

SECTION 2C

CURBS, GUTTERS AND PAVING

1. SCOPE

This Section covers curbs, walks, gutters and paving including the removal, replacement and seal coating of paving as necessary.

2. GENERAL

The Contractor shall demolish and dispose of off the site, at its expense, all existing paving as necessary or as required for the proposed construction, shall replace paving to match existing as necessary, and shall construct curbs, gutters and paving as detailed on the Contract Drawings. In all cases, surfaces shall be formed and adequately sloped to ensure the prevention of ponding. The Contractor shall seal all asphalt concrete paved surfaces, unless otherwise specified.

The removal of existing paving shall conform to **Section 401** of the Standard Specifications as amended by the Districts. At surfaces noted "JOIN" on the Contract Drawings, the finish elevation of the proposed paving shall match that of the adjoining, existing surface. The proposed pavement shall be lapped and feathered in a neat, straight line onto the existing pavement as required to provide a smooth transition that will prevent ponding and ensure proper drainage. In areas where existing paving is to be removed, it shall be saw cut and carefully removed to edges which are to join proposed paving. The exposed saw cut edges shall be properly protected to prevent breaking prior to placement of proposed pavement.

3. SUBGRADE PREPARATION

Unless shown otherwise on the Contract Drawings, subgrade preparation shall conform to the applicable requirements of **Section 301-1** "Subgrade Preparation" of the Standard Specifications and as specified in **Section 2B** of these Special Provisions.

4. BASE MATERIAL

Unless shown otherwise on the Contract Drawings, base material shall be crushed aggregate base and shall conform to the applicable requirements of **Section 200-2** "Untreated Base Materials" and **Section 301-2** "Untreated Base" of the Standard Specifications as amended by the Districts. Base material shall be placed underneath pavement sections and curbs and gutters.

5. CURBS, WALKS, AND GUTTERS

Unless shown otherwise on the Contract Drawings, curbs, walks, and gutters shall conform to the applicable requirements of **Section 303-5** "Concrete

Curbs, Walks, Gutters, Cross Gutters, Alley Intersections, Access Ramps, and Driveways" of the Standard Specifications and to the requirements specified in this Section. Where curbs or gutters are to be constructed adjacent to existing pavement, the Contractor shall remove a two(2) foot strip of the existing pavement and replace it after construction of the curb or gutter.

6. ASPHALT CONCRETE PAVING

Unless shown otherwise on the Contract Drawings, asphalt concrete paving shall conform to the applicable requirements of **Section 302-5** "Asphalt Concrete Pavement" of the Standard Specifications as amended by the Districts. The pavement cross section shall be as shown on the Contract Drawings.

Before placing pavement, all contact surfaces of longitudinal joints, headers, concrete slabs and walls shall be painted with a uniform coating of hot asphalt or an emulsified asphalt conforming to the requirements for Grade SS-1h per **Section 203-3**, "Emulsified Asphalt" of the Standard Specifications.

7. SEAL COAT OF ASPHALT PAVING

After thirty(30) day interval between completion of all paving work and immediately prior to final acceptance of the project, the Contractor shall apply a seal coat of Grade SS-1h emulsified asphalt diluted with an equal amount of water and applied at a rate of 0.15 gallons per square yard over the entire paved area. Application shall be coordinated with the Engineer to maintain traffic movement on the plant site.

The Contractor shall clean and prepare the AC paving in accordance with the seal coat manufacturer prior to installation. The Contractor shall ensure the AC paving is not traveled on by vehicles or equipment after cleaning and prior to seal coat installation.

The above coating shall be allowed to dry for a minimum of four(4) daylight hours, or until accepted by the Engineer, before traffic will be admitted over a sealed portion.

8. PREMOLDED EXPANSION JOINT FILLER

Premolded Expansion Joint Filler shall be Everlastic 1300 Series Concrete Gray Rubber Sponge Joint Filler by Williams Products; Bondtex No. 941 Neoprene Joint Filler as distributed by Rubberite Cypress Sponge; or equal. Joint fillers shall conform to AASHTO M153, Type 1 and ASTM D 1752 type I, and shall be neoprene. The thickness shall be per Contract Drawings.

