGERS AND SUPPORTS

1. TYPE 1—PIPE STANCHION SADDLE: Saddles and yokes shall be carbon steel and comply with MSS Type 37 and FEDSPEC Type 38.
  - a. Steel pipe (insulated) shall be Carpenter & Patterson Fig. 125, B-Line B3090, or equal, with insulation shield.
  - b. Steel pipe (uninsulated) shall be Carpenter & Patterson Fig. 125, B-Line B3090, or equal.
  - c. Cast and ductile iron pipe shall be Carpenter & Patterson Fig. 125, B-Line B3090 NS, or equal.
  - d. Copper pipe (uninsulated) shall be Carpenter & Patterson Fig. 125, B-Line B3090, or equal, with insulation shield or lined with dielectric material.
  - e. Copper pipe (insulated) shall be Carpenter & Patterson Fig. 125, B-Line B3090, or equal, with insulation shield.
  - f. Plastic pipe shall be Carpenter & Patterson Fig. 125, B-Line B3090, or equal.
2. TYPE 2—FLANGE PIPE SUPPORT
  - a. Flange type pipe support shall be B-Line B3094, or equal.
3. TYPE 6—FRAMING CHANNEL PIPE CLAMP: Pipe clamps shall be steel with galvanized finish and material thickness as listed below.
  - a. Steel pipe (uninsulated): Pipe size 3/8 inch and 1/2 inch shall be 16-gage; 3/4 inch through 1 1/4 inches shall be 14 gage; 1 1/2 inches through 3 inches shall be 12-gage; 3 1/2 inches through 5 inches shall be 11-gage; 6 and 8 inches shall be 10-gage; Michigan Model 431, Powerstrut PS 1100, Unistrut P 1109 series, or equal.
  - b. Steel pipe (insulated): Pipe clamp shall be as described in Paragraph 15096-2.02 B.3.a with insulation shield.
  - c. Copper (uninsulated) and plastic pipe: Pipe size 3/8 inch through 1 inch shall be 16-gage; 1 1/4 inches and 1 1/2 inches shall be 14-gage; 2 inches through 3 inches shall be 12-gage; 4 inches shall be 11-gage; clamp shall be copper-plated, plastic coated or lined with dielectric material; Michigan model 432, Powerstrut PS 1200, Unistrut P 2024C and P 2024PC series, or equal.
  - d. Copper pipe (insulated): Pipe clamp shall be as described in Paragraph 15096-2.02 B.3.a with insulation shield.
4. TYPE 7—U-BOLT: U-bolts shall be carbon steel with configuration equivalent to MSS and FEDSPEC Type 24.

- a. Steel pipe (uninsulated) shall be Grinnell Fig. 137, B-Line B3188, or equal.
  - b. Steel pipe (insulated) shall be Grinnell Fig. 137, B-Line B3188, or equal, with insulation shield.
  - c. Cast and ductile iron pipe shall be Grinnell Fig. 137, B-Line B3188, or equal.
  - d. Copper pipe (uninsulated) shall be Carpenter & Patterson Fig. 222 CT, B-Line B3501 CT, Grinnell Fig. 137C, or equal.
  - e. Copper pipe (insulated) shall be Grinnell Fig. 137, B-Line B3188, or equal, with insulation shield.
  - f. Plastic pipe shall be Grinnell Fig. 137C, Michigan model 151, B-Line B3188 C, or equal.
5. TYPE 10—(Not Used)
6. TYPE 11—OFFSET PIPE CLAMP: Pipe clamp shall be carbon steel with configuration and components as specified and shall be of standard design manufactured by a pipe hanger component manufacturer.
- a. Steel pipe (insulated) shall be B-Line B3148, Grinnell Fig. 103, or equal, with insulation shield.
  - b. Steel pipe (uninsulated) shall be B-Line B3148, Grinnell Fig. 103, or equal.
  - c. Cast and ductile iron pipe shall be B-Line B3148 NS, Grinnell Fig. 103, or equal.
  - d. Copper pipe (insulated) shall be B-Line B3148, Grinnell Fig. 103, or equal, with insulation shield.
  - e. Copper pipe (uninsulated) shall be B-Line B3148, Grinnell Fig. 103, or equal, lined with dielectric material.
  - f. Plastic pipe shall be B-Line B3148, Grinnell Fig. 103, or equal.
  - g. Vertical pipe support applications shall be as specified above except that insulation shields shall not be used for insulated pipe.
7. TYPE 12— Not Used
8. TYPE 13—FRAMING CHANNEL PIPE STRAP: Pipe strap shall be carbon steel, with configuration equivalent to MSS Type 26.
- a. Steel pipe (uninsulated) shall be Superstrut No. C-708-U, Powerstrut PS 3126, Kin-Line No. 477, or equal.
  - b. Steel pipe (insulated) shall be Superstrut No. C-708-U, Powerstrut PS 3126, Kin-Line No. 477, or equal, with insulation shield.
  - c. Copper pipe (uninsulated) shall be Superstrut No. C-708-U, Powerstrut PS 3126, Kin-Line No. 477, or equal, with insulation shield or lined with dielectric material.

- d. Copper pipe (insulated) shall be Superstrut No. C-708-U, Powerstrut PS 3126, Kin-Line No. 477, or equal, with insulation shield.
- e. Plastic pipe shall be Superstrut No. C-708-U, Powerstrut PS 3126, Kin-Line No. 477, or equal.

#### C. RACK SUPPORTS

- 1. GENERAL: Unless otherwise specified, pipe rack components shall have a minimum steel thickness of 12 gage, with a maximum deflection 1/240 of the span.
- 2. TYPE 21—PIPE RACK SUPPORT: Post and cross members shall be framing channel as specified in Paragraph 15096-2.02 E.5. Pipe rack fittings shall be carbon steel, of standard design manufactured by framing channel manufacturer. 90° fittings shall be gusseted Unistrut P2484, B-Line B844, or equal. Post base fittings shall be as specified in Paragraph 15096-2.02 D.5.

#### D. STRUCTURAL ATTACHMENTS

- 1. TYPE A—MALLEABLE IRON CONCRETE INSERT: Concrete inserts shall be malleable iron and comply with MSS and FEDSPEC Type 18. Grinnell Fig. 282, Carpenter & Patterson Fig. 108, or equal.
- 2. TYPE B—SIDE BEAM BRACKET: Bracket shall be malleable iron and comply with MSS Type 34 and FEDSPEC Type 35. Grinnell Fig. 202, B-Line B3062, or equal.
- 3. TYPE C—MALLEABLE BEAM CLAMP WITH EXTENSION PIECE: Clamp and extension piece shall be malleable iron, tie rod shall be steel. Beam clamp shall comply with MSS and FEDSPEC Type 30. Grinnell Fig. 218 with Fig. 157 extension piece, B-Line B3054, or equal.
- 4. TYPE D—STEEL BEAM CLAMP WITH EYE NUT: Beam clamp and eye nut shall be forged steel. Configuration and components shall comply with MSS and FEDSPEC Type 28. Grinnell Fig. 292, Carpenter & Patterson Fig. 297, or equal.
- 5. TYPE E—FRAMING CHANNEL POST BASE: Post bases shall be carbon steel, of standard design manufactured by framing channel manufacturer. Single channel: Unistrut P2072A, B-Line B280, or equal. Double channel: Unistrut P2073A, B-Line B281, or equal.
- 6. TYPE F—WELDED BEAM ATTACHMENT: Beam attachment shall be carbon steel and comply with MSS and FEDSPEC Type 22. B-Line B3083, Grinnell Fig. 66, or equal.
- 7. TYPE G—WELDED STEEL BRACKET: Bracket shall be carbon steel and comply with MSS Type 32 and FEDSPEC Type 33 for medium welded bracket. Heavy welded bracket shall comply with MSS Type 33 and FEDSPEC Type 34.



8. TYPE H—CAST IRON BRACKET: Bracket shall be cast iron, Carpenter & Patterson Fig. 340, or equal.
9. TYPE J—ADJUSTABLE BEAM ATTACHMENT: Beam attachment shall be carbon steel, Carpenter & Patterson Fig. 151, B-Line B3082, or equal.
10. TYPE K—DOUBLE CHANNEL BRACKET: Wall channel shall be single channel framing channel as specified in Paragraph 15096-2.02 E.5. Cantilever bracket shall be a carbon steel double framing channel assembly, Unistrut P2542 through P2546, B-Line B297-12 through B297-36, or equal.
11. TYPE L—SINGLE CHANNEL BRACKET: Wall channel shall be single channel framing channel as specified in Paragraph 15096-2.02 E.5. Cantilever bracket shall be a carbon steel single framing channel assembly, Unistrut P2231 through P2234, B-Line B198-6, B198-12, B196-18 and B196-24, or equal.
12. TYPE M—WALL MOUNTED CHANNEL: Wall channel shall be single channel framing channel as specified in Paragraph 15096-2.02 E.5.
13. TYPE N—PIPE STANCHION FLOOR ATTACHMENT: Base plate shall be carbon steel with 1/2 inch minimum thickness. Anchor bolt holes shall be 1/16 inch larger than the anchor bolt diameter. The space between the base plate and the floor shall be filled with nonshrink grout.

#### E. ACCESSORIES

1. HANGER RODS: Rods shall be carbon steel, threaded on both ends or continuous threaded and sized as specified.
2. WELDLESS EYE NUT: Eye nut shall be forged steel and shall comply with MSS and FEDSPEC Type 17. Eye nut shall be Grinnell Fig. 290, B-Line B3200, or equal.
3. WELDED EYE ROD: Eye rod shall be carbon steel with eye welded closed. Inside diameter of eye shall accommodate a bolt diameter 1/8 inch larger than the rod diameter. Eye rod shall be Grinnell Fig. 278, B-Line B3211, or equal.
4. TURNBUCKLE: Turnbuckle shall be forged steel and shall comply with MSS and FEDSPEC Type 13. Turnbuckle shall be Grinnell Fig. 230, B-Line B3202, or equal.
5. FRAMING CHANNEL: Framing channel shall be 1<sup>5</sup>/<sub>8</sub> inches square, roll formed, 12-gage carbon steel. Channel shall have a continuous slot along one side with in-turned clamping ridges. Single channel: Unistrut P1000, B-Line B22, or equal. Double channel: Unistrut P1001, B-Line B22A, or equal. Triple channel: Unistrut P1004A, B-Line B22X, or equal.

2.03 Not Used

## **PART 3 – EXECUTION**

### **3.01 HANGER AND SUPPORT LOCATIONS**

- A. The Contractor shall locate hangers and supports as near as possible to concentrated loads such as valves, flanges, *etc.* Locate hangers, supports and accessories within the maximum span lengths specified in the contract documents to support continuous pipeline runs unaffected by concentrated loads. Hanger and support locations and components shall be indicated on the piping layout drawings required by Paragraph 15010-1.03.
- B. At least one hanger or support shall be located within 2 feet from a pipe change in direction.
- C. The Contractor shall locate hangers and supports to ensure that connections to equipment, tanks, *etc.*, are substantially free from loads transmitted by the piping.
- D. Where piping is connected to equipment, a valve, piping assembly, *etc.*, that will require removal for maintenance, the piping shall be supported in such a manner that temporary supports shall not be necessary for this procedure.
- E. Pipe shall not have pockets formed in the span due to sagging of the pipe between supports caused by the weight of the pipe, medium in the pipe, insulation, valves and fittings.

### **3.02 INSTALLATION**

- A. Welded and bolted attachments to the building structural steel shall be in accordance with the requirements of the AISC Manual of Steel Construction. Unless otherwise specified, there shall be no drilling or burning of holes in the building structural steel.
- B. Hanger components shall not be used for purposes other than for which they were designed. They shall not be used for rigging and erection purposes.
- C. The Contractor shall install items to be embedded before concrete is poured. Fasten embedded items securely to prevent movement when concrete is poured.
- D. Embedded anchor bolts shall be used instead of concrete inserts for support installations in areas below water surface or normally subject to submerging.
- E. The Contractor shall install thermal pipe hanger shields on insulated piping at required locations during hanger and support installation. Butt joint connections to pipe insulation shall be made at the time of insulation installation in accordance with the manufacturer's recommendations.
- F. Hanger and support components in contact with plastic pipe shall be free of burrs and sharp edges.

- G. Rollers shall roll freely without binding.
- H. Finished floor beneath Type N structural attachments and framing channel post bases shall be roughed prior to grouting. Grout between base plate and floor shall be free of voids and foreign material.
- I. Base plates shall be cut and drilled to specified dimensions prior to welding stanchions or other attachments and prior to setting anchor bolts.
- J. Plastic or rubber end caps shall be provided at the exposed ends of all framing channels that are located up to 7 feet above the floor.

### 3.03 ADJUSTMENTS

The Contractor shall adjust hangers and supports to obtain required pipe slope and elevation. Shims made of material that is compatible with the piping material may be used. Stanchions shall be adjusted prior to grouting their base plates.

**\*\*END OF SECTION\*\***

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**SECTION 15100**  
**PIPING SYSTEMS**

**PART 1 – GENERAL**

1.01 DESCRIPTION

A. SCOPE

This section specifies systems of process piping and general requirements for piping systems. Detailed specifications for the components listed on the Piping System Specification Sheets are found in other sections of Division 15. This section shall be used in conjunction with those sections.

B. DEFINITIONS

Pressure terms used in this Section and elsewhere in Division 15 are defined as follows:

1. Maximum: The greatest continuous pressure at which the piping system operates.
2. Test: The hydrostatic pressure used to determine system acceptance.

1.02 QUALITY ASSURANCE

A. REFERENCES

This section contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
AASHTO M36/M36M	Metallic (Zinc or Aluminum) Coated Corrugated Steel Culverts and Underdrains
ANSI A13.1	Scheme for the Identification of Piping Systems
ANSI B1.20.1	Pipe Threads, General Purpose (Inch)
ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250, and 800
ANSI B16.3	Malleable-Iron Threaded Fittings
ANSI B16.5	Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24
ANSI B16.9	Factory-Made Wrought Steel Buttwelding Fittings
ANSI B16.11	Forged Fittings, Socket-Welding and Threaded
ANSI B16.12	Cast Iron Threaded Drainage Fittings
ANSI B16.22	Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings
ANSI B16.26	Cast Copper Alloy Fittings for Flared Copper Tubes
ANSI B31.3	Process Piping
ASTM A47	Ferritic Malleable Iron Castings
ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A74	Cast Iron Soil Pipe and Fittings
ASTM A105/A105M	Carbon Steel Forgings for Piping Applications
ASTM A106	Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A126	Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A197	Cupola Malleable Iron
ASTM A234/A234M	Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
ASTM A312/A312M	Seamless and Welded Austenitic Stainless Steel Pipes
ASTM A403/A403M	Wrought Austenitic Stainless Steel Piping Fittings
ASTM A536	Ductile Iron Castings
ASTM A570/A570M	Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality
ASTM B88	Seamless Copper Water Tube
ASTM D1784	Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D1785	Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
AWWA C105	Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C110	Ductile-Iron and Gray-Iron Fittings, 3-Inch Through 48-Inch (75 mm Through 1200 mm), for Water and Other Liquids
AWWA C111	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115	Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges
AWWA C151	Ductile-Iron Pipe Centrifugally Cast for Water
AWWA C200	Steel Water Pipe—6" (150 mm) and Larger
AWWA C205	Cement-Mortar Protective Lining and Coating for Steel Water Pipe—4 In. (100 mm) and Larger—Shop Applied
AWWA C206	Field Welding of Steel Water Pipe
AWWA C207	Steel Pipe Flanges for Waterworks Services—Sizes 4" through 144" (100 mm through 3600 mm)
AWWA C208	Dimensions for Fabricated Steel Water Pipe Fittings

Reference	Title
AWWA C209	Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines
AWWA C210	Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
AWWA C214	Tape Coating Systems for the Exterior of Steel Water Pipelines
AWWA M11	Steel Pipe—A Guide for Design and Installation

The following related specification sections are referenced herein:

1. Section 01300 – Submittals
2. Section 02120 – Pressure Pipeline Testing
3. Section 02130 – Non Pressure Pipeline Testing
4. Section 15096 – Pipe Hangers and Supports

**B. FITTINGS AND COUPLING COMPATIBILITY**

To assure uniformity and compatibility of piping components, fittings and couplings for grooved end piping systems and plastic piping systems shall be furnished by the same manufacturers.

**1.03 SUBMITTALS**

A. Product data on piping materials shall be provided in accordance with Section 01300 where specified.

**B. EQUIPMENT AND PIPING COORDINATION AND INSTALLATION DRAWINGS:**

1. The drawings show only the general arrangements of the project equipment, piping and appurtenances. Contractor shall prepare and submit coordination and installation drawings that show the specific locations and dimensions of equipment, tanks, control panels, piping, valves, appurtenances, gratings, and related items, based upon dimensions for the actual equipment to be furnished from the accepted shop drawings.
2. The coordination and installation drawings are required for the following systems:
  - a. Equipment and associated piping in Division 11 and Division 15
  - b. All unburied piping systems
3. **DRAWING REQUIREMENTS:**
  - a. Drawings shall be prepared with AutoCAD software, compatible with AutoCAD Version 2005, on a PC compatible hardware platform using Microsoft Windows XP operating system. The drawing files

shall be submitted with each piping system print. The drawing files shall be submitted on rewritable CDROM disks.

- b. The drawings shall be printed at a minimum scale of  $3/8'' = 1'$ , on a minimum sheet size of  $11'' \times 17''$ . Piping shall be shown in plan and section views, or alternatively, as isometric piping spool drawings.
  - c. Piping of nominal size less than 8'' may be single line with scaled lay lengths and fittings. Piping of size 8'' and greater shall be double line with scaled flanges, lay lengths, and fittings. Each pipe run shall be dimensioned.
  - d. All pipe supports, thrust restraints, and seismic bracing shall be shown. All devices shown on the P&ID drawings shall be shown.
  - e. During preparation of the drawings, Contractor shall provide interface and coordination between all equipment suppliers and subcontractors, and, including as a minimum, the structural, architectural, mechanical, electrical, and instrumentation and control elements of the work, including the process and instrumentation diagrams.
  - f. Submittal and review of the coordination and installation drawings shall be completed at least 30 days prior to commencement of piping fabrication for each system. For piping systems that are field fabricated, such as polyvinyl chloride piping systems, submittal and review shall be completed at least 30 days prior to construction of each system.
- C. Drawings shall be original layouts by the Contractor; photocopies of contract drawings are not acceptable. Layout drawings shall show pipe support locations as required by Section 15096.
- D. Load and sizing calculations for supports shall be submitted as specified in Sections 15096.

#### 1.04 SEQUENCING AND SCHEDULING

- A. For proper execution of work cooperate with other trades as needed.
- B. To avoid installation conflicts, thoroughly examine complete set of Contract Documents. Resolve conflicts with Engineer prior to fabrication and installation.
- C. Prior to installation of equipment requiring electrical connections, examine manufacturer's shop drawings, wiring diagrams, product data, and installation instructions. Verify that electrical characteristics indicated in Contract Documents are consistent with electrical characteristics of actual equipment being installed. When inconsistencies occur request clarification from Engineer.

#### 1.05 EXISTING SOILS CONDITIONS



- A. Understand existing soils conditions before submitting bid on work. No additional allowance will be granted due to lack of information for existing conditions of subsurface soils.
- B. Submittal of a bid will be considered acknowledgment of review/understanding of project geotechnical soils report.

**PART 2 – PRODUCTS**

**2.01 HAZARDOUS MATERIALS**

Do not use products containing asbestos, lead, arsenic, or any other material defined by EPA as hazardous to human or animal life.

**2.02 PIPING MATERIALS**

Unless otherwise specified, piping materials, including pipe, gaskets, fittings, connection and joint assemblies, linings and coatings, shall be selected from those listed on the piping system specification sheets. Piping materials shall conform to detailed specifications for each type of pipe and piping appurtenance specified in other sections of Division 15.

**2.03 PIPING IDENTIFICATION**

**A. PLASTIC CODING MARKERS**

Plastic markers for coding pipe shall conform to ANSI A13.1 and shall be as manufactured by W. H. Brady Company, Seton Name Plate Corporation, Marking Services Inc., or equal. Markers shall be the mechanically attached type that are easily removable; they shall not be the adhesive applied type. Markers shall consist of pressure sensitive legends applied to plastic backing which is strapped or otherwise mechanically attached to the pipe. Legend and backing shall be resistant to petroleum based oils and grease and shall meet criteria for humidity, solar radiation, rain, salt, fog and leakage fungus, as specified by MIL-STD-810C. Markers shall withstand a continuous operating temperature range of -40°F to 180°F. Plastic coding markers shall not be the individual letter type but shall be manufactured and applied in one continuous length of plastic.

Markers bearing the legends on the background colors specified in the PIPESPEC shall be provided in the following letter heights:

Outside pipe diameter, <sup>(a)</sup> inches	Letter height, inches
Less than 1½	½
1½ through 3	1⅛
Greater than 3	2¼

<sup>(a)</sup> Outside pipe diameter shall include insulation and jacketing.

In addition, pipe markers shall include uni- and bi-directional arrows in the same sizes as the legend. Legends and arrows shall be white on blue or red backgrounds and black on other specified backgrounds.

**B. PLASTIC TRACER TAPE**

1. Tracer tape shall be 6” wide, colored the same as the background colors as specified in Table A, paragraph 3.07, below, and made of inert plastic material suitable for direct burial. Tape shall be capable of stretching to twice its original length and shall be as manufactured by Allen Systems, W. H. Brady Co., Seton Name Plate Corporation, Marking Services Inc., or equal.
2. The message shall read “*CAUTION PIPE BURIED BELOW*” with bold letters approximately 2” high.

**C. DETECTABLE TRACER TAPE**

1. Tracer tape shall be 3” wide, colored the same as the background colors as specified in paragraph 3.07, below, and made of minimum 5 mil aluminum. Tape shall be suitable for direct burial. Tape shall be as manufactured by Allen Systems, W. H. Brady Co., Seton Name Plate Corporation, Marking Services Inc., or equal.
2. The message shall read “*CAUTION PIPE BURIED BELOW*” with bold letters approximately 2” high.

**2.04 VALVES**

Valves of the same size and service shall be provided by a single valve manufacturer. Packing shall be non-asbestos material. Actual length of valves shall be within 1/16 inch (plus or minus) of the manufacturer’s specified length. Flanges shall meet the requirement of ANSI B16.5. Push-on and mechanical joints shall meet the requirements of AWWA C111.

**PART 3 – EXECUTION**

**3.01 DELIVERY, STORAGE AND HANDLING**

- A. Deliver, store and handle materials and equipment in a manner to prevent damage and deterioration. Store in original container that identifies manufacturer's name, brand and model number. Do not store indoor equipment outdoors unless provided with a waterproof protective cover.
- B. Replacement: In event of damage, immediately make repairs and replacements necessary.

### 3.02 INSTALLATION

#### A. LOCATION

Piping shall be provided as specified except for adjustments to avoid architectural and structural features and shall be coordinated with electrical construction.

#### B. PIPING SIZES

Where the size of piping is not specified, the Contractor shall provide piping of the sizes required by UPC. Unless specified otherwise, small piping (less than 1" in diameter) required for services not described by UPC shall be ½".

#### C. PIPE SUPPORT, ANCHORAGE, AND SEISMIC BRACING

Piping shall be supported by anchor brackets, guides, saddles or hangers. Acceptable types of supports, guides, saddles, hangers and structure attachments for general pipe support, expansion/ contraction and for seismic bracing, as well as anchorage details, are shown on the drawings or specified. Minimum spacing shall be as specified or indicated for supports and for seismic bracing. Where a specific type of support or anchorage is indicated on the drawings, then only that type shall be used there. Piping shall be vertically supported by anchor brackets, guides, saddles or hangers and shall be seismically braced where indicated to resist lateral load. Supports shall be provided on each run at each change of direction. Pipe supports shall be hot-dip or mechanically galvanized. Unless otherwise specified, existing pipes and supports shall not be used to support new piping.

#### D. ANCHORAGE FOR BURIED PIPING

All plugs, caps, tees and bends in buried pressure piping systems shall be anchored by means of reaction backing or restrained joints as specified.

#### E. BEDDING AND BACKFILL

Bedding and backfill for buried piping shall be as specified in Section 02300.

### 3.03 PIPING IDENTIFICATION

#### A. PIPE CODING

After application of the specified coating and insulation systems, exposed piping, interior and exterior, and piping in ceiling spaces, pipe trenches, pipe chases and valve boxes shall be identified with plastic markers as specified in Paragraph 15010-2.02. Legend markers and directional arrows shall be located at each side of walls, floors and ceilings, at one side of each piece of equipment, at piping intersections, and at approximately 50-foot centers.

C. PLASTIC TRACER TAPE

A single line of tape as specified in Paragraph 2.02.B shall be provided 2 feet above the centerline of each buried pipe. For pipelines buried 8 feet or greater below finished grade, Contractor shall provide a second line of tape 12 inches below finished grade, above and parallel to each buried pipe. Tape shall be spread flat with message side up before backfilling.

D. DETECTABLE TRACER TAPE

A single line of tape as specified in Paragraph 2.02.C shall be provided 12-18 inches below grade above and parallel to the centerline of each buried, non-ferrous, plastic, and thermosetting resin pipelines. For pipelines buried 8 feet or greater below finished grade, Contractor shall provide a second line of tape 2 feet above and parallel to the centerline of each buried pipe. Tape shall be spread flat with message side up before backfilling.

3.04 VALVE IDENTIFICATION (not used)

3.05 TESTING

A. GENERAL

1. Upon completion of piping, but prior to application of insulation on exposed piping, the Contractor shall test the piping systems. Pressures, media and test durations shall be as specified in the PIPESPEC. Equipment which may be damaged by the specified test conditions shall be isolated. Testing shall be performed using calibrated test gages and calibrated volumetric measuring equipment to determine leakage rates. Each test gage shall be selected so that the specified test pressure falls within the upper half of the gage's range. Unless otherwise specified, the Contractor shall notify the Construction Manager 24 hours prior to each test.
2. Unless otherwise specified, testing, as specified herein, shall include existing piping systems which connect with new pipe systems. Existing pipe shall be tested to the nearest existing valve. Any piping which fails the test shall be repaired. Repair of existing piping will be considered and paid for as extra work.

B. LIQUID SYSTEMS

Leakage shall be zero at the specified test pressure throughout the specified duration for the following systems: exposed piping, buried insulated piping, and buried or exposed piping carrying liquid chemicals. Unless otherwise specified, leakage from other buried liquid piping systems shall be as specified in Sections 02120 and 02130.

### C. DRAINS

Drain systems, other than pumped drain systems, shall be tested in accordance with UPC and these specifications.

## 3.06 CLEANING AND FLUSHING

### A. GENERAL

Piping systems shall be cleaned following completion of testing and prior to connection to operating, control, regulating or instrumentation equipment. The Contractor may, at his option, clean and test sections of buried or exposed piping systems. Use of this procedure, however, will not waive the requirement for a full pressure test of the completed system. Unless specified otherwise, piping 24" in diameter and smaller shall first be cleaned by pulling a tightly fitting cleaning ball or swab through the system. Piping larger than 24" in diameter may be cleaned manually or with a cleaning ball or swab.

### B. LIQUID SYSTEMS

After completion of cleaning, liquid systems, unless otherwise specified, shall be flushed with clean water.

### C. APPURTENANCES AND PIPING EXTERIOR

Upon completion of installation, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated by this work. Prepare piping for coatings per Section 09960.

## 3.07 PIPING SPECIFICATION SHEETS (PIPESPEC)

Piping and valves for groupings of similar plant processes or types of service lines are specified on individual piping specification sheets (PIPESPECS). Piping services are grouped according to the chemical and physical properties of the fluid conveyed and/or by the temperature or pressure requirements. Each grouping of services (PIPESPEC) is identified by a piping system number. Piping services specified in the PIPESPECS and on the drawings are alphabetically arranged by designated service symbols as shown in Table A. Table A also indicates the system number, fluid category, and pipe color of each service.



3.09 PIPING SPECIFICATION SHEET—PIPESPEC

Piping Symbol/Service: FM—Force Main **System—2**

Test Requirements:

Medium: Water; ref. spec paragraph 15010-3.04 C  
Pressure: 150 psig  
Duration: 120 minutes

Gasket Requirements:

Flange: Compressed gasketing consisting of fibers (Kevlar) and neoprene binder (Garlock 3300 or equal)  
Push-on/Mech Cpl: Nitrile or Neoprene

Buried Pipe:

(See drawings for pipe size.)

HDPE; AWWA 906, D R17, ref. Section 15070.  
Conn; butt fused.  
Ftgs; AWWA C906, except where noted on the drawings.  
Remove inside weld bead.

See remarks below.

Exposed Pipe:

(See drawings for pipe size.)

Anchor Pump Station:  
Ductile iron; AWWA C151, Class 150, ref. Section 15062, except flanged pipe shall be thickness Class 53, , Coating and lining per 15062.  
Conn; Flanged ends per AWWA C115 and AWWA C110, faced and drilled to 125 lb standards.  
Ftgs; AWWA C153, except where noted on the drawings.

Packaged Lift Station:

PVC; ASTM D1784, Class 12454-B, ASTM D1785, Sch. 80. Ref spec Section 15064  
Conn; Flanged and Solvent weld, as shown on dwgs  
Ftgs; PVC Sch. 80, solvent weld, per ASTM D2467 and ASTM D2564.

Remarks:

1. Buried piping at Anchor Pump Station shall also be ductile iron, per the exposed pipe specifications above, with mechanical joint connections.

3.10 PIPING SPECIFICATION SHEET—PIPESPEC

Piping Symbol/Service: SS — Sanitary Sewer

**System—5**

Test Requirements: Ref. spec Section 02130

Gasket Requirements:  
Push-on: Nitrile/Neoprene (PVC)  
Urethane Compression (VCP)

Buried Pipe:  
(See drawings for pipe size.)

PVC, C900, See Section 15064.

Remarks:

1. Piping shall be provided with a minimum downward slope of  $\frac{1}{4}$ " per foot in the direction of flow, or as indicated on the Drawings.

**\*\*END OF SECTION\*\***



## SECTION 15130

### PIPING APPURTENANCES

#### PART 1 – GENERAL

##### 1.01 DESCRIPTION

###### A. SCOPE

This section specifies flow and level gages, pressure gages, strainers, vents and drains.

###### B. EXCLUSIONS

Temperature, pressure and flow measuring devices used for instrumentation are specified in Division 16.

##### 1.02 SUBMITTALS

Manufacturer's product data shall be provided in accordance with Section 01300.

#### PART 2 – PRODUCTS

##### 2.01 PRESSURE DEVICES

###### A. GAGE VALVES

Unless otherwise specified, gage valves shall be ½" ball valves in accordance with Section 15180. The exposed threads of each gage valve shall be protected by a brass plug.

###### B. PRESSURE GAGES

1. Pressure gages shall be provided at the discharge of all pumps, and where indicated on the Drawings.
2. Unless otherwise specified, pressure gage scales shall be selected so that the normal operating pressure falls between 50 and 80% of full scale, shall be 3½", 270° movement, 1.0% accuracy, full scale, and suitable for bottom stem mounting. Gages shall have a Type 316 stainless steel bourdon tube. All gages shall have a 300 series stainless steel case, shatterproof glass, and a ¼" NPT bottom connection.
3. Pressure gages for air, gas, and low pressure services (0–10') shall be premium grade, heavy-duty bourdon-tube units (bellow type for vacuum) with Delrin bushings and pinion, and stainless steel sector.

4. Gages on liquid service shall be as noted above, except they shall be provided with an internal pulsation dampening system consisting of either a glycerin fill or a silicone fluid fill. Snubbers or orifices shall not be utilized. Gages shall be Ashcroft Duragauge Fig. 1009, or equal.
5. Gages on liquid service shall be provided with diaphragm type seals with flushing connections. Seals shall have ASTM A276 Type 316 stainless steel bodies and Type 316L diaphragm unless otherwise specified. Seals shall be Mansfield and Green Type SG, Ashcroft Type 101, or equal. Seals and associated instruments shall be factory filled.

### **PART 3 – EXECUTION**

3.01 (DELETED)

3.02 GAGE TAPS

Gage taps shall be provided as indicated on the Drawings. Gage taps shall consist of a ½” gage valve attached by a threaded nipple to the pipeline.

**\*\*END OF SECTION\*\***

## SECTION 15184

### MANUAL VALVE AND GATE OPERATORS AND OPERATOR APPURTENANCES

#### PART 1 – GENERAL

##### 1.01 DESCRIPTION

This section specifies manual operators for valves and gates, and operator appurtenances. Contractor shall provide all tools, supplies, materials, equipment, and labor necessary for furnishing, installing, adjusting, and testing of valve actuators. Provide manual operators as indicated on the Plans..

##### 1.02 REFERENCES

This section contains references to the following document. It is a part of this section as specified and modified. In case of conflict between this section and the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by the organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, reference to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued, or replaced.

Reference	Title
AWWA C500	Metal-Seated Gate Valves for Water Supply Service
AWWA C504	Rubber-Seated Butterfly Valves

##### 1.03 SUBMITTALS

Submittals shall be provided in accordance with Section 01300 of the Technical Specifications and shall include the information as noted below.

- A. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the

specifications are indicated and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. The submittal shall be accompanied by a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

- B. Manufacturer's catalog information and other data confirming conformance to design and material requirements.
- C. Shop drawings for actuators shall be submitted as part of the submittals for the associated valves in accordance with Section 15200, Valves and Appurtenances.
- D. Contractor shall submit design calculations showing the required valve operation torques and the design torque provided by each actuator.

## **PART 2 – PRODUCTS**

### **2.01 GENERAL**

- A. Supplier shall supply and mount all actuators, including any type of manual or powered actuators, on the valves at the factory. Each valve and actuator shall be shipped as a unit.
- B. Each actuator shall have sufficient torque capacity and features to seat, unseat, and rigidly hold in any intermediate position the valve it controls under the operating conditions for the valve.
- C. Each actuator shall be provided with an externally mounted mechanical valve position indicator.
- D. Each valve body or operator shall have cast thereon the word "OPEN", an arrow indicating the direction to open, and flow direction arrows.

### **2.02 OPERATORS**

#### **A. GENERAL:**

Unless otherwise indicated, nonburied valves shall have an operating wheel, handle, or lever mounted on the actuator. Buried valves shall have AWWA 2-inch operating nuts and non-rising stems. Unless specified otherwise, the direction of rotation of the operator shall be counterclockwise for opening.

B. WRENCH NUTS, BOXES, AND GUIDES:

Wrench nuts shall comply with Section 3.15 of AWWA C500. A minimum of two operating keys, but no fewer than 1 key per every 10 valves, shall be provided for operation of the wrench nut operated valves.

C. GEAR ACTUATORS

1. Unless otherwise noted, gear actuators shall be provided for the following.
  - a. Where specified or shown
  - b. Where a lever or wheel operator effort would otherwise be greater than 60 foot -pounds of torque or 60 pounds of force at the rim of the wheel or lever
2. Gear actuators shall be of the worm or helical gear type with the output shaft perpendicular to the valve shaft and a removable hand wheel mounted on the output shaft. Except as required herein, the gear actuators shall conform to AWWA C504 and shall be certified.
3. Actuators shall be capable of being removed from the valve without dismantling the valve or removing the valve from the line.
4. Gearing shall be machine-cut steel designed for smooth operation. Bearings shall be permanently lubricated, with bronze bearing bushings provided to take all thrusts and seals and to contain lubricants. Housings shall be sealed to exclude moisture and dirt, allow the reduction mechanisms to operate in lubricant, and be of the same material as the valve body.
5. Manual input effort to the handwheel shall be a maximum of 40 foot pounds for operating the valve from full open to full close, under any operating conditions. Gear operators shall indicate valve position and have adjustable stops. Maximum handwheel size shall be 24 inches in diameter. Minimum handwheel size shall be 12 inches.

D. CHAIN WHEELS (NOT USED)

2.03 OPERATOR APPURTENANCES

A. VALVE BOXES:

Valve boxes shall be cast iron and shall have suitable base castings to fit properly over the bonnets of their respective valves and heavy top sections with stay-put covers. Covers shall be hot-dip galvanized.

**B. FLOOR BOXES:**

Floor boxes shall be hot-dip galvanized. Where the operating nut is in the concrete slab, the floor box shall be Monel or UHMW PE bushed. Bronze bushings will not be allowed. Where the operating nut is below slab, the opening in the bottom of the box shall be sufficient for passage of the operating key. Floor boxes for operating nuts recessed in concrete shall be standard cast iron boxes cast into the concrete, with fastening top by Clow, or equal.

**C. ADJUSTABLE SHAFT VALVE BOXES:**

Adjustable shaft valve boxes shall be concrete or cast iron Brooks No. 3RT, Christie G5, Empire 7-1/2 valve extension box, or equal. Box covers on water lines shall be impressed with the letter "W". Sewer line covers shall be impressed with the letter "S".

**D. STEM GUIDES**

Stem guides shall be of the adjustable wall bracket type, UHMW PE bushed, with maximum spacing of 10 feet as manufactured by Clow, Rodney Hunt, or equal. The minimum number of guides are indicated on the Drawings Extended operating stems shall have universal joints and pin couplings if longer than 10 feet and a rating of at least five times the maximum operating torque.

**PART 3 – EXECUTION**

**3.01 GENERAL**

Installation shall be as specified herein. Valve operators shall be located so that they are readily accessible for operation and maintenance. Valve operators shall be mounted for unobstructed access, but mounting shall not obstruct walkways. Valve operators shall not be mounted where shock or vibration will impair their operation. Support systems shall not be attached to handrails, process piping, or mechanical equipment.

**3.02 OPERATORS**

**A. GENERAL:**

Valves and gates shall be provided with manual operators, unless specified otherwise. Where possible, manual operators shall be located between 48" and 60" above the floor or a permanent work platform.

**B. WRENCH NUTS:**

Wrench nuts shall be provided on buried valves, on valves which are to be operated through floor boxes, and where specified. Extended wrench nuts shall be provided if necessary so that the nut will be within 6" of the valve box cover.

C. CHAIN WHEELS (NOT USED)

3.03 OPERATOR APPURTENANCES

A. VALVE BOXES:

Valve boxes extending to finished surfaces shall be provided for buried valves.

B. FLOOR BOXES:

Floor boxes shall be provided for wrench operation of valves located below concrete slabs. Each floor box and cover shall be of the depth required for installation in the slab.

**\*\*END OF SECTION\*\***

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## SECTION 15190

### ECCENTRIC PLUG VALVES

#### PART 1 – GENERAL

##### 1.01 DESCRIPTION

This section specifies eccentric plug valves.

##### 1.02 QUALITY ASSURANCE

###### A. REFERENCES:

This section contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between this section and the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by the organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, reference to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued, or replaced.

Reference	Title
ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings
ASTM A126	Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A276	Stainless Steel Bars and Shapes
ASTM A436	Austenitic Gray Iron Castings
ASTM A536	Ductile Iron Castings
AWWA C504	Rubber-Seated Butterfly Valves

##### 1.03 SUBMITTALS

The following product data shall be provided in accordance with Section 01300:

###### A. Manufacturer's product data.

B. Applicable operating and maintenance information specified in Section 01730.

**PART 2 – PRODUCTS**

2.01 ACCEPTABLE PRODUCTS

Eccentric plug valves shall be as manufactured by Clow, DeZurik, or equal, modified to meet the requirements specified in these Specifications valves.

2.02 MATERIALS

Materials of construction shall be as follows:

Component	Material
Body	Cast iron, ASTM A126, Class B
Plug	Cast iron, ASTM A126, Class B, or cast iron ASTM A436 (Ni-resist), or ductile iron, ASTM A536
Plug facing	Neoprene or Buna-N
Body seats	
Less than 3 inches	Cast iron, ASTM A126, Class B
3 inches and larger	Stainless steel, ASTM A276, Type 304 or nickel
Packing	Buna V-flex or TFE

2.03 MANUFACTURE

A. GENERAL:

1. Valves shall be straight-flow non-lubricated resilient plug type suitable for drip-tight, bi-directional shutoff at the specified valve design pressure. Port areas for the valve shall be at least 100% of the adjacent full pipe area. Valve body seats consisting of nickel for valves 3 inches and larger shall be constructed of a welded-in overlay of not less than 90% pure nickel. Upper and lower journal bearings shall be replaceable, sleeve-type, corrosion resistant, and permanently lubricated. Packing shall be self-adjusting chevron type replaceable without disassembling the valve.
2. Unless otherwise specified, valves shall, as a minimum, conform to the following pressure ratings:

Size, inches	Design pressure, psig
12 and smaller	175
14 through 36	150
42 through 54	125

B. END CONNECTIONS:

Valves 3 inches and smaller shall have threaded ends. Valve flange drilling for valves larger than 3 inches shall be per ANSI B16.1, Class 125. Grooved-end valves may be provided with grooved-end piping systems.

2.04 MANUAL OPERATORS:

Unless otherwise specified, exposed service valves 4 inches and smaller shall be provided with a lever type manual operator. Exposed service valves larger than 4 inches shall be provided with totally enclosed worm gear operators. Where specified, manual operators shall have an adjustable stop. All operator components shall be sized for the valve design pressure in accordance with AWWA C504, Section 3.8. Buried service valves shall be provided with wrench nuts. Manual operators shall have operating torques less than 80 ft-lbs. Unless specified otherwise, each manual operator shall be provided with a hand crank. Unless specified otherwise, the direction of rotation of the operator shall be counterclockwise for opening.

2.05 NOT USED

**PART 3 – EXECUTION**

3.01 INSTALLATION

Unless otherwise specified, valves shall be provided with the seat downstream away from flow. Valves at tank connections shall be installed with seat away from tank. Valves on pump discharge lines shall be installed with seat adjacent to the pump. Each valve shall be installed with the plug in the horizontal position.

**\*\*END OF SECTION\*\***

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**SECTION 15200**

**VALVES AND APPURTENANCES**

**PART 1 – GENERAL**

**1.01 SUMMARY**

- A. Contractor shall provide all tools, supplies, materials, equipment, and labor necessary for furnishing, installing, adjusting, and testing of all valve units.
- B. The provisions of this Section shall apply to all valve and gate units specified in the Contract Documents. Valve units consist of the valves, actuators, sensors, limit switches, controls, and other devices specified in the valve, electrical, and instrumentation Sections and Drawings to provide a complete and operable valve unit.
- C. For valves that require an electric motor, or other type of powered actuator Contractor shall assign the valve Supplier as the system integrator for the complete valve unit. The Supplier shall assume responsibility for furnishing, adjusting, testing, and satisfactory performance of each valve, actuator, sensors, limit switches, controls, and other devices as specified and shown. In addition, the valve Supplier shall be responsible for any field adjustments and settings required for satisfactory performance of each valve.
- D. Contractor shall submit design calculations, test and performance data, and other information as required to substantiate that valve units proposed in the submittals will meet the performance requirements as specified and shown.

**1.02 REFERENCED STANDARDS**

- A. The following documents are referenced in this Section.

Reference	Title
ASTM B 62	Composition Bronze or Ounce Metal Castings

**1.03 SUBMITTALS**

- A. Shop drawings of all valves and actuators, including associated wiring diagrams, electrical data, control system information, and protective coatings shall be submitted in accordance with the requirements in 01300 of the Technical Specifications.
- B. A schedule of valves to be furnished with labels shall be submitted, indicating the label location, attachment method, and proposed text for each valve.

## 1.04 QUALITY ASSURANCE

- A. Unless specified otherwise, each valve body shall be tested with a water test pressure equal to twice its working pressure rating.
- B. Prior to shipment to the Site, Contractor shall submit a certified, notarized copy of the pressure test reports for all valves over 12 inches in nominal size. These test reports shall be in compliance with the requirements of the applicable reference standards as specified.