9. HEADERS

Headers of 2-inch x 6-inch redwood or pressure treated fir (PTF) with 2-inch x 2-inch x 24-inch redwood or PTF stakes set at four(4) feet on centers shall be provided in conformity with the applicable requirements of **Section 204-1**

and **302-5** "Asphalt Concrete Pavement" of the Standard Specifications as amended by the Districts at all locations where the vertical edges of the proposed asphalt pavement are not in contact with an existing pavement or permanent structures including curbs and gutters.

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SECTION 2D

LANDSCAPING

1. SCOPE

This Section sets forth these Special Provisions and requirements for landscape materials; plant selection; plant storage and handling; construction methods; inspection; cleanup; and submittals.

2. GENERAL

The Contractor shall furnish all labor, materials, and equipment necessary to perform all work for landscaping, as shown on the Contract Drawings and specified in this Section and in **Section 800** of the Standard Specifications. The Contractor shall notify the Engineer at least five(5) work days prior to delivery of products to the site. No substitutes shall be accepted, except with the written permission of the Engineer.

3. TREE REMOVAL

The Contractor shall remove trees, as shown on the Contract Drawings and as specified in this **Section 2B Part 4** of these Special Provisions and in **Section 300-1** of the Standard Specifications.

4. TRADITIONAL LANDSCAPING

4.1 Landscape Materials.

4.1.1 Soil Enrichment: (Mycorrhizal Inoculum and Soil Conditioner). Arbuscular mycorrhizal inoculum shall consist of spores, mycelium, and mycorrhizal root fragments containing a minimum of 3600 propagules per pound combined in a soil conditioner consisting of higher plant form life, composted beyond the fibrous stage to humus. Mycorrhizal inoculum shall comply with manufacturer's standards and be viable and healthy, stored properly, and have sufficient time remaining in its recommended shelf life to compensate for any potential delays in planting. Mycorrhizal inoculum and soil conditioner shall be Gro-life, Gro-Power, or accepted equal.

4.2 Seed.

4.2.1 Grass Sod: The grass sod shall be dwarf tall fescue, (festuca arundinacea), commonly known as Marathon II. The Contractor shall apply the Marathon 15-15-15 starter fertilizer per the manufacturer's recommendation. The grass shall be applied in all areas on sheet C-4.

4.3 Construction Methods. Landscape construction methods shall conform to **Section 800** of the Standard Specifications, where applicable, except as modified in this Section. The landscape shall be constructed, and materials applied in the following steps:

Step 1 - Site Preparation and Weed Abatement. Refer to **Part 4.3.1** of this Section.

Step 2 - Soil Enrichment. Refer to **Part 4.3.2** of this Section.

Step 3 - Grass Sod Installation - Refer to **Part 4.3.3** of this Section.

Step 4 - Maintenance Period. Refer to **Part 6** of this Section.

4.3.1 Step 1 - Site Preparation and Weed Abatement: The Contractor shall complete the landscaping work for the area(s) shown on the Contract Drawings, and all disturbed earthen areas (unless shown otherwise), and as specified in this Section. The Contractor shall clear and grub any existing vegetation and rocks prior to any landscaping work or commencement of earthwork activities. Prior to commencing any landscaping work, the Contractor shall pre-irrigate and remove all existing/resulting vegetation as specified below.

After the irrigation system is installed and tested, a commercial grade, free flowing, granular fertilizer (20-5-5) shall be applied at a rate of two hundred(200) pounds per acre to all proposed landscaping areas. The Contractor shall then irrigate three(3) to four(4) times daily for fifteen(15) continuous calendar days to allow germination of weeds. After the fifteen(15) day period, the Contractor shall discontinue irrigation to allow for a drying period of at least three(3) days or to the satisfaction of the Engineer. At the end of the drying period, the Contractor shall immediately apply a non-selective contact herbicide. The herbicide shall be applied in accordance with the manufacturer's recommendations (a copy of the manufacturer's recommendations and any other requirements shall be submitted to the District for review and acceptance prior to commencement of this work) and shall be Round-up Pro, or equal. Seven(7) calendar days after the herbicide application, the Contractor shall promptly cut, rake and remove all weeds and vegetation growth to bare ground for all landscaping and planting area(s).