## PART 2 – PRODUCTS

### 2.01 GENERAL

- A. Contractor shall furnish all valves, gates, actuators, stem extensions, and other accessories as shown or specified. Unless otherwise indicated, provide valves of same size as upstream pipe size. All valves and gates shall be new and of current design. All valves of the same type shall be identical and supplied by a single manufacturer.
- B. All valves of size 6 inches and larger shall have actuators with position indicators.
- C. Valves and actuators shall have the name of the manufacturer, nominal size, flow direction arrow, design working pressure, and the reference standard cast in raised letters or indelibly marked on an appropriate part of the body.
- D. Valves and actuators located outdoors, within a building below the adjacent finished grade, in vaults, or where otherwise indicated, shall be specially designed for submerged service where water may submerge the valve and actuator due to a malfunction or damage to the facilities. All other units shall be weather tight and suitable for outdoor service.
- E. Buried valves shall be provided with valve boxes and covers that contain position indicators, and valve extensions.
- F. Clearances and access shall be provided as specified below. Prior to preparation of Shop Drawings Contractor shall evaluate the location of each valve to identify and prevent potential interferences and clearances not in compliance with those specified below.
  - 1. Valves shall be installed to provide access space and clearances for operation, removal, and maintenance, and to avoid conflicts between valve actuators and walls, structural members, handrails and other potential interferences. Clearances shall be as recommended by the valve and operator manufacturer, or as required by applicable electrical, fire, and mechanical codes and regulations, whichever is greater.

- G. (NOT USED)
- H. Flanges, gaskets, and bolts for valves shall be in accordance with Section 15010, Mechanical Piping, General.
- I. Unless otherwise specified, all interior bronze parts of valves shall conform to the requirements of ASTM B 62.
- J. A label shall be provided on all valves designated with a valve number in the Contract Documents. The label shall be of 1/16-inch thick plastic or stainless steel with a minimum size of 2 inches by 4 inches. Each label shall be permanently attached to the valve using stainless steel screws, stainless steel wire and connectors, or another method subject to approval.
- K. SERVICE
  - 1. Domestic Hot and Cold Water Shutoff and Isolation Valves:
    - a. Pipe Sizes 2-1/2 Inches and Smaller: Ball valve.
    - b. Pipe Sizes 3 Inches and Larger: Gate valve or butterfly valve.
  - 2. Drain Service; All Pipe Sizes: Drain valves.
  - 3. Bypass Around Pressure-Reducing Valves: Globe valves.
  - 4. Check Valves: Swing check.
- L. MANUFACTURERS

See individual Sections as appropriate:

Section	Title
Section 15190	Eccentric PlugValve
Section 15220	Check Valves

## 2.02 PROTECTIVE COATINGS

- A. Ferrous surfaces in water passages of all valves of size 6 inches and larger shall be abrasive blasted and at the factory. Factory coating shall be Fusion Bonded Epoxy or Amine Cured Epoxy. Surface preparation shall be a White Metal Blast Cleaning per SSPC-SP5.
- B. Coatings shall be applied prior to assembly of component parts. Before abrasive blasting, all surfaces shall be ground to remove casting imperfections, rough areas, and other areas that will be detrimental to the coating system during service. Corners and edges of casting surfaces shall be ground to a minimum radius of 1/8-inch.

- C. Exterior surfaces of all unburied and submerged valves and actuators shall be factory coated as specified for the associated piping in Section 09900, Protective Coatings.
- D. Flange faces shall not be protective coated.
- E. The exterior surfaces of valves that are buried shall be field protective coated as specified for the exterior surfaces of the associated buried piping.

## 2.03 VALVE ACTUATORS (NOT USED)

## **PART 3 – EXECUTION**

### 3.01 VALVE INSTALLATION

- A. Valves shall be installed in accordance with the manufacturer's written instructions and as shown and specified. Clearances and access shall be as specified above. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so that separate support can be provided when necessary.
- B. Insulation: Where insulation is indicated, install extended stem valves, arranged in proper manner to receive insulation.
- D. Gates shall be fitted, supported and braced to prevent warping, binding, and bending under operating conditions. Embedded parts cast into concrete shall be accurately positioned and supported during placement of concrete.
- E. Assembly of Valves and Piping
  1. Install valves with piping in accordance with Section 15010, Mechanical Piping, General and with the requirements in this Section.
  2. Valves shall be installed with piping prior to the assembled piping or attached supports being cast into concrete or attached to supports.
  3. Construction sequences and operations shall be such that the adjacent piping provides support for the valves, and that the valves do not support the piping. Where permanent supports are shown to be located at valves, the supports shall be installed after the piping and valves have been installed as a completed assembly on temporary supports.
  4. Piping and valve assemblies shall be installed so that the piping does not exert forces on the valves from settlement or assembly operations.
  5. Joining of valves to piping shall not be performed where the flanges are out of alignment or do not have the proper fit. Where piping alignment deviations exist the piping shall be adjusted before the valve is joined to the piping.



6. Unless shown otherwise, butterfly, plug, and ball valves shall be installed with the shafts in the horizontal position. Gates, gate valves, and other types of valves shall be installed with the stems in the vertical position. For manually operated valves 3 inches in nominal size and smaller, valve operators and indicators shall be oriented to display toward the normal operating direction.
7. Outside screw and yoke stems, except provide inside screw, nonrising stem where space prevents full opening of OS&Y valves. Renewable seats shall be used, except where otherwise indicated.

F. Installation of Check Valves

1. Swing Check Valves: Install in horizontal position with hinge pin horizontally perpendicular to centerline of pipe. Install for proper direction of flow.

G. Floor boxes, valve boxes, extension stems, and floor stands shall be installed vertically centered over the operating nut, with couplings as required. The elevation of the box top shall be adjusted to conform with the elevation of the finished floor, grade, or pavement at the completion of the Work. Boxes and stem guides shall be adequately supported during concrete placement to maintain vertical alignment and proper orientation.

H. Storage and Preparation for Installation

1. Valves shall be packaged and stored to prevent exposure to sunlight, chemical exposure, and atmospheric pollution.
2. Prior to installation each valve shall be inspected for damage. Any damage to seats, machined surfaces, or protective coatings shall be repaired before installation. Each valve shall be cleaned to remove any dirt and debris from the interior surfaces and seat areas. Valves shall be in the closed position for installation.
3. Some valves must be installed with seats or seat adjustment rings on the downstream side of the valve. Determine these requirements prior to installation and install the valve in the correct orientation.

### 3.02 VALVE ADJUSTING AND CLEANING

- A. Inspect valves for leaks. Adjust or replace packing to stop leaks. Replace valve if leak persists.
- B. Valve Identification. Tag valves per Section 15010.

**\*\*END OF SECTION\*\***

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## SECTION 15220

### CHECK VALVES

#### PART 1 – GENERAL

##### 1.01 DESCRIPTION

This section specifies outside lever and weight swing check valves.

##### 1.02 REFERENCES

This section contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between this section and the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by the organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, reference to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued, or replaced.

Reference	Title
ASTM A126	Gray Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A276	Stainless Steel Bars and Shapes
AWWA C508	Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS

##### 1.03 SUBMITTALS

- A. Manufacturer's catalog information including dimensions, cross-sectional views, details of construction, and materials list shall be provided in accordance with Section 01300 of the Technical Specifications.
- B. Applicable operating and maintenance information specified in Section 01730.

## PART 2 – PRODUCTS

### 2.01 ACCEPTABLE PRODUCTS

Check valves shall be Golden Anderson Fig. 340, or equal, modified to meet the requirements specified in this section.

### 2.02 MATERIALS

Materials of construction shall be as follows:

Component	Material
Body, Cover	Cast iron, ASTM A126, Class B
Disc	Cast iron, ASTM A126, Class B
Seat Rings	Bronze, AWWA C508
Hinge Shafts and Hinge Pins	Stainless steel, ASTM 276, Type 304
Shaft Bushings	Bronze, AWWA C508

### 2.03 MANUFACTURE

- A. Disc, disc arm, shaft, keyways, lever and weight shall be capable of closing within 0.05 seconds of pump stoppage and fluid moving at velocity of 8 ft/sec. Weight location shall be adjustable. The valve design shall permit mounting levers on either side of the valve body.
- B. Valves shall be provided with a clear opening equal to or greater than the connecting piping, with no raised seating surface. Seats shall be threaded onto the body or fitted with an O-ring seal and locked in place with stainless steel screws or pins and shall be replaceable. Shafts shall be provided with stuffing box and packing or O-ring seals at each end which are externally replaceable.
- C. Unless otherwise specified, valves shall, as a minimum, conform to the following pressure ratings:

Size, inches	Working Pressure, psig	Hydrostatic Pressure, psig
2 through 12	175	350

## **PART 3 – EXECUTION**

### **3.01 INSTALLATION**

Swing check valves shall be installed in accordance with the manufacturer's recommendations.

**\*\*END OF SECTION\*\***

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## SECTION 15505

### MECHANICAL IDENTIFICATION

#### PART 1 – GENERAL

##### 1.01 SUMMARY

- A. Work Included: Materials and installation of mechanical systems identification.

##### 1.02 REFERENCED STANDARDS

- A. References

Reference	Title
ANSI A13.1	Scheme for Identification of Piping Systems

##### 1.03 SUBMITTALS

- A. Equipment Identification Tag materials
- B. Equipment Identification Tag chart
- C. Pipe markers, duct markers

##### 1.04 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of identification devices of types and sizes required.
- B. Codes and Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices, unless otherwise indicated.

#### PART 2 – PRODUCTS

##### 2.01 MECHANICAL IDENTIFICATION MATERIALS

- A. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 15 sections. Where more than a single type is specified for application, provide single selection for each product category.
- B. Manufacturers: Allen Systems, Inc., W. H. Brady Co., Signmark Division, Industrial Safety Supply Co., Inc., Seton Name Plate Corporation, or approved.

## 2.02 PLASTIC PIPE MARKERS

- A. Provide one of the following:
  - 1. Snap-on Type: Manufacturer's standard preprinted, semi-rigid snap-on, color-coded pipe markers.
  - 2. Pressure-Sensitive Type: Manufacturer's standard preprinted, permanent adhesive, color-coded, pressure sensitive, vinyl pipe markers.
- B. Small Pipes: For external diameters less than 6 inches (including insulation, if any), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:
  - 1. Snap-on application of pretensioned semi-rigid plastic pipe marker.
  - 2. Adhesive lap joint in pipe marker overlap.
  - 3. Laminated or bonded application of pipe marker to pipe (or insulation).
  - 4. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4 inch wide; full circle at both ends of pipe marker, tape lapped 1-1/2 inches.
- C. Large Pipes: For external diameters of 6 inches and larger (including insulation, if any), provide either full-band or strip-type pipe markers, but not narrower than three times letter height (and of required length), fastened by one of the following methods:
  - 1. Laminated or bonded application of pipe marker to pipe (or insulation).
  - 2. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1-1/2 inches wide; full circle at both ends of pipe marker, tape lapped 3 inches.
  - 3. Strapped-to-pipe (or insulation) application of semi-rigid type, with manufacturer's standard stainless steel bands.
- D. Lettering: Comply with piping system nomenclature as specified, scheduled or shown, and abbreviate only as necessary for each application length.
  - 1. Pipe Marker Schedule – Exposed pipe shall be labeled indicating pipe contents as shown.
    - a. Potable Water (W)
    - b. Non-Potable Water (NPW)
    - c. Vent (V, VTR)
    - d. Drain (D)
- E. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.



### 2.03 PLASTIC DUCT MARKERS

- A. General: Manufacturer's standard laminated plastic, color-coded duct markers. Supply separate color codes for supply, exhaust, outside, and return air.
- B. Include the Following Nomenclature:
  - 1. Direction of air flow.
  - 2. Duct service (supply, return, exhaust, outdoor air)

### 2.04 VALVE TAGS

- A. Brass Valve Tags: Polished brass valve tags with stamp-engraved piping system abbreviation in 1/4-inch high letters and sequenced valve numbers 1/2 inch high, and with hole for fastener. 1-1/2-inch diameter tags, except as otherwise indicated.
- B. Valve Tag Fasteners: Solid brass chain (wire link or beaded type), or solid brass S-hooks.
- C. Access Panel Markers: Manufacturer's standard 1/16-inch thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve. Include center hole to allow attachment.

### 2.05 ENGRAVED PLASTIC-LAMINATE SIGNS

- A. General: Engraving stock melamine plastic laminate, Federal Specification L-P-387, in the size and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color), punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
- B. Thickness: 1/16 inch for units up to 20 sq. in. or 8 inches in length; 1/8 inch for larger units.
- C. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

### 2.06 PLASTIC EQUIPMENT MARKERS

- A. General: Manufacturer's standard laminated plastic, color-coded equipment markers. Conform to the following color code:
  - 1. Green: Cooling equipment and components.
  - 2. Yellow: Heating equipment and components.
- B. Nomenclature: Match terminology used on drawing schedules as closely as possible.

- C. Size: Provide approximate 2-1/2- by 4-inch markers for control devices, dampers, and valves; and 4-1/2- by 6-inch markers for equipment.

## 2.07 LETTERING AND GRAPHICS

- A. General: Coordinate names, abbreviations and other designations used in mechanical identification work with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.
- B. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples: Chiller No. 3, Air Handling Unit No. 42, Standpipe F12, and the like).

## PART 3 – EXECUTION

### 3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

### 3.02 MECHANICAL EQUIPMENT IDENTIFICATION

- A. General: Install engraved plastic laminate sign or plastic equipment marker on or near each item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices: Pumps, compressors, chillers, cooling towers and similar motor driven units, electric duct heaters, terminal units, coils, fans, water heaters, blowers, unitary HVAC equipment, tanks and pressure vessels, filters, water treatment systems and similar equipment.
- B. Valve identification tags and charts shall conform to Agency tag numbering system. No tag will be allowed to be installed until after the Agency has reviewed and approved the tag numbering.
  - 1. Tags which have been installed without Agency approval of tag numbering shall be removed and replaced with new appropriately numbered tag at Contractor's expense.

### 3.03 ADJUSTING AND CLEANING

- A. Adjusting: Relocate any mechanical identification device which has become visually blocked.
- B. Cleaning: Clean face of identification devices, and glass frames of valve charts.

**\*\*END OF SECTION\*\***

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## SECTION 16010

### ELECTRICAL

#### PART 1 - GENERAL

##### 1.01 SCOPE OF WORK

- A. The Contractor shall install, ready for use, the electrical system as specified herein and shown on the Contract Drawings. This document describes the function and operation of the system and general components, but does not necessarily describe all necessary devices. All components and devices shall be furnished and installed as necessary to provide a complete, operable and reliable system for accomplishing the functions and meeting the performance set forth hereinafter.
- B. Furnish all required labor, materials, equipment, tools, safety equipment, transportation, test equipment, incidentals and services to provide a complete and operational electrical system as shown on the Contract Documents. See Appendix "B" for "Device Index," and applicable instruments for this project.
- C. Examine the Specification and Drawings for mechanical equipment and provide all starters, circuit breakers, switches, pushbuttons and appurtenances which are not specified to be with the mechanical equipment. Erect all electrical equipment not definitely stated to be erected by others, furnish and install conduit, wire and cable and make connections required to place all equipment in complete operation.
- D. The major areas in the scope of work shown, including both the furnishing and installing at both Anchor PS and Spinnaker PS are:
  - 1. Replace existing electrical controls with new pedestal line-up, including motor controls.
  - 2. New Processor Logic Controllers (PLC), Operator Interface (OI) hardware and antenna system for controlling the pump and other miscellaneous devices will be provided by others for Contractor to install. Contractor shall provide backpan to Owner so PLC, radio, etc. can be installed. Contractor shall install backpan and make final connections.
  - 3. New utility service.
  - 4. New telephone service.
  - 5. Installation of primary devices, equipment and instruments are not completely detailed on Contract Drawing plan sheets. Use Device Indexes and Contract Drawings installation details for installation and mounting requirements.

6. All necessary miscellaneous shut off, sample, manifold and calibration valves to sensors.
  7. Conduits and the field interconnection wiring between pedestals, panelboards, controls, lighting, receptacles, and equipment provided under all other Divisions, etc.
  8. Return existing equipment to Owner.
  9. Provide all necessary hardware, fittings and devices to connect the designated equipment and wiring.
  10. Coordination for connection of PG&E power utility reconnection.
  11. Trenching, backfilling, and compaction for all underground conduit routes, concrete pads, and pull boxes.
  12. Grounding system and equipment grounding.
  13. Concrete pads and supports for electrical and instrumentation equipment.
  14. Removal and disposal of excess materials from excavation, pavement removal and demolition work.
- E. Existing site is limited in space. It is the Contractor's responsibility to provide a pedestal package to fit in the allocated space.
- F. PLC programming, Operator Interface (OI) configuration and SCADA graphics by others.
- G. Field instruments will be provided by District to Contractor for installation.
- H. The following Specifications incorporate specific equipment and devices that are standards of the Owner because of their serviceability, because of the local availability of labor, parts and materials or because of the ability of the Owner to umbrella the equipment under existing maintenance contracts.
- I. All electrical work shall conform with the National Electric Code (NEC) 2011 issue. Nothing on the Drawings or in the Specifications shall be construed to permit work or materials not conforming to these codes and standards.

- J. All panels and panelboards shall be supplied by one System Supplier. All panels listed for Division 16, in all Division 16 appendix Indexes, shall be supplied by the same System Supplier. This includes, but is not limited to, all work necessary to select, furnish, supervise, install, calibrate, program, and place into operation all transmitters, instruments, controllers, alarm equipment, monitoring equipment, and accessories as specified herein. The System Supplier shall not subcontract any portions of the equipment provisioning, with the exception of fire and security alarm systems, without written approval of Owner.
- K. The System Suppliers listed below have been determined to meet minimum qualifications specified in this Division and are pre-qualified by the Owner for providing Supplier bids as System Suppliers on the project. Other System Suppliers may submit to Owner, prior to bid opening, a statement of qualification listing relevant experience on similar projects completed. The Owner will list additional pre-qualified System Suppliers in an addendum prior to bid opening.
  - 1. Krug-Bixby-Long Associates (KBL) (phone 510 887-1117)
  - 2. MCC Control System (formerly Meyer Controls) (phone 707 449-0341)
  - 3. Tesco (phone 916 395-8800)
  - 4. Telstar (phone 925-671-2888)

#### 1.02 RELATED WORK IN OTHER SECTIONS

- A. Provide an electrical system that interfaces to work performed under other Mechanical and Equipment Sections of these Specifications.
- B. Install and wire moisture relays provided with pumps per Manufacturer's wiring diagrams.
- C. The following is part of Division 16:
  - 1. Section 16605 – Electrical Systems Analysis.

#### 1.03 CONTRACT DOCUMENTS

- A. The Contract Drawings and Specifications are intended to be descriptive of the type of electrical system to be provided, any error or omissions of detail in either shall not relieve the Contractor from the obligations there-under to install in correct detail any and all materials necessary for a complete operational system at no additional cost.
- B. The Contract Drawings are generally diagrammatic; exact locations of electrical products shall be verified in the field with the Engineer. Except where special details on Drawings are used to illustrate the method of installation of a particular piece or type of equipment or materials, the requirements or descriptions in this Section shall take precedence in the event of conflict.

- C. Location at facilities of equipment, inserts, anchors, panels, pull boxes, conduits, stub-ups, and fittings for the electrical system are to be determined by the Contractor and Engineer at time of installation. Contractor shall make minor adjustments to locations of electrical equipment required by conditions and coordination with other trades at no additional cost.
- D. The Contractor shall examine the architectural, mechanical, structural and electrical and instrumentation equipment provided under other Sections of this Contract in order to determine the exact routing and final terminations for all conduits and cables. The exact locations and routing of cables and conduits shall be governed by structural conditions, physical interferences, and the physical location of wire terminations on equipment. Conduits shall be stubbed up as near as possible to equipment.
- E. All equipment shall be installed and located so that it can be readily accessed for operation and maintenance. The Engineer reserves the right to require minor changes in location of equipment without incurring any additional costs.
- F. "Provide" means to furnish equipment and accessories, do the installation, complete connections, submit documentation, perform start-up, and be responsible for the warranty.
- G. Where conduits are shown as "home runs" on the Contract Drawings or stated to be furnished, but not explicitly shown as part of the scope of work, the Contractor shall provide all fittings, boxes, wiring, etc. as required for completion of the raceway system in compliance with the NEC and the applicable Specifications in this Section.
- H. No changes from the Contract Drawings or Specifications shall be made without written approval of the Engineer. Should there be a need to deviate from the Contract Documents, submit written details and reasons for all changes to the Engineer for favorable review.
- I. The resolution of conflicting interpretation of the Contract documents shall be as determined by the Engineer.
- J. The Contractor shall coordinate with other Suppliers on the project for a complete and operable system.

#### 1.04 COORDINATION

- A. The Contractor shall coordinate the electrical work with the other trades, code authorities, utilities, and the Engineer; with due regard to their work, towards promotion of a rapid completion of the project. If any cooperative work must be altered due to lack of proper supervision of such, or failure to make proper provisions, then the Contractor shall bear expense of such changes as necessary to be made in the work of others.



- B. Manufacturer's directions and instructions shall be followed in all cases where such is not shown on the Contract Drawings or herein specified.
- C. Power Utility Coordination: Coordinate all work with the serving Pacific Gas & Electric (PG&E) for the work shown on Contract Drawings. This coordination includes:
1. The Contractor shall obtain the required inspections.
  2. Submit to the power Utility the proposed metering details. Provide a written statement to Owner from the Utility that shows approval of the proposed metering.
  3. All work associated with material and installation for the Utility power service not paid by the Utility shall be borne by the Contractor. The Contractor shall provide and install all material, conduits, wiring, pull ropes, pole risers, pull boxes, transformer pads, bollards, etc. as shown on Power Utility engineered drawings for new power service.
  4. All fees and charges of the Utility power for service hook-up will be paid by the Owner.
  5. All work shall meet the requirements of the serving power Utility Company (PG&E).
- D. It is the responsibility of the Contractor to make all equipment approval arrangements and scheduling with the power and telephone utility company connected with this project. Schedule within 30 days after award of contract all service installations and connections with the power Utility. Lack of effort by the Contractor to properly schedule Utility service will not be considered valid justification for delays in project completion and no extension in contract time will be given.
- E. Telephone Utility Coordination
1. It is the responsibility of the Contractor to make all equipment approval arrangements and scheduling with the telephone Utility company connected with this project.
  2. The Utility telephone company serving this project is TELCO.
  3. Owner will request initial telephone connection with the serving telephone Utility.
  4. Contractor shall coordinate all work with the serving telephone Utility, obtain the required inspections, and notify the respective Utility Company when service is required.

5. All work associated with material and installation for the utility telephone service not paid by the Utility shall be borne by the Contractor. All work shall meet the requirements of the serving telephone Utility Company.
  6. All fees and charges of telephone utility for new service hook-up will be paid by the Owner.
  7. One (1) separate permanent voice data telephone lines shall be provided at the site.
  8. Additional temporary lines are required for jobsite trailer.
- F. Contractor shall be responsible for obtaining Utility Engineered drawings for service conductor conduits, pull boxes, wire size requirements, pull rope requirements, etc. Conflicts between the Contract drawings and the Utility Engineered drawings shall be brought to the attention of the Engineer.
- G. The Contractor shall cease work at any particular point, temporarily, and transfer his operations to such portions of work as directed, when in the judgment of the Engineer it is necessary to do so.
- H. Prior to commencing the first submittal, the Contractor shall arrange a conference with the Owner, and Electrical Contractor, System Supplier vital to the current phase of work, and shall verify types, sizes, locations, and installation requirements. The Contractor shall, in writing, inform the Engineer that all phases of coordination of this equipment have been covered and if there are any unusual conditions, they shall be enumerated at this time.

#### 1.05 SUPERVISION

- A. The Contractor shall schedule all activities, manage all technical aspects of the project, coordinate submittals and Drawings, and attend all project meetings associated with this Section.
- B. The Contractor shall supervise all work in this Section, including the electrical system general construction work, from the beginning to completion and final acceptance.
- C. The Contractor shall supervise and coordinate all work in this Section to ensure each phase of the project, submittal, delivery, installation, and acceptance testing, etc. is completed within the allowable scheduled time frames.
- D. The Contractor shall be responsible for obtaining, preparing, completing, and furnishing all paperwork for this Section, which shall include transmittals, submittals, forms, documents, manuals, instructions, and procedures.

## 1.06 INSPECTIONS

- A. All work or materials covered by the Contract Documents shall be subject to inspection at any and all times by the Owner. If any material does not conform to the Contract Documents or does not have a favorably reviewed submittal status, then the Contractor shall, within three days after being notified by the Owner, remove said material from the premises. If said material has been installed, the entire expense of removing and replacing same, including any cutting and patching that may be necessary, shall be borne by the Contractor.
- B. Work shall not be closed in or covered over before inspection and approval by the Engineer. All costs associated with uncovering and making repairs, where non-inspected work has been performed, shall be borne by the Contractor.
- C. The Contractor shall cooperate with the Engineer and provide assistance at all times for the inspection of the electrical system under this Contract. The Contractor shall remove covers, provide access, operate equipment, and perform other reasonable work which, in the opinion of the Engineer, will be necessary to determine the quality and adequacy of the work.

## 1.07 JOB CONDITIONS

- A. The Contractor shall make all arrangements and pay the costs thereof for temporary services required during construction of the project, such as temporary electrical power and telephone service. Upon completion of the project, remove all temporary services, equipment, material and wiring from the site as the property of the Contractor.
- B. The Contractor shall provide adequate protection for all equipment and materials during shipment, storage and construction. Equipment and materials shall be completely covered with two layers of plastic and set on cribbing six inches above grade so that they are protected from weather, wind, dust, water, or construction operations. Equipment shall not be stored outdoors without the approval of the Engineer. Where equipment is stored or installed in moist areas, such as unheated buildings, etc., provide an acceptable means to prevent moisture damage, such as a uniformly distributed heat source, to prevent condensation.

## 1.08 SUBMITTAL AND DRAWING REQUIREMENTS

- A. Eight (8) copies of electrical submittals shall be submitted for favorable review by the Engineer, per this subsection and Section 01300. They shall be complete, giving all details of connections, wiring, instruments, enclosures, materials and dimensions. Standard sales literature will not be acceptable.

- B. A copy of the appropriate Division Specification Sections, with addendum updates included, and with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (√) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated and, therefore, requested by the Contractor, each deviation shall be underlined and denoted by a unique number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the Specifications. The submittal shall be accompanied by a detailed, written justification for each numbered item explaining variance or non-compliance with specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no review.
- C. The electrical submittals shall include but not be limited to data sheets and Drawings for each product together with the technical bulletin or brochure. The electrical submittals shall include:
1. Product (item) name used herein and on the Contract Drawings.
  2. The Manufacturer's model or other designation.
  3. Tag name/number per the Drawings or schedules.
  4. Index Binder Tab Dividers.
  5. Detail electrical one line, elementary and loop diagrams and interconnection diagrams showing all wiring requirements for each system. General sales literature will not be acceptable. The part or model number with options to be provided shall be clearly identified. Where more than one item or catalog number appears on a catalog cut, the specific item(s) or catalog numbers(s) proposed shall be clearly identified.
  6. Complete documentation with full description of operation.
  7. Location of assembly at which it is installed.
  8. Input-output characteristics.
  9. Range, size, and graduations as required.
  10. Physical size with dimensions and mounting details.
  11. Enclosure fabrication and color.
  12. Enclosure layout and elevation drawings to scale.

13. Quantity and quality requirements for electric power, air, and/or water supply.
  14. Materials of construction of components.
  15. Nameplate schedule.
  16. Interconnection diagrams.
  17. Bill of Materials: A complete Bill of Materials list shall be provided at the inside of the front cover. The Contractor shall provide Bill of Material for electrical components formatted, as shown in Appendix "A." The System Supplier shall submit a separate set of Bill Materials for the panel, spare parts and another listing all field equipment. Generic names or part numbers used by a distributor or Systems House are not acceptable. Originating Manufacturer's name and part number shall be listed.
  18. A separate instrument data sheet shall be provided for each instrument, per ISA S20 standards or approved equal. Data sheets shall be printed on blue or pink paper. Provide an index with proper identification and cross-referencing of each data sheet.
- D. Submit CD disk copies of all submitted Drawings in AutoCAD format. For each resubmittal, provide a copy of submittal comments and a separate letter, on Company letterhead, identifying how each submittal comment has been addressed in the resubmittal. All Drawings shall be drawn using AutoCAD, drawn in a professional manner and submitted on 11" x 17" sheets. Shop Drawings shall be provided with minimum drafting details, as illustrated on the Contract "electrical" series drawings. Diagrams shall carry a uniform and coordinated set of wire colors, wire numbers, and terminal block numbers. The shop Drawings shall include:
1. Electrical one-line diagrams detailing all devices associated with the power distribution system. The following applicable information or data shall be shown on the one-line diagram: location, size and amperage rating of bus; size and amperage rating of wire or cable; breaker ratings, number of poles, and frame sizes; generator receptacle; manual transfer switch, utility metering, voltage, amperage, number of wires and phases; fault interrupt ratings; ground size and connections; neutral size and connections; power fail and other protective devices; fuse size and type; distribution transformer; panelboard; starters; Contactor size and overload range; motor full load amperage of submitted motor and horsepower; rating for miscellaneous loads, etc. Submit a list for each piece of equipment containing the motor voltage, phase and full load amps with one-lines for verification of accuracy of submitted one-line Drawings.

2. Elementary diagrams shall be provided for all relay logic, power supplies, PLC I/O and other wiring. All elementary diagrams shall be drawn in JIC EMP/EGP format and standards similar to those shown on the E-series elementary diagrams showing ladder rung numbers and coil & contact cross referencing numbers.
3. Analog and digital I/O loop diagrams shall be provided showing the wiring requirements for each instrument loop. Graphic symbols shall conform with ISA S5.4 drawing standards. A loop diagram shall be furnished for each analog and digital I/O process and all modified PLC I/O cards. Loop diagrams shall include the following, as a minimum:
  - a. The loop diagram shall be drawn with sufficient detail to express control philosophy. The diagram shall show all components and accessories of the instrument loop, highlighting special safety and other requirements. These diagrams shall be arranged to emphasize device elements and their functions as an aid to understanding the operation of a system and for maintaining or troubleshooting that system.
  - b. A separate drawing shall be prepared for each analog and digital card. Each card shall be arranged on the diagram in the same order as the physical arrangement of the card terminations. All termination points on the diagram shall be shown with the actual equipment identification, device and relay terminal number or letter, and I/O point P&ID English descriptor and tag name. A separate drawing shall be prepared for each card.
  - c. Energy Sources - Electrical power, air supply, pneumatic and hydraulic fluid supply, designating voltage, current, pressure, etc. shall be shown in detail on the diagram. Input and output signals (e.g., 1-5 VDC, 4-20 mA DC, 3-15 psig, etc.) and power and instrument supplies to devices (e.g. 120 VAC, 24 VDC, 80 psig, etc.) shall be shown.
  - d. Engineering units shall be shown on the diagram. Each wire label, equipment identification terminal number or letter and color code shall be shown. Signal and DC polarities shall be shown.
  - e. All spare wires, cables and termination points shall be shown. All jumpers, grounding, shielding, power supply details shall be shown.
4. Enclosure and Elevation layout diagrams for panels; show all front panels, sidepan and backpan devices drawn to scale. Show fabrication methods and details, including material of construction, paint color, support & latching mechanisms, fans & ventilation system, and conduit entrance areas.

5. Interconnection Diagram - Interconnection diagrams shall be furnished for each electrical and instrumentation system. Each interconnection diagram shall include the following, as a minimum:
  - a. Interconnect drawings shall be prepared for all equipment by the System Supplier.
  - b. The diagrams shall be utilized by the electrician during all phases of installation and connection of all conductors to ensure coordination of equipment interconnects.
  - c. The diagrams shall show wiring as field labeled at the end of the project when as-builts are submitted.
  - d. Each wire labeling code as actually installed shall be shown. The wiring labeling code for each end of the same wire must be identical.
  - e. All device and equipment labeling codes shall be shown.
  - f. Interconnections shall be shown point to point with identified lines. Diagrams of the wireless or wire schedule type are not acceptable. Bundled wires shall be shown as a single line with the direction of entry/exit of individual wires clearly shown. Interconnect diagrams shall not be combined with loop or elementary diagrams.
  - g. All terminations points on the diagram shall be shown with the actual equipment identification terminal number or letter. This identification of terminations includes terminal blocks, junction boxes, all devices, computer I/O points, etc.
  - h. Diagrams shall include raceway numbers, raceway size, cable numbers, wire color code, and wire numbers.
  - i. Each wire and cable size and color code shall be shown. Each conduit route with the conduit label and conduit size shall be shown. Wire and cable routing through conduits, wireways, manholes, handholes, junction boxes, terminal boxes and other electrical enclosures shall be shown with the appropriate equipment labels. All spare wires, cable, and termination points shall be shown. Cable shields shall be shown.
  - j. Labeling codes for terminal blocks, terminals, wires, cables, panels, cabinets, instruments, devices, and equipment shall be shown.
  - k. Schematic symbols shall be used for field devices, showing electrical contacts. Signal and DC circuit polarities shall be shown.

- l. The diagrams shall show all other Contract and supplier drawing numbers, for reference, that are associated with each device that is interconnected.
- m. Attached to each interconnect, a copy of all the support documents used in preparing interconnects shall be submitted. This includes current issues of panel schematics, elementary diagrams, panelboard schedules, conduit schedules, one-line diagrams, connection diagrams, terminal block diagrams, submittals, contract drawings, vendor drawings and all other data used to develop the interconnection diagram as noted in the “Reference Documents” corner of interconnect drawings.
- n. Interconnects shall include list of all applicable reference drawings, request for clarifications, field instructions and change orders. All deletions and additions of equipment, conduits, wire, and cables shall be clearly shown. Clearly state why termination data is not available. Statements should point to applicable area and be placed in a bold box.
- o. Field wiring shall not start before the interconnection drawings have been submitted by the Contractor and approved by the Owner.
- p. Do not show the same wires or jumpers on the elementary or loop and interconnection diagrams. All jumper, shielding and grounding termination details not shown on the connection diagrams shall be shown on the interconnection diagrams.
- q. Interconnection diagrams shall be submitted and approved by the Owner for each electrical and instrumentation system. The Contractor shall not pull in any wires into conduits that do not have approved interconnects. If the Contractor pulls in wire without Owner approval of associated interconnect drawings, the Contractor will not be reimbursed for labor for re-pulling in wires even if there was an error in wire fill or sizing. Also, if the Contractor pulls in wire without Owner approval of associated interconnect drawings, then all progress payments for that particular area of work will be withheld until approved interconnect drawings are in use.
- r. All interconnection diagrams shall be prepared by a System Supplier under the supervision of or by a State of California Registered Electrical Engineer and shall bear that Engineer’s professional stamp and signature for all Interconnection Drawings submitted for approval including as-builts and those used in the field installation. Engineer’s stamp missing from interconnection drawings will be sufficient grounds to reject entire interconnection drawing submittal without



review. All deletions and additions of equipment, wire, and cables shall be clearly shown. Interconnects shall include list of all applicable reference Drawings, request for clarifications, field instructions, and change orders. Failure to provide backup references or signed and stamped drawings may be grounds for immediate rejection.

- s. Example format of Interconnection diagram is shown on Contract “E” Series Drawings or may be obtained from the Engineer.
- t. Interconnection Drawings shall use bundled wire format as shown on example interconnect Contract Drawing. Interconnect drawings submitted with wiring of a single conduit run separated onto multiple interconnect drawings will be rejected without review. A single conduit run with wiring shown on separate interconnect drawings will be allowed only after written approval is given by the Engineer for each conduit run prior to submitting the associated interconnect drawings.
- u. Only field wiring between switchboards, MCCs, Panelboards, Control Panels, and other electrical and instrumentation devices or equipment shall be shown on interconnection drawings. No internal panel wiring shall be shown on interconnect drawings except jumper or other wiring to be installed in field by Electrical Contractor.
- v. Interconnect Drawings along with the corresponding support documents shall be submitted in a separate submittal package. Interconnect drawings submitted with non interconnect drawing packages will be rejected. The latest support documents shall be obtained by system supplier from Contractor for all non-division 16 instruments, panels, and equipment, and included with interconnect drawing submittal. Support documents shall have their submittal number marked in upper right hand corner.
- w. Provide a notes section on each interconnect drawing. In the note section, provide a detailed list of any variances from the Contract conduit schedule necessary for completing the interconnections (i.e. wire fill changes, conduit additions, etc). Change orders regarding wire fill, conduit schedule and errors in plans regarding conduits and wires may not be processed until interconnect drawings have been received for such work.

- x. The field electrician shall mark-up all interconnection diagrams during installation to show accurate as-built wiring, conduits runs, terminations, etc. If interconnection drawings are not properly as-built, the Electrical Contractor will have cost deducted from the Contract for the Owner to field verify and prepare as-built interconnection drawings amount. The amount of the deduction shall be determined on a time and material basis. The cost of such work shall be \$120.00 per hour plus expenses.
  - y. The system supplier shall be responsible to collect all information necessary to complete each interconnection drawing. This includes making field trips to collect all terminal connection data for new and existing, panels, switchboards, panelboards, instruments, equipment and electrical panels.
  - z. An index of drawings shall be provided with each Interconnection submittal listing the unique drawing number and the description of the interconnect drawing (e.g. Drawing 4321-IC1004 Pump 1004 Interconnect Drawing).
  - aa. Provide conduit and interconnect drawing cross reference indexes. Interconnect Conduit Index shall list all conduits listed in the Conduit & Wire Routing schedule and its associated Interconnection Drawing number. An Interconnection Drawing Index shall list all Interconnection drawings and the conduits shown on that specific drawing. These two indexes shall be at the front of all interconnection drawing submittals.
  - bb. Interconnection submittals that contain more than two motor control panels/centers shall have heavy duty dividers with permanent plastic labeled index tabs separating each group of drawings.
6. Submit full size drawing of all nameplates and tags, as specified herein, to be used on project. The Engineer has the right to adjust nameplate engraving titles during submittals at no additional cost to the Owner. Submittal to include the following:
- a. Dimensions of nameplate.
  - b. Exact lettering and font for each nameplate.
  - c. Color of nameplate.
  - d. Color of lettering.
  - e. Materials of construction.

- f. Method and materials for attachment.
  - g. Drawing showing location of nameplate on each panel.
- E. Each submittal shall be bound in a three-ring binder, which is sized such that when all material is inserted the binder is not over 3/4 full. Binder construction shall allow easy removal of any page without complete manual disassembly; spiral ring type binders are not acceptable.
- 1. Each binder shall be appropriately labeled on the outside spine & front cover with the project name, contract number, equipment supplier's name, specification section(s), and major material contained therein.
  - 2. An index shall be provided at the inside of the front cover. This index shall itemize the contents of each tab and sub tab section. Also list the project name, contract number and equipment supplier's name, address, phone number, and contact person on the index page. Index dividers (tabs) shall be provided to separate each section.
  - 3. All copies shall be clear and legible. Data sheets shall be provided for each instrument, with an index and proper identification and cross-referencing.
  - 4. Field equipment shop documents, panel equipment shop documents, drawings, and bill of materials shall be grouped under separate tabs. Catalog cuts shall be ordered in the same sequence as their corresponding Contract specification subsection.
  - 5. Failure to provide submittals with heavy duty permanent plastic labeled index tabs may be grounds for immediate rejection without review.
  - 6. Drawings shall be submitted in a separate hole-punched binder that covers the entire 11" X 17" length of the Drawing:
    - a. Shop Drawings with less than 10 sheets total in the submittal, may be provided in an 11½-inch by 17½-inch reinforced folder.
    - b. All Interconnection Drawings or Shop Drawings of 10 sheets or more shall be provided in separate three-ring binder to allow drawings to be easily removed. Binder shall be Cardinal D-Ring Easy Open Ledger Binder with locking D-Rings or approved equal.
    - c. Failure to provide drawing submittal in correct binder format may be grounds for immediate rejection without review.

- d. Each drawing title block shall contain the English description name for drawing contents (i.e. Lift Pump No. 1 Interconnect Drawing) and drawing number. All pages and drawings in the submittal shall be numbered sequentially (with no number skipped) in lower right hand corner.
  - e. Drawings that are "C" or "D" size shall be folded, with the title block visible and placed in reinforced clear plastic pockets.
- F. Exceptions to the Contract Specifications or Drawings shall be clearly defined by the Equipment Supplier.
  - 1. Data shall contain sufficient details so a proper evaluation may be made by the Engineer. Contractor shall provide separate letter (located in the front of the submittal) detailing specific exceptions to the Contract Specifications or Drawings.
  - 2. Exceptions that are noted in the marked-up Drawings or Specifications, but not listed on the Exceptions/Clarifications letter, will be considered as non-responsive and not accepted as changes to the Contract Documents
- G. The Supplier shall coordinate submittals with the work so that the project will not be delayed. This coordination shall include scheduling the different categories of submittals so that one will not be delayed for lack of coordination with another.
- H. No material or equipment shall be allowed at the job site until the submittal for such items has been favorably reviewed by the Engineer and marked “No Exceptions Taken” or “Make Corrections Noted.”
- I. The equipment specifications have been prepared on the basis of the equipment first named in the Specifications. The Supplier shall note that the second named equipment, if given, is considered acceptable and equal equipment, but in some cases additional design, options, or modifications may be required, at no additional cost, to meet Specifications.
- J. The decision of the Engineer governs what is acceptable as a substitution. If the Engineer considers it necessary, tests to determine equality of the proposed substitution shall be made, at the Supplier's expense, by an unbiased laboratory satisfactory to the Engineer.
- K. Electrical submittals shall be complete giving all details of connections, wiring, instruments, enclosures, materials and dimensions. Standard sales literature will not be acceptable.
- L. Request for information (RFIs) shall not be included in submittals. RFI’s shall be submitted separately in its individual submittal number.

- M. Resubmittals shall be provided with a copy of the previous submittal comments and a separate letter, on company letterhead, identifying how each submittal comment has been addressed in the resubmittal.

## **PART 2 - PRODUCTS**

### **2.01 QUALITY**

- A. All equipment and materials shall be new and the products of reputable suppliers having adequate experience in the manufacture of these particular items. For uniformity, only one Manufacturer will be accepted for each type of product.
- B. All equipment shall be designed for the service intended and shall be of rugged construction, of ample strength for all stresses which may occur during fabrication, transportation, erection, and operation. All equipment shall be adequately stayed, braced and anchored and shall be installed in a neat and workmanlike manner. All components and devices installed shall be standard items of industrial grade, unless otherwise noted, and shall be of sturdy and durable construction. Light duty, fragile and competitive grade devices of doubtful durability shall not be used.
- C. Products that are specified by Manufacturer, trade name or catalog number establish a standard of quality and do not prohibit the use of equal products of other Manufacturers when a listing "or approved equal" is given provided they are favorably reviewed by the Engineer prior to installation.
- D. Underwriters Laboratories (UL) listing is required for all substituted equipment when such a listing is available for the first named equipment.
- E. When required by the Contract specifications or requested by the Engineer, the Contractor shall submit equipment or material samples for test or evaluation. The samples shall be furnished with information as to their source and prepared in such quantities and sizes as may be required for proper examination and tests, with all freight and charges prepaid. All samples shall be submitted before shipment of the equipment or material to the job site and in ample time to permit the making of proper tests, analyses, examinations, rejections, and resubmissions before incorporated into the work.
- F. It is the System Supplier's responsibility to visit jobsite to collect and document existing equipment device part numbers in order for all similar called out new equipment to match existing.