After removal of all weeds and vegetation, the Contractor shall irrigate three(3) to four(4) times daily for a three(3)-day period to rinse the topsoil and allow germination of weeds not affected by the non-selective herbicide. A minimum of four(4) calendar days after this irrigation period, the Contractor shall remove all weeds and vegetative growth, and then proceed with **Step 2** of the Construction Methods as specified in **Part 4.3** of this Section.

Care should be taken not to expose any trees to the herbicide(s) due to high winds or other environmental conditions not conducive to application of herbicide(s). No planting or seed mix application will be permitted until the Site Preparation and Weed Abatement program is complete to the satisfaction of the Engineer. If there is a time delay and new weeds and vegetation germinate prior to completion of the landscaping **Steps 2** through **4** as specified in **Part 4.3** of this Section, then herbicide application and the following three(3)-day rinse period and subsequent removal of weeds and vegetation shall be repeated by the Contractor at its expense. All proposed landscaping areas should be void of any and all undesirable vegetation prior to application of landscaping materials specified in **Part 4.3, Steps 2** through **4** of this Section.

4.3.2 Step 2 - Soil Enrichment: Two(2) weeks after the last application of herbicide specified in Step 1, the Contractor shall enrich the existing soil by applying the soil enrichment and organic fertilizer materials specified in **Parts 4.1.1** of this Section. The landscape and planting area shall be brought to finish grade before spreading the enrichment materials specified. Enrichment materials shall be mixed and mechanically spread at a uniform rate of one thousand(1,000) pounds of material per acre, and manufacturer recommended quantities of organic fertilizer. After spreading, the Contractor shall water the slopes as directed by the Engineer to allow the granular fertilizer to dissolve into the soil. The Contractor shall install grass sod within six(6) weeks after the soil enrichment.

4.3.3 Step 3 - Grass Sod Installation: After completion of soil preparation and enrichment, place grass sod in a moist condition on the prepared surface. Lay sod in parallel rows with tightly butted and staggered joints, ensuring full contact between sod and soil without air pockets. Trim edges neatly at curbs, walks, and other boundaries. Roll sod immediately after placement to ensure firm contact with the soil surface. Water sod immediately after installation and maintain in a continuously moist condition until the roots have established and growth is vigorous. Replace any sod that fails to establish or becomes damaged prior to acceptance at no additional cost to the Owner.

## 5. INSPECTION

5.1 Traditional Landscaping. The quantities of materials shall be verified by delivery tickets furnished to the Engineer before application.

The rates at which the materials are applied shall be verified with the District's Engineer before application.

## 6. MAINTENANCE PERIOD

The Contractor shall continuously maintain the irrigation system and the landscaped areas included in the Contract as to proper operation, care, growth and upkeep of the areas for a period of forty(40) working days. The accounting of the Maintenance Period days shall start the day after all the planting work has been completed, inspected, and accepted by the Engineer. Maintenance of the landscaped areas shall include eradicating weeds, eradicating insects and disease, protecting slopes and ditches from irrigation caused erosion, maintaining mulch, watering, and any other necessary care needed to promote healthy plant growth.

During the first two(2) weeks of the maintenance period, the Contractor shall provide a representative(s) to be on the jobsite at least four(4) hours per day five(5) days per week for general landscaping, to monitor the performance of the seeds and irrigation system and to pull weeds using small hand tools. This person or persons shall be responsible for all necessary repairs and adjustments to ensure adequate and uniform irrigation without runoff or erosion and to monitor growth of plants. The landfill roads shall not be allowed to get wet enough that normal traffic will cause ruts. This person shall comply with daily sign-in/sign-out procedures as directed by the Engineer.