### **2.02 NAMEPLATES & TAGS**

- A. Equipment exterior nameplates - Nameplate material shall be rigid laminated black phenolic with beveled edges and white lettering; except for caution, warning, and danger nameplates the color shall be red with white lettering. The size of the nameplate shall be as shown on the drawings. No letters are allowed smaller than 3/16". All phenolic nameplates located outdoors shall be UV resistant. Securely fasten nameplates in place using two 316 stainless steel screws if the nameplate is not an integral part of the device. Epoxy cement or glued on nameplates will not be

acceptable. Engrave the nameplates with the inscriptions as approved by the Engineer in the submittal.

1. For each major piece of electrical equipment provide a Manufacturer's nameplate showing the Contract specified name and number designation, the Manufacturer's name, model designation, part number, serial number, and pertinent ratings such as voltage, amperage, # of phases, range, U.L listing, etc.
  2. For each device with a specific identity (pushbutton, indicator, instrument, etc.) mounted on the exterior or deadfront of a piece of equipment, provide a nameplate with the inscription as shown in the Contract documents. Where no inscription is indicated in the Contract documents, furnish nameplates with an appropriate inscription providing the name and number of device.
- B. Equipment Interior Nameplates - Nameplate material shall be clear plastic with black machine printed lettering as produced by a KROY or similar machine; except caution, warning, and danger nameplates shall have red lettering. The size of the nameplate tape shall be no smaller than 2" in height with 3/8" lettering unless otherwise approved by the Engineer. Securely fasten nameplates in place on a clean surface using the adhesion of the tape. Add additional clear glue to hold the nameplate securely in place when necessary. Nameplates shall not be attached to wireways or gutters. For each device with a specific identity (relay, module, power supply, fuse, terminal block, etc.) mounted in the interior of a piece of equipment provide a nameplate with the inscription as shown in the Contract documents. Where no inscription is indicated in the Contract documents, furnish nameplates with an appropriate inscription providing the name and number of device used on the submittal drawings. Stamp the nameplates with the inscriptions as approved by the Engineer in the submittal.
- C. Equipment Tags - When there is no space or it is impractical to attach an engraved phenolic nameplate with screws, as is the case with most field devices and instruments, the Contractor shall attach a tag to the equipment with the same inscriptions as specified above in paragraph A. The tag shall be made from 316 stainless steel material and the size of the nameplate shall be no smaller than 3/8"h x 2"w with 3/16" machine printed or engraved lettering unless otherwise approved by the Engineer. The tag shall be attached to the equipment with 316 stainless steel wire of the type normally used for this purpose.

## 2.03 CONTROL DEVICES

### A. Components

#### 1. Fuses

- a. Fuses used in circuits 200 VAC and above shall be time- delay type FNQ or approved equal, 13/32" x 1-1/2", and have an interrupting rating of 10,000 AIC at 500 VAC. Fuse holders shall be of the barrier type and rated 600 VAC.
- b. Fuses used in 120 VAC shall be time-delay type MDL or approved equal, 1/4" x 1-1/4", and have a rating of 250 VAC. Fuses larger than 8 amps shall be DMA or approved equal. Fuse-holders shall be of the terminal block type.
- c. Fuses used in signal and 24 VDC circuits shall be fast acting type ABC or approved equal, 1/4" x 1-1/4", and have a rating of 250 VAC. Fuse-holders shall be of the terminal block type.
- d. Fuses shall be sized in conformance with the NEC.

#### 2. Switches and Pushbuttons

- a. Switches (HS) and pushbuttons (HC) for general purpose applications shall be water and oil tight, as defined by NEMA 13, corrosion resistant, as defined by NEMA ICS 6-110.58, U.L. listed, standard 30 mm diameter, with round plastic clamp ring. Switches shall be Allen-Bradley 800T or approved equal.
- b. Switches and pushbuttons shall have contacts rated 10 amperes continuous and 600 VAC.
- c. Manufacturer's standard size legend plates shall be provided and engraved to specify each switch and pushbutton function. The legend plate color shall be black.
- d. Selector switch handles and pushbutton caps shall be black.
- e. Selector switches for hand-off-auto (HOA) applications shall have the hand position to the left, off in center, and auto in the right position.



### 3. Relays and Timers

- a. General: Relays and timers shall be provided with N.O. or N.C. contacts as shown on the Contract drawings. All spare contacts shown shall be provided. Contacts shall be rated 10 amps minimum at 120 VAC, 60 Hz unless otherwise stated. Supply power or coil voltage shall be 120 VAC unless shown otherwise on the Contract drawings. Relays and timers shall be designed for continuous duty. All relays shall be U.L. listed. The following is a summary of abbreviations associated with relays and timers:

CR - Control relay

PFR - Power Fail relay

TR - Timing relay

TDOE - Time delay on energization

TDOD - Time delay on de-energization

- b. Control relays (CR) shall be plug-in type with indicating lights and clear see-through sealed or enclosed housing to exclude dust. Sockets for plug-in relays shall be standard industrial type 8 pin with barrier pressure screw terminals. Provide IDEC type RH, Potter and Brumfield, or approved equal. Two form-C contacts (minimum) shall be provided on each relay.
- c. The power fail relay (PFR) shall continuously monitor the three phases for undervoltage, voltage unbalance, phase loss, and phase reversal. The power fail relay shall both normally open and normally closed relays. Power fail relays shall be Diversified SLJ, Time Mark, or approved equal.
- d. Time delay relays (TR) shall be solid state plug-in relays with a timer adjustable over the range 1 second to 3 minutes unless other ranges are indicated or required. Provide LED timer energized indicator lamp. Sockets for plug-in timers shall be standard industrial type 8 pin with barriered pressure screw terminals. Time delay relays shall be Square D, Potter and Brumfield, or approved equal.

### 4. Indicating Lights

- a. Indicating Lights for general purpose applications shall be water and oil tight as defined by NEMA 13, corrosion resistant as defined by NEMA ICS 6-110.58, U.L. listed, High intensity multi-chip LEDs, full voltage (unless shown otherwise), standard 30 mm diameter, with round plastic lens and miniature bayonet lamp base. Indication lights shall be Allen-Bradley 800T, to match Owner Standard.

- b. Manufacturer's standard size legend plates shall be provided and engraved to specify each light's function. The legend plate color shall be black.
- c. Indicating lights shall be provided with a push-to-test (PTT) switch and wiring.
- d. Indicating light type and color of lens shall be as shown on the Drawings or specified in the Contract documents. Lamp color will be as follows:
 

1)	Open/On	Green
2)	Closed/Off	Red
3)	Alarm	Amber
4)	Power On	White

**B. Circuit Breakers**

- 1. Circuit breakers shall be of the indicating type, providing ON, OFF and TRIPPED positions of the operating handle. Circuit breakers shall be quick-make, quick-break, with a thermal-magnetic (TM) action, except when protecting motor feeders where motor circuit protector (MCP) breakers with adjustable magnetic trip shall be used. Circuit breakers shall be the bolted on type. The use of tandem or dual circuit breakers in a normal single-pole space to provide the number of poles or spaces specified are not acceptable. All multiple-pole circuit breakers shall be designed so that an overload on one pole automatically causes all poles to open. Circuit breakers and motor circuit protectors shall be manufactured by Square D, Allen-Bradley or approved equal.
- 2. Each 480 volt or 240V circuit breaker shall have a minimum interrupting capacity of 42,000 amperes. Each 120 volt breaker shall be rated for a minimum 10,000 amperes interrupting capacity. Breakers shall be sized as shown on Drawings and as necessary for the supplied equipment.
- 3. Fused disconnects shall not be used in place of breakers.

**C. Elapsed Time Meters**

- 1. Elapsed time meters (ETM) for general use shall be nonresettable with 0.0 to 99,999.9 hour readout, permanently lubricated synchronous motor drive, surface mount housing, screw terminals, and rated at 120 VAC, at 60 Hz. Elapsed time meters shall be Cramer 635, Stemco-Engler Series 210, or approved equal.

## D. Motor Starters

### 1. Contactors

- a. Motor starters (M) shall be magnetically operated, electrically held, full voltage, non-reversing except as shown on the Drawings. NEMA sizes shall be as required for the horsepower of the motor supplied. Starters that are not NEMA rated are not acceptable. Contactors shall be U.L. rated and listed. Motor starters shall be Allen-Bradley, Square D or approved equal.
2. Each motor starter shall have a 120 volt operating coil rated for continuous operation.
3. Auxiliary contacts shall be provided as shown on the Drawings or as required. Each motor starter shall be furnished with a minimum of 2 spare auxiliary contacts in excess from those shown to be used. Auxiliary contacts shall be convertible, in the field, from normally open to normally closed or vice versa.
4. Overload relays shall be adjustable for trip point and for automatic or manual reset. Each overload shall be ambient compensated and shall trip on 600% of full load current in less than 6 seconds. Each overload relay shall have a test trip pushbutton built-in and an adjustable calibrated trip with indicating dial. Three-phase starters shall have 3 overload relays. Each overload relay shall have a normally closed holding contact and a normally open isolated contact for overload alarm. Motor overloads shall be Furnas, Square "D" or approved equal. Heater elements shall be supplied that match motor nameplate amps. There shall be a steel operator, with insulated plastic foot (for safety) through the front door for manual reset of overload relay.

## E. Terminal Blocks

### 1. Control Panel Terminal Blocks

- a. Terminal blocks to be clamp type, 6mm spacing, 600 volt, minimum rating of 30 amps, and mounted on DIN rail, Phoenix Contact UT-4/6 or approved equal.
- b. DIN rail shall be same type as used for the relays. Install an extra DIN rail on each type of terminal strip with 4 terminals for future additions.

- c. Provide terminal blocks with "follower" plates which compress the wires and have wire guide tangs for ease of maintenance. Terminal blocks which compress the wires with direct screw compression are unacceptable. All power, control and instrument wires entering and leaving a compartment shall terminate on terminal blocks with wire numbers on terminals and on both ends of the wires.
- d. Terminal Tags and Markers: Each terminal strip shall have a unique identifying alphanumeric code at one end (i.e.: TB1, TB2, etc.) and plastic marking strip running the entire length with a unique number for each terminal. On each terminal strip, terminal numbers shall be assigned starting with #1 at one end, incrementing in alphanumerical order (i.e.: 1,2,3,4...). Numbers shall be assigned to all blocks except grounding blocks. Fuse blocks shall be assigned unique tag numbers such as FU1, FU2. No two fuses shall be assigned the same tag number.
- e. Plastic marking tabs shall be provided to label each terminal block. These marking tabs shall have a unique number/letter for each terminal which is identical to the "elementary" and "loop" diagram wire designation. Numbers on this marking strip shall be machine printed and 1/8 inch high minimum.
- f. Terminal blocks shall be physically separated into groups by the level of signal and voltage served. Power and control wiring above 100 volts shall have a separate group of terminal blocks from terminal blocks for wiring below 100 volts, intermixing of these two types of wiring on the same group of terminal blocks is not allowed.
- g. Provide a ground terminal or connection point for each grounding conductor.
- h. Provide a separate common or neutral terminal for every two (maximum) inputs and/or outputs.

F. Surge Protective Device

- 1. The surge protective device shall be rated for voltage on a 208V VAC, 3 phase system as shown on Contract Drawings. The maximum transient current the surge protective device will dissipate will be 80,000 amps. The surge protective device shall be Leviton 42000 series, Eaton or approved equal.

G. Panelboard

1. The Contractor shall furnish a panelboard of the type indicated on the Contract E-series Plans and specified herein. Panelboard to be provided with breakers shown on Contract Drawings. Panelboard with a 240V high-leg (stinger) shall not be used.
2. Provide panelboard with steel bolt-on type breakers.
3. A copper ground and neutral bus bar shall be included in panelboards with terminal screws.
4. The panelboard shall comply with the applicable sections of UL, NEC, W.U.E.S.S.C., OSHA and NEMA and shall be manufactured by Square D, Allen-Bradley or approved equivalent.
5. Provide a machine typed circuit directory on inside of panelboard of door breaker identification when panelboard is delivered to site. Update the panelboard legend at end of project to reflect as-built conditions.

H. Loop Powered Indicator shall be a slim-line, edgewise, electronic, 2 wire loop powered, 4-20 mA input, 3-1/2 digit red backlit positive image transfective LCD display with 0.6" characters. The indicators shall be scaled in the actual engineering units with the proper range rather than generic units of 0 to 100%. Each indicator shall require no external power supply or internal battery for operation. Indicators located in field shall be mounted in the Control Panel and shall have a NEMA 4X/IP65 sealed front panel bezel. Temperature range shall be from 0° to +60° Centigrade. The indicator shall be Red Lion CUB4LP40, Newport, or approved equal.

I. Intrusion door switches to be wide gap SPDT switches with armored cable, Sentrol Model No. 2507-A, or approved equal.

2.04 UTILITY METERING

- A. Provide a dead-front type, utility metering cabinet as shown on one-line diagram drawing and elevation diagram drawing. Metering main shall include meter socket, factory installed breaker and test by-pass facility. Voltage and amperage ratings shall be as shown on one-line diagrams. Metering shall be rated for a minimum interrupting current shown on Contract Drawings.
- B. Wiring and terminal blocks within the cabinet shall be furnished as required. Control components mounted within the assembly, such as test blocks, power termination block, etc., shall be suitable marked for identification corresponding to appropriate designations on Manufacturer's wiring diagrams.

- C. Provide Service Entrance UL Label and necessary applicable service entrance features per NEC, local codes, and PG&E requirements.
- D. Metering cabinet shall be NEMA 3R construction for underground utility service.
- E. Metering to be approved in writing by Power Utility prior to the start of fabrication. The Contractor shall be responsible for obtaining written Utility approval of the metering cabinet. A copy of this written Utility approval shall be submitted to the Owner prior to shipment of Metering to jobsite.
- F. The Contractor shall obtain the required inspections and pay all permits and fees for the new service.

## 2.05 WIRE

- A. This section applies to all wires or conductors used internal (non-field) for all electrical equipment or external for field wiring. Wire quantity and size shall be per “Conduit & Wire Routing Schedule”.
- B. Material - Wire shall be new, plainly marked with UL label, gauge, voltage, type of insulation, and Manufacturer's name. All wire shall conform to the following:
  - 1. Conductors shall be copper, with a minimum of 98% conductivity.
  - 2. Wire shall be Class B stranded.
  - 3. Insulation of all conductors and cables shall be rated 600 volt.
  - 4. Insulation type for conductors smaller than #6 AWG shall be moisture and heat resistant thermoplastic NEC Type THHN/THWN, rated 90 °C in dry locations and 75 °C in wet locations, or approved equal. Conductors #6 AWG and larger shall be XHHW insulation rated 90 °C in dry locations and 75 °C in wet locations.
  - 5. Field wire minimum AWG sizes:
    - a. #12 for wires used for individual conductor circuits 100 volt and above, except for Control Wire which may be #14AWG when listed in the Conduit and Wire Routing Schedule.
    - b. #14 for wires used for individual conductor circuits below 100 volt.
  - 6. Non-field or equipment wire minimum AWG sizes:
    - a. #16 for wires used for individual conductor circuits 100 volt and above.
    - b. #18 for wires used for individual conductor circuits below 100 volt.

7. Instrument wiring:
- a. Field: Instrument cables shall have 600V tray/UV rated cable rated insulation and 100% individual shielded twisted pair #16 AWG conductors with drain wire.
  - b. Non-Field (inside enclosures): Instrument cables shall have 600V rated insulation and 100% individual shielded twisted pair #18 AWG conductors with drain wire.
  - c. Single twisted shielded pair (T.S.PR.) cables shall be Belden or approved equal.
8. Special purpose wiring:
- a. Manufacturer Supplied Cables (MNFR CBL): Cables and wiring for special systems shall be provided by the Manufacturer with the equipment and installed per the Manufacturer's recommendations.
- C. Color code - color code of all wire shall conform with the following table. Tape color coding allowed only on #6 AWG wires and larger.

**WIRES COLOR CODE TABLE**

<b>DESCRIPTION</b>	<b>PHASE/ CODE LETTER</b>	<b>FIELD WIRE WIRE OR TAPE COLOR</b>	<b>NON-FIELD WIRE COLOR</b>
480 V, 3 PHASE	A	BROWN	BROWN
	B	ORANGE	ORANGE
	C	YELLOW	YELLOW
240 V or 208 V, 3P	A	BLACK	-
	B	RED (ORANGE if high leg)	-
	C	BLUE	-
240 / 120 V, 1 P	L1	BLACK	BLACK
	L2	RED	-
24V POSITIVE	24P	PINK	PINK
24V NEGATIVE	24N	BLACK	BLACK
AC CONTROL		VIOLET	RED (YELLOW FOR FOREIGN CIRCUITS)
DC CONTROL		BLUE	BLUE
NEUTRAL	N	WHITE	WHITE
GROUND	G	GREEN	GREEN
SHIELDED PAIR	+	CLEAR	CLEAR

DESCRIPTION	PHASE/ CODE LETTER	FIELD WIRE WIRE OR TAPE COLOR	NON-FIELD WIRE COLOR
	-	BLACK	BLACK

Note #1: High leg of open delta shall be colored orange per NEC 110.15.

- D. Wire Identification - All wires, field and interior (non-field) to equipment, shall be identified with machine permanent ink printed sleeve markers or clip-on markers covered with clear plastic heat shrinkable tubing. Hand lettered wire labels are not acceptable and shall be replaced at the Contractor's expense. All wires that are electrically the same (connected to common termination points) and do not pass through a contact or other switching device shall have the same wire identification. The wire labeling code for each end of the same wire shall be identical. Tubing shall be sized for the wire and shrunk into place with the properly sized heat gun. The wire identification code for field and panel wiring shall be the number/letter designated on the approved "elementary," "loop" and "interconnection" diagrams.

## 2.06 CONDUIT, RACEWAYS, AND WIREWAYS

- A. GENERAL - Conduit, raceways, and wireways, wiring methods, materials, installation shall meet all requirements of the NEC, be UL labeled for the application, and meet the minimum following specifications.
1. All wiring shall be installed in conduits, raceways, or wireways when interconnecting equipment and devices.
  2. The Contractor shall use special conduit, raceways, wireways, construction methods, and materials as shown on the Contract drawings; which shall take precedence over any general methods and materials specified in this section.
  3. The minimum size conduit shall be 3/4-inch unless indicated otherwise on the Drawings or for special connections to equipment.
  4. Conduit stubs shall be capped with coupling, nipple, & cap and each end identified with conduit labels.
  5. Conduit Marking
    - a. All conduits listed in the "Conduit and Wire Routing Schedule" shall have conduit tags at both terminations of each conduit.



- b. Tag material shall be rigid laminated red phenolic with white lettering. The size of the tag shall be 2" diameter. No letters are allowed smaller than 7/16". Tags shall be heat and UV resistant, stainproof, electrically non-conductive and non corroding. Securely fasten tags in place using UV resistant, black plastic tie-wraps. Engrave the tags, on both sides, with the conduit number as listed in the Conduit and Wire Routing Schedule on the Contract "E"-series Drawings. Labeling shall be neatly installed for visibility and shall be clearly legible. Conduit tags shall be Brady Custom B-1 or approved equal.

**B. Galvanized Rigid Steel Conduit – (GRS)**

1. Standard weight, zinc coated on outside by hot-dipping or sherardizing process. Fabrication shall be hot-dip galvanized after fabrication, conforming to NEMA RN1.
2. Provide galvanized rigid steel factory elbows for 90 degree transitions.
3. Fittings and couplings shall be hot dipped galvanized steel or galvanized cast ferrous metal. Provide threaded-type fittings, couplings, and connectors; set-screw type and compression-type are not acceptable.
4. All joints shall be treated with T & B type CP "Kopr-Shield," LPS No. 3 rust inhibitor, or approved equal.
5. All junction and metal pull boxes shall be galvanized.
6. Metal conduits entering enclosures shall be fitted with insulated grounding bushing; O-Z "HBLG", Appleton "GIB", or approved equal. All grounding bushings shall be tied to the grounding system with properly sized bonding conductors per the NEC code.
7. GRS conduit is allowed only when specifically called out in the "Conduit and Wire Routing Schedule".

**C. Galvanized Rigid Steel Conduit - PVC Coated (GRS-PVC)**

1. Standard weight, galvanized conduit with a 40-mil thick polyvinylchloride coating bonded to both the outside and urethane interior coating. Conduit shall be hot-dip galvanized conforming to NEMA RN 1. GRS-PVC conduit to be Robroy Plasti-bond Red or approved equal.
2. Provide PVC coated galvanized rigid steel factory elbows for 90 degree transitions.

3. Fittings shall be hot dipped galvanized steel or galvanized cast ferrous metal with a PVC 40 mils thick coating. Provide threaded-type fittings, couplings, and connectors; set-screw type and compression-type are not acceptable.
4. All junction and metal pull boxes shall be galvanized with exterior surfaces PVC coated to 40 mils thickness.
5. Conduits entering enclosures shall be fitted with insulated grounding bushing; O-Z "HBLG", Appleton "GIB", or approved equal. All grounding bushings shall be tied to the grounding system with properly sized bonding conductors per the NEC code.
6. GRS-PVC conduits shall be used for underground conduits where listed in the "Conduit and Wire Routing Schedule".

D. PVC Conduit, Schedule 40 or 80 (PVC)

1. Shall be high impact schedule 40 or 80 polyvinylchloride suitable for use underground, direct burial and for use with 90 C wires, and shall conform to UL 651. Shall be UL listed and labeled for "direct" burial.
2. A copper bonding conductor shall be pulled in each raceway and bonded to equipment at each end with approved lugs.
3. Each underground run shall be placed in a trench with a five (5) inch sand bed evenly compacted on all sides, top and bottom.
4. Bends, elbows, and risers shall be made with PVC coated galvanized rigid steel (GRS-PVC) conduit using threaded adapters. Bond each metallic portion to each other and to equipment connected at each end of conduit run.
5. PVC fittings shall have solvent-weld-type conduit connections.
6. PVC conduit shall be stored on a flat surface and shielded from the sun.

E. Liquid Tight Flexible Metal Conduit - (FLEX)

1. All flex conduits shall be metallic with water tight outer jackets.
2. Connectors:
  - a. NEMA 1 or 12 Areas: Metallic with insulated bushings.
  - b. Non-NEMA 1 or 12 Areas: PVC coated metallic with insulated bushings.