During the remainder of the maintenance period, and at no additional cost to the District, the Contractor shall have a representative or representatives visit the site once a week to monitor performance of plants and the irrigation system. A minimum of one(1) day per week, the Contractor must run cycle through all irrigation stations to check for operation of valves, heads, etc., and to adjust irrigation systems as necessary to ensure all landscape areas are adequately and uniformly irrigated, as initially set-up and accepted by the Engineer at the start of the maintenance period. The Contractor shall remain in weekly contact via telephone with the Engineer to monitor performance of the plants and the irrigation system and shall respond to any problems observed by the Engineer within an eight (8) hour period. The Contractor shall be responsible for addressing and correcting the problem(s) and providing or identifying remedies to prevent further problems of a similar nature from occurring.

If, in the opinion of the District, the areas landscaped show sparse or no growth, the Contractor shall repeat **Steps 3** through **4** of **Part 4.3** of this Section at no additional cost to the District.

7. CLEANUP

Upon completion of the landscaping, the site shall be cleaned of all debris, superfluous materials, and the equipment, all of which shall be entirely removed from the project site. The Contractor will clean irrigation valves, spray heads, or drip lines of any debris as deemed necessary.

8. SUBMITTALS

8.1 Traditional Landscaping. The following information shall be submitted, in accordance with **Section 1A, Part 9** of these Special Provisions, and accepted before delivery or application of any material.

- Part 4.1.1** Mycorrhizal Inoculum and Soil Conditioner
- Part 4.2.1** Grass Sod and Starter Fertilizer
- Part 4.3.1** Commercial Fertilizer and Non-Selective Contact Herbicide

The following information shall be submitted to the Engineer, at the time of delivery, and accepted prior to application of any material.

- Part 4.3** Delivery ticket labels, and test results for landscape materials.

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SECTION 3A

CONCRETE

1. SCOPE

This Section sets forth the requirements for all concrete work for reinforced structures as shown on the Contract Drawings. For unreinforced concrete, refer to **Sections 201** and **303** of the Standard Specifications.

2. GENERAL

Concrete work shall conform to the requirements specified in this Section and to the applicable requirements of **Sections 201** and **303** of the Standard Specifications.

3. PRODUCTS

3.1 Reinforced Concrete. Unless shown otherwise on the Contract Drawings or specified otherwise in this Section, concrete shall be of the following classes and shall be used as follows:

SC-4000 Concrete: All structures, equipment pads and miscellaneous elements containing reinforcing steel.

3.2 Unreinforced Concrete. Unless shown otherwise on the Contract Drawings or specified otherwise in this Section, all unreinforced concrete shall conform to the requirements of the Concrete Class Use Table in **Section 201-1.1.2** "Concrete Specified by Class and Alternate Class" of the Standard Specifications.

3.3 Concrete Properties. Concrete shall meet the following requirements:

	<u>SC-4000</u>
Minimum compressive strength (at 28-day test)	4,000 psi
Maximum Water to Cementitious Material ratio (w/c)	0.45
Minimum cementitious material content, irrespective of concrete strength (lbs. of cementitious material per cubic yd. of concrete)	560 lbs.
Minimum Class F Fly Ash content	-
Maximum Aggregate Size	1"
Slump (without water reducers)	3" to 5"
Slump (with water reducers)	5" to 9"

3.4 Cementitious Materials. The following cementitious materials may be used in concrete as follows:

3.4.1 Cement: All cement shall be one(1) of the following:

- a. Type II cement conforming to ASTM C 150.
- b. Type IL (MS) conforming to ASTM C 595.

All cement used under this Section shall be of the same brand and type and shall be derived from the same source, unless otherwise accepted by the Engineer.

3.4.2 Fly Ash: The use of only Class F fly ash is allowed as a substitute material for part of the required cement in a concrete mix in accordance with **Section 201-1.2.5** of the Standard Specifications and as specified in this Section. The amount of cement replaced by fly ash shall be no more than 20 percent by weight. All fly ash used in the concrete under this Section shall be the same type and from the same source, unless otherwise accepted by the Engineer.

3.4.3 The Contractor shall obtain written permission from the Engineer prior to using a cementitious material in the concrete other than specified above.

3.5 Aggregates. Aggregates shall be obtained from pits acceptable to the Engineer, shall be innocuous, and shall conform to ASTM C 33 - Concrete Aggregates. Maximum size of coarse aggregate shall be as indicated.

3.5.1 Aggregates shall be non-reactive and conform to one(1) of the following requirements:

- a. Aggregates shall be tested in accordance with ASTM C 1260. Aggregates that exhibit expansions of less than 0.10 percent at sixteen(16) days after casting are considered innocuous and may be used. Aggregates that exhibit expansions of more than 0.20 percent at sixteen(16) days after casting shall not be used. Aggregates that exhibit expansions of between 0.10 percent and 0.20 percent at sixteen(16) days after casting when tested to ASTM C 1260, shall be tested in accordance with ASTM C 1567. Aggregates that exhibit expansions of less than 0.10 percent at sixteen(16) days when tested to ASTM C 1567, using the combination of supplementary cementitious materials in the proposed mix design, are considered innocuous and may be used.
- b. Aggregates shall be tested in accordance with ASTM C 1293. Aggregates that exhibit expansions of less than 0.04 percent at 365 days after casting are considered innocuous and may be used.

The Contractor shall furnish satisfactory evidence to the Engineer that aggregate used in the work meets the specifications. A report shall be included with each concrete mix design submittal showing that aggregate, intended for use in the concrete, is innocuous. Aggregate from the upper San Gabriel River area will be accepted as non-reactive. Tests shall be performed by an independent accredited testing laboratory and the cost of all testing shall be borne by the Contractor.

If the Engineer deems that additional testing of aggregate is necessary, samples may be selected from any of the aggregate to be used on the job and have same tested by any recognized laboratory of the Engineer's choice. Such material shall not be used in the work until test reports are available. If in such tests the material fails to meet the specified requirements, the aggregate will be rejected. The expense of all testing shall be borne by the Contractor.

3.5.2 Coarse aggregates shall consist of clean, hard, durable gravel, crushed gravel, crushed rock, or a combination thereof. The coarse aggregates shall be prepared and handled in two(2) or more size groups for combined aggregates with a maximum size greater than 3/4-inch. When the aggregates are proportioned for each batch of concrete, the two(2) size groups shall be combined. During the trial batch the aggregate proportions may be adjusted by the testing laboratory using the two(2) coarse aggregate size ranges to obtain the required properties. If one(1) size range produces an acceptable mix, a second size range need not be used. Such adjustments shall be considered refinements to the mix design and shall not be the basis for extra compensation to the Contractor. When tested in accordance with ASTM C 33, the coarse aggregate shall show a loss not exceeding 42 percent after five hundred(500) revolutions or 10.5 percent after one hundred(100) revolutions. When tested in accordance with ASTM C 33, the loss resulting after five(5) cycles of the soundness test shall not exceed 12 percent for coarse aggregate when using sodium sulfate.

3.5.3 Fine aggregates shall be natural sand or a combination of natural and manufactured sand that is hard and durable. When tested in accordance with ASTM D 2419 - Test Methods for Sand Equivalent Value of Soils and Fine Aggregate, the sand equivalency shall not be less than 75 percent for an average of three(3) samples, nor less than 70 percent for an individual test. Gradation of fine aggregate shall conform to ASTM C 33 when tested in accordance with ASTM C 136 for the fineness modulus of the sand used, including the optional grading in Section 6.2 of ASTM C 33. The fineness modulus of sand used shall not be over 3.1. When tested in accordance with ASTM C 33, the fine aggregate shall produce a color in the supernatant liquid no darker than the reference standard color solution. When tested in accordance with ASTM C 33, the loss resulting after five(5) cycles of the soundness test shall not exceed 10 percent for fine aggregate when using sodium sulfate.