3. Final connections to vibrating equipment such as heaters and fans shall be made with flexible conduits
4. Flexible conduit lengths shall not be greater than 36 inches.
5. Flexible metallic conduit shall not be considered as a ground conductor; install a separate wire for equipment bonding.
6. Flexible conduit shall only be installed in exposed or accessible locations.
7. Flex conduits shall be used for conduit coupling to all vibrating and shifting equipment.
8. Flex conduits shall be Thomas & Betts, to match Owner Standard.

## 2.07 WIRING DEVICES

### A. Boxes

1. Concealed device boxes shall be of zinc-galvanized steel type with shape and size best suited for the particular application, rated for the location installed, and shall be supported directly to structure by means of screws, anchors, or bolts.
2. Exposed boxes located in outdoor or in moist locations shall be weatherproof (WP) PVC coated cast type with threaded hubs. Indoor exposed boxes not in moist locations can be non-coated cast type.
3. Box dimensions shall be in accordance with size, quantity of conductors, and conduit clearances per NEC articles 314 requirements.

### B. Switches

1. General purpose switches shall be manufactured in accordance with UL 20. Switches shall be one pole rated, 20 amps, at 277 VAC. Bodies shall be of ivory phenolic compound supported by mounting strap having plaster ears. Switches shall have copper alloy contact arm with silver cadmium oxide contacts. Switches shall have slotted terminal screws and a separate green grounding screw. Furnish Hubbell 1221, Leviton 1221, or approved equal.

### C. Receptacles

1. General purpose receptacles shall be duplex and rated 20 amps, 120 VAC, 2 pole, 3 wire grounding, NEMA 5-20R configuration, specification grade, and side wired to screw terminals. Face color shall be white or ivory. General purpose receptacles shall be Leviton 5362, Bryant, Hubbell, or approved equal.
2. GFI (ground fault circuit interrupting) receptacles shall be used in all boxes shown as weatherproof. GFI receptacles shall be duplex, 20A, 120V, with "test" and "reset" buttons with shallow design for mounting and standard screw terminals for direct wiring. Receptacles shall be designed, manufactured, and tested to prevent nuisance tripping from voltage spikes, RFI, EMI, or electronic component failures. Chaining multiple receptacles from one GFI unit is not acceptable. GFI receptacles shall be Leviton 6899, Arrow-Hart or approved equal.
3. Receptacles installed in Control Panel to be DIN rail mounted Phoenix Contact EM-DUO to match Owner Standard.

### D. Device Plates and Covers

1. Non-Weatherproof general purpose device plates and covers shall be 316 stainless steel. Plates or covers shall be attached with 316 stainless steel screws. Circuit breaker number and panelboard name shall be stamped on each cover.
2. Device plates and covers for cast metal boxes shall be same material as the box.
3. PVC coated device boxes shall have PVC coated gasketed covers.
4. Each receptacle access cover shall have a gasketed spring door to maintain the weatherproof integrity with plug inserted in accordance with NEC 406.9 for unattended locations. Final decision of type of access cover for specific location shall be per engineer. Screws and hinge springs shall be 316 stainless steel. Weatherproof access covers shall be Hubbell, Tay Mac, Crouse-Hinds, or approved equal.
5. Receptacle and light switch plates shall be stamped or engraved as specified herein.

## 2.08 GROUNDING SYSTEM

- A. Install bare copper ground bond wires to the various locations shown on the drawings.

- B. Ground clamps shall be bolt-on type as manufactured by ILSCO type AGC, O-Z Gedney type GRC, or approved equal.
- C. Grounding conductors shall be sized as shown on the Plans or in accordance with NEC Table 250.122, whichever is larger.
- D. All buried, ground rod, large pipe, and steel plate or frame ground bond connections shall be made by exothermic welding process equal to CADWELD.
- E. The ground rods shall consist of not less than 10 continuous feet of ¾-inch copper coated electroplated high grade carbon steel. The ground rods shall be pointed type, UL listed, manufactured of 1035 cold drawn steel. The ground rods shall extend up for visible connection of a UL approved “ground clamp”.
- F. Provide 14 inch diameter, 9-inch nominal throat, 12 inches depth minimum, concrete ground rod boxes where shown on plans. Boxes to have cast iron traffic cover embossed or engraved “GROUND.” Ground rod boxes to be as manufactured by BES Concrete Products, Christy Concrete Products, or approved equal.
- G. Grounding and bonding wires shall be installed in all conduits and raceways and connected to the grounding termination point in all equipment.
- H. Each ground bus shall be copper. Screw type fasteners shall be provided on all ground busses for connection of grounding conductors. Ground bus shall be a Challenger GB series, ILSCO CAN series or approved equal.
- I. The system neutral conductor and all equipment and devices required to be grounded by the National Electrical Code shall be grounded in a manner that satisfies the requirements of the National Electrical Code.
- J. The system neutral (grounded conductor) shall be connected to the system's grounding conductor at only a single point in the system. This connection shall be made by a removable bonding jumper sized in accordance with the applicable provisions of the National Electrical Code if the size is not shown on the Drawings. The grounding of the system neutral shall be in the enclosure that houses the service entrance main overcurrent protection.
- K. One side of the secondary on all transformers and DC power supplies shall be grounded to the ground bus.
- L. All raceway systems, supports, enclosures, panels, motor frames, and equipment housings shall be permanently and effectively grounded.
- M. All receptacles shall have their grounding contact connected to a grounding conductor.

- N. Branch circuit grounding conductors for receptacles or other electrical loads shall be arranged such that the removal of a lighting fixture, receptacle, or other load does not interrupt the ground continuity to any other part of the circuit.
- O. Attachment of the grounding conductor to equipment or enclosures shall be by connectors specifically provided for grounding. Mounting, support, or bracing bolts shall not be used as an attachment point for ground conductors.

## 2.09 AUTOMATIC TRANSFER SWITCH

- A. Provide true 3-phase double-throw 100A, 22,000 KAIC rated automatic transfer switch with inherently interlocked construction. The switch shall be mechanically interlocked to ensure only one of two possible positions, normal or emergency. Provide separate bypass-isolation switch. ATS shall be ASCO model 7000, with group 5 control panel, or approved equal.
- B. Generator Exercise Timer: Seven (7) day timer, adjustable in 15-minute increments provided for operator adjustment of day, time and run duration for exercising the generator under operating loads by activating the automatic transfer switch. This timer shall be field set by the Contractor with date and time as specified by Owner.
- C. Provide separate signal lights indicating when Pedestal is powered from Utility source and when Pedestal is powered from Generator source. Provide full voltage type lights with push-to-test feature, in oil-tight units with lenses. Nameplates shall be provided with each light to identify each light's function.
- D. A pushbutton shall be provided to simulate normal source failure. Provide nameplate as shown on Contract Drawing.

## 2.10 GENERATOR RECEPTACLE

- A. Generator receptacle to be a 3 phase, 4 wire, 4, pole, 208VAC, 100A, Crouse-Hinds Arktite, 100A cast aluminum receptacle with spring door AR1041, reverse interior –S22, and 100A feed through 15° back box junction box AJC67 (2” NPT) to match Owner Standard.

## **PART 3 - EXECUTION**

### **3.01 WORKMANSHIP**

- A. All work in this Section shall conform to the codes and standards outlined herein.
- B. The Contractor shall employ personnel that are skilled and experienced in the installation and connection of all elements, equipment, devices, instruments, accessories, and assemblies. All installation labor shall be performed by qualified personnel who have had experience on similar projects. Provide first class workmanship for all installations.
- C. Ensure that all equipment and materials fit properly in their installations.
- D. Perform any required work to correct improper installations at no additional expense to the Owner.
- E. The Engineer reserves the right to halt any work that is found to be substandard or being installed by unqualified personnel.

### **3.02 CONSTRUCTION METHODS, GENERAL**

- A. All field wires and panel wires shall have wire markers as specified in the "WIRE" subsection.
- B. No wires shall be spliced without prior approval by the Engineer.
- C. Where splices are allowed or approved by the Engineer they shall conform with the following:
  - 1. Wire splicing devices shall be sized according to Manufacturer's recommendations.
  - 2. Splices of #10 and smaller, including fixture taps, shall be made with see-thru nylon self-insulated twist on wire joints; T & B "Piggys," Ideal "Wing-Nut" or approved equal.
  - 3. Splices of #8 and larger shall be hex key screw two way connectors, with built in lock washers; T & B "Locktite," O-Z type XW or approved equal, insulated with 3M Scotch Super #88, Plymouth or approved equal.
  - 4. Splices in underground pullboxes and exterior connection boxes shall be insulated and moisture sealed with 3M "Scotchlok" cast resin splice kits. Do not use splice kits with a date marking for shelf life that has expired.

### 3.03 PANEL FABRICATION

- A. Panel cutouts for devices (i.e. indicating lights, switches) shall be cut, punched, or drilled and smoothly finished with rounded edges. Exposed metal from cutouts that are made after the final paint finish has been applied shall be touched up with a matching paint prior to installing device. Do not paint nameplates, labels, tags, switches, receptacles, conductors, etc.
- B. All Panel doors shall be fully gasketed with non-shrinkable, water and flame resistant material.
- C. Bolts and screws for mounting devices on doors shall be as specified by the Manufacturer; otherwise they shall have a flush head which blends into the device or door surface. No bolt or screw holding nuts shall be used on the external surface of the door.
- D. Each component within the Panel shall be securely mounted on an interior cubicle or backpan and arranged for easy servicing, such that all adjustments and component removal can be accomplished without removing or disturbing other components. Mounting bolts and screws shall be front located for easy access and removal without special tools. Access behind the sub panel or backpan shall not be required for removing any component.
- E. A ground bus shall be provided in each bussed Panel section. It shall have provisions for connecting a minimum of ten grounding conductors. Screw type lugs shall be provided for connection of grounding conductors. All grounding conductors shall be sized as shown on plans or in accordance with NEC Table 250.66, whichever is larger.
- F. Minimum wire bending space at terminals and minimum width of wiring gutters shall comply with NEC Tables 312.6(a) & (b).
- G. Future device and component mounting space shall be provided on the door, backpan, and subpanel where detailed on the Drawings. Where no detail is shown, provide a minimum of 15 percent usable future space. Also, add extra DIN rail to allow adding relays & terminal blocks in the future as called out on Contract drawings.
- H. Doors shall swing freely a minimum of 90° and close with proper alignment.
- I. HARNESS: Where space is available, all wiring shall be run in slotted plastic wire ways or channels with dust covers. If space is not available for wireways, then all wiring shall be neatly bundled and laced with plastic tie-wraps, anchored in place by screw attached retainer. Wire ways or channels shall be sized such that the wire fill does not exceed 60%. Tie-wraps shall be T&B TY-RAP or approved equal.



- J. **HINGE LOOPS:** Where wiring crosses hinged surfaces, provide a “U” shaped hinge loop protected by clear nylon spiral wrap. The hinge loop shall be of sufficient length to permit opening and closing the door without stressing any of the terminations or connections. Spiral wrap shall be Graybar T25N or approved equal.
- K. **RETAINERS:** Wire ways, retainers, and other devices shall be screw mounted with round-head 316 stainless steel screws or mechanically mounted by push-in or snap-in attachments. Glue or sticky back attachment of any type or style shall not be used. Retainers shall be T&B TC series or approved equal.
- L. **ROUTING:** Wires shall be routed in slotted plastic wire-ways with snap covers. Wires carrying 120 VAC shall be separated as much as possible from other low voltage wires and signal cables, and shall be routed only in ducts for 120 VAC. If the power wiring has to cross the signal wiring, the crossing shall be as close to a right angle as possible. Ducts for 24 VDC wiring shall be used for all other wires and cables. Routing of 120 VAC in combined ducts is not allowed without prior written approval of the Owner. Wires and cable shall be routed along the shortest route between termination points, excepting routes which would result in routing 120 VAC and other wires and cables in the same duct. Wires and cables shall have sufficient length to allow slack and to avoid any strain or tension in the wire or cable. Wires and cables shall be placed in the ducts in a straight, neat and organized fashion and shall not be kinked, tangled or twisted together. Additional wire ducting shall be provided for use by the electrical subcontractor for routing field wires to their landing points in the each electrical and instrumentation panel.
- M. Wiring not routed in duct work shall be neatly bundled, treed, and laced with plastic ties. Wiring across door hinges shall be carefully made up and supported to avoid straining and chafing of the conductors or from putting any strain on their terminals.
- N. **TERMINATIONS:** Single wire and cable conductors shall be terminated according to the requirements of the terminal device. All terminations must be made at terminals or terminal blocks. Use of spring or buttsplice connectors are not allowed.
1. Provide 3” minimum separation between wireway and terminal blocks. Installation of wireways too close to terminal blocks will be required to be completely reworked to the satisfaction of the Owner.
  2. For captive screw pressure plate type terminals, the insulation shall be removed from the last 0.25 inches of the conductor. The conductors shall be inserted under the pressure plate to full length of the bare portion of the conductor and the pressure plate tightened without excess force. No more than two conductors shall be installed in a single terminal. All strands of the conductor shall be captured under the pressure plate.

3. For screw terminals, appropriately sized locking forked spade lugs shall be used. Lugs shall be crimp on type that form gas tight connections. All crimping shall be done using a calibrated crimping tool made specifically for the lug type and size being crimped.
  4. On shielded cables, the drain wire shall be covered with insulating tubing along its full bare length between the cable jacket and the terminal lug or terminal pressure plate.
  5. For screwless terminals, wire shall be stripped back and inserted per the Manufacturer's instructions. When stripping insulation from conductors, do not score or otherwise damage conductor.
  6. Heat shrink shall be placed on ends of shielded cable to cover foil.
  7. Additional condulets with terminal blocks shall be supplied for wire termination to devices with leads instead of terminals (i.e. solenoid valves, level probe, etc.).
- O. All devices and wiring shall be permanently labeled.
- P. All components associated with a particular compartment's or enclosure's function shall be mounted in that compartment or enclosure.
- Q. Spacing and clearance of components shall be in accordance with UL, JIC, and NEC standards.

### 3.04 DAMAGED PRODUCTS

- A. Damage products will not be accepted. All damaged products shall be replaced with new products at no additional cost to the Owner.

### 3.05 FASTENERS & LUGS

- A. Fasteners for securing equipment to walls, floors, and the like shall be 316 stainless steel.
- B. All wire & cable lugs shall be copper; aluminum or aluminum alloy lugs shall not be used. The Electrical Contractor shall supply all lugs to match the quantity & size of wire listed in the conduit & wire routing schedule.

### 3.06 INSTALLATION, GENERAL

- A. Install all products per Manufacturer's recommendations and the Drawings.
1. Contract Drawings are intended to show the basic functional requirements of the electrical and instrumentation system and do not relieve the Contractor from the responsibility to provide a complete and functioning system.

2. Provide all necessary hardware, conduit, wiring, fittings, and devices to connect the electrical equipment provided under other Sections. The following shall be done by the Contractor at no additional cost to the Owner:
  - a. Provide additional devices, wiring, conduits, relays, signal converters, and isolators to complete interfaces of the electrical and instrumentation system.
  - b. Changing normally open contacts to normally closed contacts or visa versa.
  - c. Adding additional relays to provide more contacts as necessary.
3. All programmable devices (excluding PLC & radio) shall be programmed, set-up and tested by the Contractor prior to startup. This includes all instruments. Programming and set-up parameters shall be adjusted or changed as directed by the Owner or Engineer during start-up and throughout the warranty period, at no additional cost to the Owner. Record of all programming parameters setup for this project shall be recorded by Contractor and included in the final O&M manuals.
4. Coordinate with the Owner and setup all alarm, process, and operation setpoints.

B. Panels and enclosures:

1. Install panels and enclosures at the location shown on the Plans or approved by the Engineer.
2. Install level and plumb.
3. Seal all enclosure openings to prevent entrance of insects and rodents.
4. All conduits entering outdoor panels and enclosures shall use watertight hubs. These hubs shall be located on sides or bottom only. Top entry of outdoor panels or enclosures is not allowed unless specifically shown on plans.
5. Clearance about electrical equipment shall meet the minimum requirements of NEC 110.66.

C. Conduits:

1. Install conduit free from dents and bruises.
2. All conduits shall be labeled on all ends at junction boxes, pull boxes, enclosures, stub-outs or other terminations.

3. All conduits entering or leaving a Panel shall be stubbed up into the bottom horizontal wireway directly below the vertical section in which the conductors are to be terminated.
4. A maximum of three equivalent 90 degree elbows are allowed in any continuous runs. Install pull boxes where required to limit bends in conduit runs to not more than 270 degrees or where pulling tension would exceed the maximum allowable for the cable.
5. Route all above grade conduits parallel or perpendicular to structure lines and/or piping. Conduits installed above grade shall be braced in place with stanchions. Expansion joints shall be installed every 100 feet.
6. In pullboxes and vaults, separate power wiring to one side within and all other wiring to opposite side in bundles, see Electrical Drawing details. In vault, these separate bundles are to be supported on plastic cable supports rated for the bundle loading.

D. Wiring:

1. Wiring, grounding, and shielding: It is important to observe good grounding and shielding practices in the generally noisy environment in this application. The shield of shielded cables shall be terminated to ground at one end only, and covered with insulated heat shrink tubing. The shield at the other end shall be encased in an insulated material to isolate it from ground.

E. Provide the excavation for utility service, equipment foundations, and trenches for conduits or buried cables as necessary. Repave any area that was paved prior to excavation. Backfill and surface all areas as shown on the Drawings or where not shown to the original condition that was present prior to the excavation.

F. Conduit entrances: Seal each conduit entrance from below grade into the panel and other electrical enclosures with plugging compound sealant to prevent the entrance of insects and rodents. Conduits between the enclosures shall be sealed with plugging compound sealant on each end. Plugging compound sealant shall be Courtaulds Aerospace (609 456-5700) Semco PR-868 or approved equal.

G. Seals:

1. Seal around all conduits, wires, and cables penetrating between walls, ceilings, and floors in all buildings with a fire stop material. Seal shall be made at both ends of the conduit with a fire stop putty. Seal shall have a minimum two hour rating. Fire stop sealing shall be International Protective Coatings Flamesafe, or approved equal.
2. Seal around conduits entering outside to inside structures and around bottom of free standing enclosures to maintain watertight integrity of structure.

3. Place conduit seal inside each underground conduit riser into panels and enclosures to prevent entrance of insects and rodents.

H. Cleaning and Touch-up:

1. Prior to startup and completion of the work subsequent to final acceptance, all parts of the installation, including all equipment, exposed conduit, devices, and fittings shall be cleaned and given touch up by Contractor as follows:
  - a. Remove all grease and metal cuttings.
  - b. Any discoloration or other damage to parts of the building, the finish, or the furnishings, shall be repaired.
  - c. Thoroughly clean any of his exposed work requiring same.
  - d. Vacuum and clean the inside of all panel and electrical and instrumentation enclosures.
  - e. Clean all above and below ground pull boxes, junction boxes, and vaults from all foreign debris prior to final acceptance.
  - f. Paint all scratched or blemished surfaces with the necessary coats of quick drying paint to match adjacent color, texture, and thickness. This shall include all prime painted electrical equipment, including enclosures, panels, poles, boxes, devices, etc.
  - g. Repair damage to factory finishes with repair products recommended by Manufacturer.
  - h. Repair damage to PVC or paint finishes with matching touchup coating recommended by Manufacturer.

3.07 MAINTENANCE AND OPERATING INSTRUCTIONS

- A. Provide five (5) sets Operation and maintenance manuals bound in three ring binders with one set made up completely with original manuals per this subsection and Submittal section. O&M manuals shall provide at least the following as a minimum:
  1. A comprehensive index.
  2. A complete "Record" set of favorably reviewed electrical submittals as provided under SUBMITTAL AND DRAWING REQUIREMENTS.
  3. As-built one-line, elevation, loop, elementary and interconnection drawings with all field changes included.

4. A complete list of the equipment supplied, including serial numbers, ranges, catalog cuts, and pertinent data.
  5. Full specifications on each item.
  6. Detailed service, maintenance and operation instructions for each item supplied. Schematic diagrams of all electronic devices shall be included. A complete parts lists, including stock numbers, shall be provided on the components that make up the assembly.
  7. Safety precautions and procedures.
  8. Record of each breaker and overload heater element including Manufacturer, full part number, size, setting etc.
  9. Record of each motor nameplate data including manufacturer, full part number, size, etc.
  10. Special maintenance requirements particular to this system shall be clearly defined, along with special calibration and test procedures.
  11. Spread sheet listing all setpoints and programmable parameters entered for this project for instruments, etc.
  12. All of these sets of O & M Manuals shall be made up of "original" (no copies, PDFs or reproductions) documents. No photo or fax copies are allowed of standard published manuals available from Manufacturers.
  13. Include all completed and signed test data and forms from factory and field testing.
  14. Warranty certificate with start dates, duration and contact information.
- B. At the end of the project these manuals shall be updated to show "as-built" conditions.
- C. Provide two (2) sets of CDs containing all drawings in AutoCAD (unlocked) format updated to reflect as-built conditions. These disks shall be the property of the Owner, for its use on this and future projects.