3.5.4 Combined aggregates shall be well graded from coarse to fine sizes and shall be uniformly graded between screen sizes to produce concrete that has optimum workability and consolidation characteristics. Where a trial batch is required for a mix design, the final combined aggregate gradations will be established during the trial batch process.

3.6 Water. Water used in mixing concrete shall conform to ASTM C 1602 and to **Section 201-1.2.3** of the Standard Specifications. In case of conflict between these two(2) documents, the more stringent requirement shall apply.

3.7 Reinforcing Steel. All reinforcing steel shall conform to ASTM A 615 in accordance with **Section 201-2**, and **Sections 303-1.7.1** through **303-1.7.3** of the Standard Specifications and to the requirements specified in this Section,

unless noted otherwise on the Contract Drawings. All reinforcing steel shall be Grade 60.

3.8 Admixtures. Admixtures may be used in the concrete as follows:

3.8.1 Air Entraining Admixtures: Concrete may contain an air-entraining admixture conforming to **Section 201-1.2.4** of the Standard Specifications.

3.8.2 Water Reducers:

3.8.2.1 High Range Water Reducer. The Concrete mix design may include a high range water reducing admixture. The high range water reducing admixture shall be in accordance with **Section 201** of the Standard Specifications.

3.8.2.2 Mid-Range Water Reducer (MRWR). The Concrete mix design may include a MRWR admixture. The MRWR shall meet the requirements of ASTM C 494 Type A and Type F. The use of MRWR shall conform to the Manufacturer's recommendation for dosage, re-dosage, and point of addition for each specific admixture. MRWR may be added at the batch plant or jobsite, as accepted by the Engineer. The MRWR shall be accepted by the Engineer prior to use.

3.8.3 All admixtures in a class of concrete shall be from a single manufacturer. Admixtures shall be compatible with each other in each mix design.

3.8.4 Calcium chloride and set accelerating admixtures containing calcium chloride SHALL NOT BE USED.

3.8.5 The Contractor shall obtain written permission from the Engineer prior to using any admixture in the concrete other than specified above.

3.9 Full Tension Mechanical Splice (Coupler). Full tension mechanical splices or couplers shall meet the requirements of Type 2 splice connection as specified the latest edition of the American Concrete Institute's "Building Code Requirements for Structural Concrete" (ACI 318). Full tension mechanical splices or couplers shall be Position Taper Threaded Grip-Twist System (threaded coupler swaging process) by Bar Splice Products, Inc. (ICC Report ESR-2299), Lenton Position Coupler P9 by Erico (ICC Report ER-3967), HRC 500/510 Xtender by Headed Reinforcing Corporation (ICC Report ESR-2764), or equal. Special Inspection is required and shall be performed in accordance with the ICC evaluation report findings. The Special Inspector shall be certified by the Los Angeles County Department of Public Works. A written report of each special inspection shall be submitted to the Engineer within five(5) working days of the inspection.

3.10 Epoxy Binder. Epoxy binder shall be Sikadur 32 Hi-Mod LPL adhesive as manufactured by Sika Corp., Lyndhurst, New Jersey, Sure-Bond, JP-58LPL by Dayton Superior, Miamisburg, OH, or equal. Application shall be in strict conformance with the Manufacturer's recommendations.

3.11 Expansion Joint Material. Expansion joint material shall be Bondtex No. 941 neoprene joint filler as distributed by Rubberite Cypress Sponge; Everlastic 1300 Series by Williams Products; or equal, unless shown otherwise

on the Contract Drawings. Joint fillers shall conform to AASHTO M-153, Type 1 and ASTM D 1752, Type 1, and shall be neoprene.

3.12 Curing Compound. Curing compound shall conform to **Section 201-4** of the Standard Specifications. Curing compound shall be Safe-Cure Clear DR by ChemMasters, Resin Cure with Dye J11WD by Dayton Superior, 1100 by W.R. Meadows, or equal.

3.13 Clear Liquid Hardener. Clear liquid hardener for concrete floors shall be BASF'S "Lapidolith", Euclid Chemical "Surfhard", or equal, and shall be applied in accordance with the Manufacturer's written instructions.