### 3.08 TESTING

#### A. General Requirements

1. It is the intent of these tests to assure that all equipment is operational within industry and Manufacturer's tolerances and is installed in accordance with design plans and specifications

2. All equipment setup and assembled by the Contractor shall be in accordance with the design plans and Drawings and the Manufacturer's recommendations and instructions and shall operate to the Engineer's satisfaction. Follow all Manufacturer's instructions for handling, receiving, installation, and pre-check requirements prior to energization. After energization, follow Manufacturer's instructions for programming instrumentation, set-up and calibration of equipment. The Contractor shall be responsible for, and shall correct by repair or replacement, at his own expense, equipment which, in the opinion of the Engineer, has been caused by faulty mechanical or electrical assembly by the Contractor. Necessary tests to demonstrate that the electrical and mechanical operation of the equipment is satisfactory and meets the requirements of these Specifications shall be made by the Contractor at no additional cost to the Owner.
3. The testing shall not be started until the Manufacturer has completed fabrication, wiring, and setup, has performed satisfactory checks and adjustments and can demonstrate the system is complete and operational. Certification of completion of Contractor's in-house tests shall be submitted prior to scheduling of factory testing.
4. Factory tests shall not be scheduled until submittals associated with the equipment have been approved by the Engineer. If equipment is significantly different from submittal drawings, this shall be grounds for cancellation and rescheduling of factory tests at no additional costs to Owner or extension of Contract time.
5. The first Pre-Energization tests shall be performed to determine the suitability for energization and shall be completed with all power turned off and complete prior to the start of any of the Post-Energization tests. The Electrical Contractor shall have qualified personnel on the job site for all Pre-Energization and Post-Energization tests.
6. All tests shall be witnessed by the Engineer and/or Owner personnel. The test forms shall be completed by the testing person for field checkout, testing, and calibration of all equipment and instruments. All filled in test forms shall be given to the Engineer and/or Owner the day of the test. Fill in two sets of test forms if Contractor wants to keep a copy. All tests shall be documented in writing by the supplier and signed by the Engineer as satisfactory completed. The supplier shall keep a detailed log of all tests that failed or did not meet specifications, including date of occurrence and correction. Completed forms with proper signatures and dates shall be included and become a component of the Operations and Maintenance Manual for each of the respective systems.

7. Prior to any field testing, Interconnection Drawings and Operation & Maintenance Manuals shall have been submitted by the Contractor and approved by the Engineer.
8. The Contractor shall notify the Owner and the Engineer of the Supplier's readiness to begin all factory and field tests in writing (a minimum of ten working days prior to start), and shall schedule system checkout on dates agreed to by the Owner and the Engineer in order that the testing be scheduled and witnessed.
9. The Contractor shall fill in & submit for approval the "Scheduled Test Request Form" located in Appendix "A" for each requested inspection, factory and field test.
10. The supplier shall submit for approval, the proposed factory & field testing sheets at least 24 days prior to the start of the tests. Each testing sheet shall have a title giving the type of test and entry spaces for the name of the person who performed the test, name of the person who witnessed the test, and the date. Tests performed without approved forms shall be retested at no additional cost to Owner.
11. Separate test procedures in separate binders shall be submitted for approval for the Factory and Field Tests. Testing shall not commence until the test procedures have been reviewed and approved by the Owner.
12. If the results of any of tests are unacceptable to the Engineer, the Contractor shall make corrections and perform the tests again until they are acceptable to the Engineer; these additional tests shall be done at no additional cost to the Owner.

B. Failure to Meet Test

1. Any system material or workmanship which is found defective on the basis of acceptance tests shall be reported to the Engineer. The Contractor shall replace the defective material or equipment and have tests repeated until test proves satisfactory to the Engineer without additional cost to the Owner.

C. Safety

1. Testing shall conform to the respective Manufacturer's recommendations. All Manufacturer's safety precautions shall be followed.
2. The procedures stated herein are guidelines for the intended tests, the Contractor shall be responsible to modify these tests to fit the particular application and ensure personnel safety. Absolutely no tests shall be performed that endanger personal safety.



3. The Electrical Contractor shall have two or more Electricians present at all electrical field tests.
4. Two non-licensed portable radios are to be made available by the Contractor for the testing organization to conduct tests.
5. California Electrical Safety Orders (ESO) and Occupational Safety and Health Act (OSHA): The Contractor is cautioned that testing and equipment shall comply with ESO and OSHA as to safety. Appropriate clearances, padlocks and barriers around electrical equipment energized shall be utilized during testing.
6. Field inspections and pre-energization tests shall be completed prior to applying power to equipment.

D. Electrical Factory Tests

1. The system supplier shall conduct a thorough and complete factory test by qualified factory-trained personnel witnessed by Owner per the criteria specified herein. Factory test shall be held within 150 miles of project location.
2. All components of the system setup shall be completely assembled and thoroughly pre-tested by the supplier or Manufacturer before start of factory test.
3. Faulty and/or incorrect hardware operation of major portions of the system may, at the discretion of the Owner Engineer, be cause for suspension or restarting of the entire factory test, at no additional cost to the Owner or extension in contract time.
4. Factory test shall not be scheduled until submittals associated with the equipment have been approved by the Engineer. If equipment is significantly different from submittal drawings this shall be grounds for cancellation and rescheduling of factory tests at no additional costs to Owner or extension of Contract time.
5. The testing personnel shall provide all material, equipment, labor and technical supervision to perform such tests and inspections.
6. The Contractor shall pay all expenses incurred by his personnel, including labor, material, transportation, lodging, daily subsistence, and other associated incidental costs during the factory testing.
7. Temporary wiring and equipment shall be setup during these tests to simulate the complete assembled system.

8. The tests, as a minimum, shall simulate all operating conditions including steady state, transients, upsets, startup, shutdown, power failure, and equipment failure conditions (for control logic).
9. The panel system set-up for factory testing consists of, but is not limited to, Motor Control Panel, control panels, pedestal, PLC, field control stations and any miscellaneous associated electrical equipment.
10. The length of the factory testing shall be a minimum of 8 hours all on one day. If in the opinion of the Owner or Engineer the factory testing is not completed at the end of the working day, the testing shall be extended, at no additional cost to the Owner or extension in Contract time. The Contractor shall agree that the sum set forth hereafter is a reasonable amount to be charged as liquidated damages; and it is therefore agreed that the Contractor will pay the Owner the sum of five hundred dollars (\$500.00) in liquidated damages for each and every calendar day beyond the time prescribed above for the completion of factory testing for the panel system. Liquidated damages will be assessed to the Contractor each and every day past the time allotted for factory testing.
11. All factory tests shall be conducted at the System Supplier's facility. All factory tests shall be completed prior to installation of any of the panel system at the jobsite. The panel system shall be fully assembled and connected as it will be installed in the final configuration. If the panel system is found to be not fully and completely ready for factory testing, the Contractor shall be responsible for paying for the Owner and Engineer to return for the factory testing. Factory testing is to ensure that there are no defects. The hardware shall be tested for compliance with the plans and Specifications included herein and for the ability to perform the control functions.
12. Provide a complete clean copy of System Supplier drawings for Owner and Engineer's use during Factory Test.
13. The associated factory tests for each of the factory testing sheets that are to be performed by the supplier and witnessed by the Owner Engineer shall include the following panel system as a minimum:
  - a. Inspections of the panel as follows:
    - 1) Visual and mechanical, for compliance with Contract and submittal drawings.
    - 2) Inspect for physical damage, proper support, and wiring.
    - 3) The Contractor shall fill in test form TF4 located in Appendix "A."

- b. Testing of the panel as follows:
    - 1) All PLC/OI components of the system shall be completely assembled, programmed, and thoroughly pre-tested by the supplier or Manufacturer before start of factory test.
    - 2) I/O points shall be simulated for the complete checkout of PLC program and OI setup.
    - 3) The Contractor shall complete each test and fill in the I/O test form TF11 located in Appendix "A".
  - c. Each line of control logic on the elementary diagrams shall be checked. After a line of control logic is tested, the person performing test shall initial the corresponding line on the elementary diagram. When the complete elementary diagram has been checked, it shall be signed and dated by testing person and person witnessing test.
- 14. During the testing period, under the supervision of the supplier, the Engineer and other Owner personnel shall have unlimited and unrestricted access to the usage and testing of all hardware and software in the system.
  - 15. Spare parts for the system shall also be tested during this test period. The supplier shall prove by temporarily connecting the spare hardware to the system that any or all of the spare parts function in a manner equivalent to the original equipment under test.
  - 16. The factory test will be considered complete only when the integrated system has successfully passed all tests to the satisfaction of the Owner or Engineer. No electrical equipment shall be shipped to jobsite without authorization from the Owner or Engineer that the factory test has been completed.
  - 17. Acceptance and witnessing of the factory tests does not relieve or exclude the Contractor from conforming to the requirements of the Contract Documents.
  - 18. All modifications to documentation as a result of the factory tests shall be corrected and completed before the submittal and delivery of "operation and maintenance" manuals.
  - 19. Copies of the completed and witnessed factory testing forms shall be placed in the Operation and Maintenance Manual.

E. Electrical Field Tests

1. PRE-ENERGIZATION TESTS: These tests shall be completed prior to applying power to any equipment.

a. Inspections:

1) Visual and Mechanical:

a) Inspect for physical damage, proper anchorage and grounding.

2) The Contractor shall fill in, for each piece of equipment, Test Form TF4 located in Appendix "A."

b. Torque Connections:

1) All electrical, mechanical and structural threaded connections inside equipment shall be tightened in the field after all wiring connections have been completed. Every worker tightening screwed or bolted connections shall be required to have and utilize a torque screwdriver/wrench at all times. Torque connections to the value recommended by the equipment Manufacturer. If they are not available, use NEC Annex I as guidelines.

c. Wire Insulation and Continuity Tests:

1) All devices that are not rated to withstand the 500V megger potential shall be disconnected prior to the megger tests.

2) Megger insulation resistances of all 600 volt insulated conductors using a 500 volt megger for five seconds. Make tests with circuits installed in conduit and isolated from source and load. Each conductor shall be meggered conductor to conductor and conductor to ground. These tests shall be made on cable after installation with all splices made up and terminators installed but not connected to the equipment.

3) Megger insulation resistances of all motor leads using a 500 volt megger for ten seconds. Make these tests with motors installed in place and not connected to any other wiring. Each motor lead shall be tested conductor to ground.

- 4) Each megger reading shall not be less than 100 Meg-ohms resistive. Corrective action shall be taken if values are recorded less than 100 Meg-ohms.
- 5) Continuity Tests: Each instrumentation conductor twisted shielded pair shall have the conductor and shield continuity measured with an ohmmeter. Conductors with high ohm values, that do not match similar lengths of conductors the same size, shall be replaced at no additional cost to the Owner.
- 6) The Contractor shall fill in test forms Power and Control Conductor Test Form TF1 and Instrumentation Conductor Test Form TF2 located in Appendix "A."
- 7) Values of different phases of conductors in the same conduit run showing substantially different Meg-ohm values, even if showing above 100 Meg-ohms shall be replaced.

d. Grounding System Test

- 1) Visual and Mechanical Inspection.
  - a) Verify ground system is in compliance with drawings and specifications.
- 2) Electrical Tests
  - a) Before making connections to the ground electrodes, and before placement of sidewalks, landscape and paving, measure the resistance of each electrode to ground using a ground resistance tester. Perform the test not less than two days after the most recent rainfall and in the afternoon after any ground condensation (dew) has evaporated.
  - b) After all individual ground electrode readings have been made, interconnect as required and measure the system's ground resistance.
  - c) Perform point-to-point tests to determine the resistance between the main grounding system and all major electrical equipment frames, system neutral, and/or derived neutral points.
  - d) The grounding test shall be in conformance with IEEE Standard 81.

- e) Plots of ground resistance shall be made and submitted to the Engineer for approval.
  - f) The current reference rod shall be driven at least 100 feet from the system under test.
  - g) Measurements shall be made at 10 feet intervals beginning 25 feet from the test electrode and ending 75 feet from it in a direct line between the system being tested and the test electrode.
- 3) Test Values
- a) The resistance between the main grounding electrode and ground shall be no greater than five ohms for commercial or industrial systems per IEEE Standard 142.
  - b) Investigate point-to-point resistance values that exceed 0.5 ohms.
  - c) The Contractor shall fill in Grounding System Test Form TF3 located in Appendix "A"
- e. Panelboard Test:
- 1) Visual and Mechanical Inspection:
    - a) Inspect for physical damage, proper anchorage and grounding.
    - b) Compare equipment nameplate data with design plans.
    - c) Compare breaker legend for accuracy.
    - d) Check torque of bolted connections.
  - 2) The Contractor shall fill in Panelboard Test Form TF5 located in Appendix "A."
- f. Breaker Test:
- 1) All breakers shall be checked for proper mounting, conductor size, and feeder designation. Operate circuit breaker to ensure smooth operation. Inspect case for cracks or other defects. Check tightness of connection with torque wrench in accordance with Manufacturer's recommendations.

- 2) All breakers 100 amps and above shall be tested, including the generator breaker. Time current characteristic tests shall be performed by bypassing three hundred percent (300%) rated current through each pole separately. Trip time shall be determined. Instantaneous pickup current shall be determined by run up or pulse method. Clearing times should be within four (4) cycles or less. All trip times shall fall within NETA Table values. Instantaneous pickup current levels should be within 20% of Manufacturer's published values. Certification stickers, listing date and company who performed the tests, shall be attached to the inside of the breaker compartment door right after the breaker has passed all tests.
- 3) Contact and Insulation Resistance: Contact resistance shall be measured and be compared to adjacent poles and similar breaker. Deviations of more than 50% shall be reported to Engineer. Insulation resistance shall be measured and shall not be less than 100 megohms.
- 4) After the completion of all breaker tests, all breakers shall be set by Contractor to their proper settings to protect equipment.
- 5) The Contractor shall fill in Breaker Test Form TF8 located in Appendix "A."

## 2. Post Energization Tests

### a. Panel Tests

- 1) During these tests, simulate all local and remote control operations.

### b. Electrical Tests

- 1) Perform operational tests by initiating control devices to affect proper operation.
- 2) The Contractor shall fill in Operational Device Checks and Tests Form TF6 and MCC Device Test Form TF7 located in Appendix "A."

### c. Phase Rotation Tests

- 1) Check connections to all equipment and motors for proper phase relationship. During this test, disconnect all devices which could be damaged by the application of voltage or reversed phase sequence. Three phase equipment shall be

tested for the phase sequence "ABC" front to back, left to right, and top to bottom.

- 2) The Contractor shall fill in Phase Rotation Test Form TF10 located in Appendix "A."

d. Motor Testing

- 1) Record the amperage draw on all phases of each motor operating under full load. Ensure that these values do not exceed the motor nameplate full load amperage.
- 2) Record the voltage between all phases of each motor operating under full load. If the voltage balance is not within plus or minus 5 percent of nominal, request the Utility power company or other responsible party to correct the problem.
- 3) The Contractor shall compile, by visual inspection of equipment installed for each motor, the following data in neatly tabulated form and be placed in the O&M manual:
  - a) Equipment driven.
  - b) Motor horsepower.
  - c) Nameplate amperes.
  - d) Service factor.
  - e) Temperature rating.
  - f) Overload catalog number.
  - g) Overload current range and setting.
  - h) Circuit breaker rating.
  - i) Circuit breaker trip setting, for magnetic only circuit breakers.
- 4) The Contractor shall fill in Motor Test Form TF9 located in Appendix "A."

e. Instrumentation Tests

- 1) Instrumentation tests shall be conducted per the following criteria:
  - a) As a minimum, all the tests indicated/specified on the Instrument Data Sheet and Calibration Record Form TF12 in appendix "A" shall be performed by the Contractor all instruments listed in Appendix B "Device Index."



- 2) Test equipment used for testing shall be of suitable quality so as not to mask performance deficiencies. All test equipment shall be traceable to National Bureau of Standards and have been calibrated within six months of test date.
- 3) Testing shall be accomplished using simulated inputs only with prior written approval of the Owner.
- 4) Calibration stickers shall be installed on all instruments right after calibration has been successfully completed. Calibration stickers shall list the following information:
  - a) Tag number.
  - b) Calibrated by whom (name), firm, city and telephone number.
  - c) Date calibrated.
  - d) Calibration range.
  - e) Comments.
- 5) The Contractor shall provide a minimum of one (1) hour of field acceptance testing for each instrument. If any instrument has not been fully tested during its allotted time, the Contractor shall provide additional hours for finishing testing of the instrument, to be paid by the Contractor.

f. Control System Tests

- 1) All the I/O points for the PLC shall be tested by the system supplier in the field for proper operation of alarms, status, analog, control, and Human Machine Interface (HMI/OI) display functions. Where practical, the final element shall be used, i.e. trip the intrusion switch or change levels. Testing shall be accomplished using simulated inputs only when necessary.
- 2) The overall accuracy of each instrument loop shall be checked to ensure that it is within acceptable tolerance.
- 3) All the I/O points for the PLC/OI shall be tested by Contractor for proper wiring. Where practical, the final element shall be used, i.e., trip the intrusion switch or change levels. During this task the Contractor shall have:
  - a) Test instruments as required.
  - b) A pair of radios for communication.

- c) Coordinated to have the PLC/SCADA provided field technician available so PLC/OI program changes can be made.
- 4) During this task the System supplier shall have:
  - a) Qualified field technician with experience in the startup of similar systems with PLC controls, and other field devices.
  - b) Test instruments as required.
  - c) A pair of radios for communication.
- 5) The Contractor shall fill in "I/O Point Checkout Test Sheet" TF11.

F. Operational Testing

- 1. After all the previous tests in this subsection are complete, the Contractor shall conduct operational testing.
- 2. For the operational testing, the new equipment shall be activated to automatically run for 5 days, Monday through Friday, 24 hours a day. During this five day period the Owner will run the different combinations of the pump control options. If equipment failure occurs during the 5 days of operational testing, the Contractor shall repair or replace the defective equipment and shall begin another 5-day operational test, Monday through Friday, 24 hours a day. This shall be continued until the new equipment functions acceptably for 5 consecutive days.

3.09 TRAINING

- A. At time of completion, the Contractor shall provide a period of not less than 4 hours training for instruction of operation and maintenance personnel in the use of all control systems at the station site. Provide product literature and application guides for user's reference during instruction.

3.10 SPARE PARTS

- A. The Contractor shall supply all spare parts prior to start of field tests. All parts shall be sealed in plastic bags and delivered to the site in a heavy duty plastic storage bag. Bag shall be clearly labeled with part name & number and the corresponding equipment tagname.
- B. The Contractor shall make available any replacement parts that are not Manufacturer's normal stock items for immediate service and repair of all the electrical & instrumentation equipment throughout the warranty period.

- C. The following spare parts shall be provided to the Owner as part of this Contract:
  - 1. Ten (10) fuses for each type of fuse.
  - 2. Twenty (20) lamps for each type of light.
  - 3. One (1) relay for each type of control, power fail and time delay relays.

### 3.11 WARRANTY

- A. The Contractor shall have a staff of experienced personnel available to provide service on 2 working days notice during the warranty period. Such personnel shall be capable of fully testing and diagnosing the hardware, software and implementing corrective measures. If the Contractor "fails to respond" in 2 working days, the Owner, at its option, will proceed to have the warranty work completed by other resources; the total cost for these other resources shall be deducted from the Maintenance Bond. "Fail to Respond" shall be defined as: The Contractor has not shown a good faith effort and has not expended adequate resources to correct the problem. The use of other resources, as stated above, shall not change or relieve the Contractor from fulfilling the remainder of the warranty requirements.
- B. The Contractor shall warrant all electrical and instrumentation equipment hardware and programming prepared for this project for a period of one (1) year from date of final acceptance. Standard published warranties of equipment which exceed the preceding specified length of time shall be honored by the Manufacturer or Supplier.
- C. The Contractor shall provide all labor and material to troubleshoot, replace, or repair any hardware that fails or operates unpredictably and correct any software problems during the warranty period at no additional cost to the Owner.
- D. Each time the Supplier's repair person responds to a system malfunction, during the warranty period, he or she must contact the designated Owner maintenance supervisor for scheduling of the work, access to the jobsite, and permission to make repairs. Operation of facilities necessary to test equipment shall only be performed by or under the direction of the Owner staff. The Owner reserves the right, at its sole discretion, to deny operations requested by the Supplier. A written description of all warranty work performed shall be documented on a field service report, to be given to Owner prior to the repair person leaving job site each day. This field service report shall detail and clearly state problem, corrective actions taken, additional work that needs to be done, data, repair person name and company.
- E. Prior to "Final Acceptance," the Contractor shall furnish to the Owner a listing of warranty information for all Manufacturers of materials, instruments, and equipment used on the project. The listing shall include the following:
  - 1. Manufacturer's name, service contact person, phone number, and address.
  - 2. Material and equipment description, equipment number, part number, serial number, and model number.

3. Manufacturer's warranty expiration date.

### 3.12 FINAL ACCEPTANCE

- A. Final acceptance will be given by the Owner after the equipment has passed the "final acceptance trial period," each deficiency has been corrected, final documentation has been provided, and all the requirements of design documents have been fulfilled.
- B. Upon completion of the project, prior to final acceptance, remove all temporary services, equipment, material, and wiring from the site.
- C. At the end of the project, following the completion of all of the field tests, and prior to final acceptance, the Supplier shall provide the following final documentation to the Owner:
  1. A listing of warranty information.
  2. Each "Operation and Maintenance" manual shall be modified or supplemented by the Supplier to reflect all field changes and as-built conditions.
  3. Two (2) disk copies of all final documentation to reflect as-built conditions.
- D. Prior to final acceptance, submit each key with matching duplicate. Wire all keys for each lock securely together. Tag and plainly mark with lock number or equipment identification and indicate physical location, such as panel or switch number.

## **APPENDIX "A"**

### **TEST FORMS**

#### Index of Forms:

	Bill of Materials
	Scheduled Test Request Form
TF1	Power and Control Conductor Test Form
TF2	Instrumentation Conductor Test Form
TF3	Grounding System Test Form
TF4	Visual and Mechanical Inspection Form
TF5	Panel-Board Test Form
TF6	Operational Device Checks and Tests Form
TF7	MCC Device Test Form
TF8	Breaker Device Test Form
TF9	Motor Test Form
TF10	Phase Rotation Test Form
TF11	I/O Point Checkout Test Sheet
TF12	Instrument Data Sheet and Calibration Record Form



## SCHEDULED TEST REQUEST FORM

COMPANY PERFORMING TEST: \_\_\_\_\_  
TESTING PERSONNEL : \_\_\_\_\_  
PHONE NUMBER OF COMPANY: \_\_\_\_\_  
TEST PROCEDURE SUBMITTAL: \_\_\_\_\_ APPROVED : \_\_\_/\_\_\_/\_\_\_  
SCHEDULED TEST DATE : \_\_\_\_\_ DATE : \_\_\_/\_\_\_/\_\_\_

TIME	DESCRIPTION OF TEST
8:00	
9:00	
10:00	
11:00	
12:00	
13:00	
14:00	
15:00	
16:00	

NOTES:

TESTED BY : \_\_\_\_\_ DATE : \_\_\_/\_\_\_/\_\_\_  
WITNESSED BY: \_\_\_\_\_









## VISUAL AND MECHANICAL INSPECTION FORM

### TEST FORM (TF4)

**EQUIPMENT**

NAME : \_\_\_\_\_ LOCATION : \_\_\_\_\_

NAMEPLATE DATA

MFGR. : _____	SERIES # : _____
MODEL # : _____	U.L. # : _____
VOLTAGE : _____	PHASE : _____
AMPERAGE : _____	SERVICE : _____
BUS TYPE : _____	BUS BRACING: _____
VERT. BUS : _____	HORZ. BUS : _____
GND. BUS : _____	NEU. BUS : _____
ENCLOSURE : _____	_____
_____	_____

**INSPECTION CHECK LIST**

ENTER: A-ACCEPTABLE R-NEEDS REPAIR OR REPLACEMENT NA-NOT APPLICABLE

- TIGHTEN ALL BOLTS AND SCREWS \_\_\_\_\_
- TIGHTEN ALL WIRING AND BUS CONNECTIONS \_\_\_\_\_
- VERIFY ALL BREAKERS AND FUSES HAVE PROPER RATING \_\_\_\_\_
- CHECK BUS BRACING AND CLEARANCE \_\_\_\_\_
- CHECK MAIN GROUNDING CONNECTION AND SIZE \_\_\_\_\_
- INSPECT GROUND BUS BONDING \_\_\_\_\_
- CHECK EQUIPMENT GROUNDS \_\_\_\_\_
- CHECK CONDUIT GROUNDS AND BUSHINGS \_\_\_\_\_
- INSPECT NEUTRAL BUS AND CONNECTIONS \_\_\_\_\_
- CHECK HEATERS AND THERMOSTATS \_\_\_\_\_
- CHECK VENTILATION AND FILTERS \_\_\_\_\_
- CHECK FOR BROKEN OR DAMAGED DEVICES \_\_\_\_\_
- CHECK DOOR AND PANEL ALIGNMENT \_\_\_\_\_
- INSPECT ANCHORAGE \_\_\_\_\_
- CHECK FOR PROPER CLEARANCES AND WORKING SPACE \_\_\_\_\_
- REMOVE ALL DIRT AND DUST ACCUMULATION \_\_\_\_\_
- INSPECT ALL PAINT SURFACES \_\_\_\_\_
- CHECK FOR PROPER WIRE COLOR CODES \_\_\_\_\_
- INSPECT ALL WIRING FOR WIRE LABELS \_\_\_\_\_
- CHECK FOR PROPER WIRE TERMINATIONS \_\_\_\_\_
- CHECK FOR PROPER WIRE SIZES \_\_\_\_\_
- INSPECT ALL DEVICES FOR NAMEPLATES \_\_\_\_\_
- CHECK IF DRAWINGS MATCH EQUIPMENT \_\_\_\_\_
- CHECK ACCURACY OF OPERATION & MAINTENANCE \_\_\_\_\_
- \_\_\_\_\_

TESTED BY : \_\_\_\_\_  
 WITNESSED BY: \_\_\_\_\_

DATE : \_\_\_/\_\_\_/\_\_\_

## PANEL-BOARD TEST FORM

### TEST FORM (TF5)

PANEL NAME: \_\_\_\_\_ LOCATION : \_\_\_\_\_

#### NAMEPLATE DATA

MFGR. : _____	SERIES # : _____
MODEL # : _____	U.L. # : _____
VOLTAGE : _____	PHASE : _____
AMPERAGE : _____	SERVICE : _____
BUS TYPE : _____	BUS BRACING: _____
VERT. BUS : _____	HORZ. BUS : _____
GND. BUS : _____	NEU. BUS : _____
ENCLOSURE : _____	MAIN BKR : _____

#### INSULATION RESISTANCE TESTS - MEGOHMS

A-GND	B-GND	C-GND	

#### INSPECTION CHECK LIST

ENTER: A-ACCEPTABLE R-NEEDS REPAIR OR REPLACEMENT NA-NOT APPLICABLE

- TIGHTEN ALL BOLTS AND SCREWS \_\_\_\_\_
- TIGHTEN ALL WIRING AND BUS CONNECTIONS \_\_\_\_\_
- VERIFY ALL BREAKERS AND FUSES HAVE PROPER RATING \_\_\_\_\_
- CHECK BUS BRACING AND CLEARANCE \_\_\_\_\_
- CHECK MAIN GROUNDING CONNECTION AND SIZE \_\_\_\_\_
- INSPECT GROUND BUS BONDING \_\_\_\_\_
- CHECK EQUIPMENT GROUNDS \_\_\_\_\_
- CHECK CONDUIT GROUNDS AND BUSHINGS \_\_\_\_\_
- INSPECT NEUTRAL BUS AND CONNECTIONS \_\_\_\_\_
- CHECK FOR BROKEN OR DAMAGED DEVICES \_\_\_\_\_
- CHECK DOOR AND PANEL ALIGNMENT \_\_\_\_\_
- INSPECT ANCHORAGE \_\_\_\_\_
- CHECK FOR PROPER CLEARANCES AND WORKING SPACE \_\_\_\_\_
- REMOVE ALL DIRT AND DUST ACCUMULATION \_\_\_\_\_
- INSPECT ALL PAINT SURFACES \_\_\_\_\_
- CHECK FOR PROPER WIRE COLOR CODES \_\_\_\_\_
- INSPECT ALL WIRING FOR WIRE LABELS \_\_\_\_\_
- CHECK FOR PROPER WIRE TERMINATIONS \_\_\_\_\_
- CHECK FOR PROPER WIRE SIZES \_\_\_\_\_
- INSPECT ALL DEVICES FOR PROPER LEGEND NAMEPLATES \_\_\_\_\_

CALIBRATION TEST EQUIPMENT PART NO.	DATE CALIBRATED:

TESTED BY : \_\_\_\_\_ DATE : \_\_\_/\_\_\_/\_\_\_  
 WITNESSED BY: \_\_\_\_\_



# MCC DEVICE TEST FORM

## TEST FORM (TF7)

MCC # : \_\_\_\_\_ CUBICLE : \_\_\_\_\_  
EQUIP NAME: \_\_\_\_\_ EQUIP # : \_\_\_\_\_

### MOTOR DATA

### CONTACTOR DATA

H.P. : \_\_\_\_\_ MFGR. : \_\_\_\_\_ PART # : \_\_\_\_\_  
F.L.A. : \_\_\_\_\_ NEMA SIZE : \_\_\_\_\_ COIL VOLT : \_\_\_\_\_

### OVERLOAD TESTS

MFGR. : \_\_\_\_\_ HEATER # : \_\_\_\_\_ RANGE : \_\_\_\_\_  
PART # : \_\_\_\_\_ FINAL OVERLOAD SETTING: \_\_\_\_\_

TEST  
AMPS

### MEASURE TRIP TIME @ TEST AMPS

MFGR LISTED  
TRIP TIME

AMBIENT  
COMPENSATION

PHASE A

PHASE B

PHASE C

TEST AMPS	PHASE A	PHASE B	PHASE C	MFGR LISTED TRIP TIME	AMBIENT COMPENSATION

### BREAKER TESTS

MRGR. : \_\_\_\_\_ PART # : \_\_\_\_\_ FRAME # : \_\_\_\_\_

### CONTACT RESISTANCE TESTS - OHMS

### INSULATION RESISTANCE TESTS-MEGOHMS

PHASE A

PHASE B

PHASE C

A-GND

B-GND

C-GND

PHASE A	PHASE B	PHASE C	A-GND	B-GND	C-GND

MFGR TRIP TIME @300% MIN: \_\_\_\_\_ BREAKER RATING / RANGE: \_\_\_\_\_  
MFGR TRIP TIME @300% MAX: \_\_\_\_\_ FINAL BREAKER SETTING: \_\_\_\_\_  
MFGR INST. PICKUP AMPS: \_\_\_\_\_

### TIME-CURRENT TEST

### TRIP TIME IN SECONDS @ 300% AMPS

### INSTANTANEOUS TRIP TEST - AMPS

PHASE A

PHASE B

PHASE C

PHASE A

PHASE B

PHASE C

PHASE A	PHASE B	PHASE C	PHASE A	PHASE B	PHASE C

NOTES:

TESTED BY : \_\_\_\_\_  
WITNESSED BY: \_\_\_\_\_

DATE : \_\_\_\_/\_\_\_\_/\_\_\_\_



## MOTOR TEST FORM

TEST FORM (TF9)

EQUIPMENT

NUMBER : \_\_\_\_\_ NAME : \_\_\_\_\_

NAMEPLATE DATA - FIELD RECORDED

MANUFACTURER		MODEL #		SERIAL #		FRAME #	
H.P.	R.P.M	F.L.A	VOLTS	PHASE	FREQ.	P.F.	S.F.
CODE	N.E.M.A.	INSUL.	ENCLOSUR.	DUTY	DESIGN		

INSULATION TESTS PHASE TO GROUND MEG-OHMS			MOTOR FRAME GROUNDING SYSTEM TEST			MOTOR HEATER	MOTOR THERMAL
A	B	C	APPLIED VOLTS	MEAS. AMPS	CALC. OHMS	MEAS. AMPS	TRIP TEST

MOTOR TESTS - MEASURED VALUES

AMPERAGE			VOLTAGE			POWER FACTOR	WATTAGE
A	B	C	AB	BC	CA		

NOTES:

VOLTAGE, AMPERAGE, POWER FACTOR, & WATTAGE SHALL BE RECORDED WITH A TRUE RMS METER.

TESTED BY : \_\_\_\_\_

DATE : \_\_\_/\_\_\_/\_\_\_

WITNESSED BY: \_\_\_\_\_









**APPENDIX "B"**

**DEVICE INDEX**

**16010 DEVICE INDEX**

P&ID REF	E-DWG REF	M-DWG REF	TAG NO.	DESCRIPTION	TYPE	SPECIFICATION PARAGRAPH	MIN NEMA RATING	SIZE	VOLT	SP / RANGE	EGR UNITS	DWG REF DET MOUNTING	NOTES AND ACCESSORIES	16010 TEST FORM
I2	E6	C07	FE 171	Flow Element	Mag	By District	6P	4"	-	-	-	E10-H		-
I2	E3	C07	FIT 171	Flow Indicating Xmtr	Mag	By District	12	-	-	-	GPM	Pedestal		TF12
I2	E6	C07	LE 151	Level Element	Ultra	By District	6P	-	-	-	-	E10-F		-
I3	E7	C10	LE 251	Level Element	Ultra	By District	6P	-	-	-	-	E10-F		-
I2	E3	C07	LIT 151	Level Indicating Xmtr	Ultra	By District	12	-	-	0-16	FT	Pedestal		TF12
I3	E3	C10	LIT 251	Level Indicating Xmtr	Ultra	By District	12	-	-	0-13	FT	Pedestal		TF12
I2	E6	C07	LSHH 151	Level Switch	Float	By District	-	20' CBL	-	-1.25	Elev	E10-E		TF11
I3	E7	C10	LSHH 251	Level Switch	Float	By District	-	20' CBL	-	2	Elev	E10-E		TF11
I2	E6	C07	LSL 151	Level Switch	Float	By District	-	20' CBL	-	-2.5	Elev	E10-E		TF11
I3	E7	C10	LSL 251	Level Switch	Float	By District	-	20' CBL	-	1	Elev	E10-E		TF11
I2	E6	C07	LSLL 151	Level Switch	Float	By District	-	20' CBL	-	-3.25	Elev	E10-E		TF11
I3	E7	C10	LSLL 251	Level Switch	Float	By District	-	20' CBL	-	-2	Elev	E10-E		TF11
I2	-	C07	MSH 111	Moistrure Switch	Cond	Div 11	-	-	-	-	-	Seal	Relay in Pedestal	TF11
I2	-	C07	MSH 112	Moistrure Switch	Cond	Div 11	-	-	-	-	-	Seal	Relay in Pedestal	TF11
I3	-	C10	MSH 211	Moistrure Switch	Cond	Div 11	-	-	-	-	-	Seal	Relay in Pedestal	TF11
I3	-	C10	MSH 212	Moistrure Switch	Cond	Div 11	-	-	-	-	-	Seal	Relay in Pedestal	TF11
I2	-	C07	PI 161	Pressure Indicator	Gauge	By District	-	-	-	0-50	PSI	Pipe		-
I2	E6	C07	PIT 161	Pressure Indicating Xmtr	Gauge	By District	6P	-	24VDC	0-50	PSI	E10-G		TF12
I2	-	C07	TSH 111	Temperature Switch	N.C.	Div 11	-	-	-	-	-	Motor		TF11
I2	-	C07	TSH 112	Temperature Switch	N.C.	Div 11	-	-	-	-	-	Motor		TF11
I3	-	C10	TSH 211	Temperature Switch	N.C.	Div 11	-	-	-	-	-	Motor		TF11
I3	-	C10	TSH 212	Temperature Switch	N.C.	Div 11	-	-	-	-	-	Motor		TF11

END OF SECTION 16010

## SECTION 16605

### ELECTRICAL SYSTEM ANALYSIS

#### PART 1 - GENERAL

##### 1.01 SUBMITTALS

- A. Provide the following submittals, per Section 16010, for the electrical power system from the 208V system down to and including the 120V distribution system:
  - 1. Short Circuit Study.
  - 2. Arc Flash Study.
- B. Short Circuit and Arc Flash Studies shall be prepared, stamped and signed by a professional Electrical Engineer registered in the State of California and in accordance with IEEE 242, IEEE 399 ANSI/IEEE C37.13 and IEEE 519.

##### 1.02 SEQUENCING AND SCHEDULING

- A. It is the responsibility of those performing the electrical system analysis to collect and field-verify all data. This includes obtaining all data from the serving Utility for this project.
- B. The Short Circuit and Arc Flash Studies shall be updated prior to Project Completion. Utilize characteristics of as-installed equipment and materials.
- C. It is the Contractor's responsibility to obtain the required information from the Utility Company and vendors necessary for completing the required studies.

## **PART 2 - MATERIALS**

### **2.01 GENERAL**

- A. Equipment and component titles and numbers used in the Studies shall be identical to the equipment and component titles and numbers shown on the Drawings.
- B. Perform Studies using PC based computer software. State program name and version (e.g. version 2.1) in report.
- C. Perform complete fault calculations for Utility and generator sources. Equipment shall not be grouped as a single large load; they shall be treated as individual loads.
- D. Utilize proposed load data for the Study obtained from submittals, Utility Company and field verifications.
- E. Complete protective device coordination study listing all device settings shall be utilized during start-up of electrical equipment.
- F. It is the Contractor's responsibility to obtain the required information from the Utility Company, Generator supplier and vendors necessary for completing the requested studies.

### **2.02 SHORT CIRCUIT STUDY**

- A. Short Circuit Study Content:
  - 1. Provide unique page numbers for every sheet in Study. Unique page numbers to be manually placed by Study Company after printout if study report doesn't assign page numbers.
- B. Include the following in the short circuit study:
  - 1. Cable impedances based on copper conductors.
  - 2. Bus impedances based on copper bus bars.
  - 3. Transformer impedances based on tolerances specified in ANSI C57.12.00.
  - 4. Source data (i.e. cable lengths, sizes, and quantity, for all runs in study, listing of bus loads, etc).
  - 5. Utility data:
    - a. Size of Utility transformer.



- b. Impedance of Utility transformer.
  - c. Primary voltage of Utility transformer.
  - d. Fault information on primary side of Utility transformer:
    - 1) Three phase bolted fault.
    - 2) X/R ratio (positive sequence).
    - 3) Line to ground fault.
    - 4) X/R ratio (zero sequence).
  - e. Protective relays (type & settings).
6. Voltage drop and current flow at each node and load in system.
- C. Calculate Short Circuit interrupting duties for an assumed three-phase bolted fault and line-to-ground fault at each of the following locations:
- 1. Motor Panel.
  - 2. Panelboard.
  - 3. 208V, 3 phase motor and equipment loads 10HP and larger.
  - 4. 3 phase transformer secondaries.
  - 5. 208/120V equipment.
- D. Verify:
- 1. Equipment and protective devices are applied within their ratings.
  - 2. Adequacy of switchboard, panelboard and MCC bus bars to withstand Short Circuit stresses.
  - 3. Adequacy of transformer windings to withstand Short Circuit stresses and over-current.
  - 4. Cable sizes for ability to withstand normal and fault load currents.
- E. Provide the following in the Short Circuit study report:
- 1. Calculation methods and assumptions.
  - 2. Input data.

3. Short circuit data:
  - a. Impedances.
  - b. X to R ratios.
  - c. Asymmetry factors.
  - d. Motor contributions.
  - e. Short Circuit kVA.
  - f. Symmetrical and asymmetrical line-to-line and line-to-ground fault currents.
  - g. Device evaluation including rating of equipment.
  - h. Bus evaluation including rating of equipment.
  - i. Source data, from Electric Utility Company.
4. Tabulations of calculated quantities.
5. Results, conclusions, and recommendations.
6. One line diagram of distribution system
7. Impedance diagram showing the resistances and reactances for all cables of the distribution system.
8. Two studies (minimum) – one for worst case scenario and one for actual equipment operating.
9. Calculations for maximum and minimum contributions of fault current magnitude. The minimum calculation shall assume the minimum motor load. Conversely, the maximum calculation shall assume a maximum contribution from the Utility and shall assume motors to be operating under full-load conditions. The Study shall also calculate the fault current using in-rush current values.

### 2.03 ARC FLASH HAZARD STUDY

- A. General:
  1. Arc flash boundary and incident energy shall be calculated using a PC computer program at all significant locations in the electrical network, including switchgears, switchboards, MCCs, transformers, and other major equipment where work could be performed on energized equipment.
  2. Arc flash computation shall include both line and load side of main breaker calculations, where necessary.
- B. Safe working distances shall be specified for calculated fault locations based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm<sup>2</sup>.

- C. Study shall include the following:
1. All significant locations in 480 volt, 240 volt and 208 volt systems fed from transformers equal to or greater than 125 kVA.
  2. Incident energy and flash protection boundary calculations in spreadsheet format in the Arc Flash Hazard study report.
  3. Provide the following incident energy and flash protection boundary calculations in spreadsheet format in the Arc Flash Hazard study report (values shall be calculated for all electrical equipment in the power distribution system):
    - a. Arcing fault magnitude
    - b. Device clearing time
    - c. Duration of arc
    - d. Boundary for:
      - 1) Arc flash limited shock approach
      - 2) Limited shock approach
      - 3) Restricted shock approach
      - 4) Prohibited shock approach
    - e. Working distance
    - f. Personal Protective Equipment Levels
    - g. Incident energy at 18 inches (in cal/sq-cm)
    - h. Hazard Risk Category
    - i. Recommendations for arc flash energy reduction for each location having more than 8 cal/sq-cm. Provide preliminary cost estimate for implementing recommendations.
  4. Provide recommendations for the Personal Protective Equipment (PPE) that the Owner should maintain on site for the level of hazard.
  5. Provide recommendations for safety label design that should be posted on electrical equipment.

## 2.04 STUDY REPORTS

- A. Written reports submitted for approval shall contain:
  - 1. Scope of Studies performed.
  - 2. Explanation of bus and branch numbering system.
  - 3. Report calculations, tabulations and spreadsheets.
  - 4. Selected equipment deficiencies.
  - 5. Results of Short Circuit & Arc Flash Studies.
  - 6. Comments, recommendations or suggestions regarding:
    - a. Changes and additions to equipment rating and/or characteristics.
    - b. Circuit protective devices improperly rated for overload or fault conditions.
    - c. Arc Flash protective equipment and safety labels.
  - 7. Stamped, signed and dated by Electrical Engineer registered in the State of California who performed the analysis.
- B. Reports are to be updated to reflect as-built conditions and placed in O&M manual, per Section 16010 requirements.

## PART 3 – EXECUTION

### 3.01 GENERAL

- A. Make minor modifications to equipment settings as required to accomplish conformance with the Short Circuit and Arc Flash Studies.
- B. Notify Engineer in writing of any required major equipment modifications.
- C. Provide two (2) CDs at the completion of the project. One CD shall contain the as-built set of studies, reports, settings, and other pertinent information. The other CD will contain the original source format of input data used for the PC based computer software. Provide all setup information used for the computer based study and report.

### 3.02 FIELD TESTS

- A. Provide field testing of protective equipment.

### 3.03 ARC FLASH WARNING LABELS

- A. All Arc Flash warning labels shall meet NEC requirements, OSHA standards and NFPA recommendations.
- B. Provide and install 3.5 in. x 5 in. thermal transfer type labels of high adhesion polyester for each work location analyzed and as required by the NEC for flash protection on power distribution equipment.
- C. Each label shall have an orange header with the wording, “WARNING, ARC FLASH HAZARD,” and shall include the following machine printed information:
  - 1. Location designation
  - 2. Nominal voltage
  - 3. Flash protection boundary
  - 4. Hazard risk category
  - 5. Incident energy
  - 6. Working distance
  - 7. Engineering report number, revision number and issue date
- D. Labels shall not be hand labeled.

- E. For all areas, Contractor shall post the following:
  - 1. Required PPE levels
  - 2. Working distances
  - 3. Shock hazard voltage
  - 4. Shock Approach Boundaries:
    - a. Limited
    - b. Restricted
    - c. Prohibited
  
- F. Provide Arc Flash labels for the each of the following pieces of equipment:
  - 1. 480V and applicable 208V panelboards
  - 2. MCCs
  - 3. Switchboard
  - 4. Switchgears
  - 5. Control Panels
  - 6. Pedestals
  - 7. All electrical equipment with an incident energy level greater than 1.2 Cal/cm<sup>2</sup>.
  
- G. Labels shall be submitted for approval. No labels shall be installed without prior approval by Owner or Owner Representative.

**\*\*END OF SECTION\*\***