3.14 Form Ties. Form ties shall be provided with a plastic cone or other suitable means for forming a conical hole to ensure that the form tie may be broken off back of the face of the concrete. The maximum diameter of removable cones for rod ties, or of other removable form-tie fasteners having a circular cross-section, shall not exceed 1-1/2-inches; and all such fasteners shall be such as to leave holes of regular shape for reaming. Form ties for water-retaining structures or buried structures shall have integral waterstops that tightly fit the form tie so that they cannot be moved from mid-point of the tie.

3.15 Removable Taper Ties. The larger end of removable taper tie shall be on the wet side of walls in water retaining structures. A preformed neoprene or polyurethane tapered plug sized to seat at the center of the wall shall be inserted in the hole left by the removal of the taper tie.

3.16 Grout and Dry Pack.

3.16.1 Cement Grout and Dry Pack: Unless shown otherwise on the Contract Drawings, or specified otherwise in this Section, grout and dry pack shall conform to the following: Grout shall be composed of one(1) part cement and not more than 3-1/2 parts of sand by volume with sufficient water for placing. Dry pack shall be composed of one(1) part cement and not more than 2-1/2 parts of sand with sufficient water for hydration of cement.

3.16.2 Non-Shrink Grout: Non-shrink grout shall be suitable for the purpose intended and shall be a high strength non-staining grout meeting the requirements of ASTM C 1107. The non-shrink grout shall be Five Star Grout by Five Star Products, Inc., SikaGrout 212 by Sika Corp. or equal, and shall be submitted to the Engineer for review and acceptance. The grout shall be mixed, handled and placed in accordance with the Manufacturer's written instruction.

3.16.3 Epoxy Grout: Epoxy grout shall be used where called for on the Contract Drawings and shall be Sikadur 42 as manufactured by Sika Chemical Corporation, Lyndhurst, New Jersey; HP Epoxy Grout as manufactured by Five Star Products, Fairfield, CT; or equal. The surface to receive the grout shall be dry and shall be prepared in accordance with the Manufacturer's instructions. The epoxy grout shall be mixed and placed strictly in accordance with the Manufacturer's recommendations.

3.16.4 High Early Strength Non-shrink Grout: High early strength non-shrink grout shall be a high strength, non-staining grout meeting the requirements of ASTM C 1107. The non-shrink grout shall be capable of attaining a compressive strength of at least 2,000 psi within five(5) hours of mixing when tested according to ASTM C 109 at a temperature of 73 degrees F. The non-shrink grout shall be Instant Grout by Five Star Products, Inc., SikaGrout 428 FS by Sika Corp. or equal, and shall be submitted to the Engineer for review and acceptance. The grout shall be mixed, handled and placed in accordance with the Manufacturer's written instruction. High early strength non-shrink grout shall only be utilized where specifically noted on the Contract Drawings or with the written permission of the Engineer.

#### 4. EXECUTION

##### 4.1 Mixing, Placement, And Consolidation.

4.1.1 General: Mixing, placement, and consolidation of concrete shall be in accordance with applicable requirements of **Sections 201** and **303** of the Standard Specifications and specified in this Section.

##### 4.1.2 Proportioning:

4.1.2.1 Basis. Concrete materials shall be proportioned in accordance with **Section 201-1.3** of the Standard Specifications so as to produce a workable mixture in which the water content will not exceed the maximum specified.

4.1.2.2 Control. Mix proportions shall be established to meet specified requirements by the same laboratory that is employed for testing aggregates, and the costs for such mix design shall be borne by the Contractor.

The exact proportions of all materials entering into the concrete shall be as established by laboratory mix design and shall be changed only as directed by the Engineer or Laboratory when necessary to obtain specified strength or desired density, uniformity, and workability.

##### 4.1.3 Tests:

4.1.3.1 Laboratory Testing: Trial batch testing of all mixes shall be performed in accordance with **Section 201-1.1.4** of the Standard Specifications.

4.1.3.2 Field Testing: Concrete shall be sampled and tested in accordance with **Section 201-1.1.5** of the Standard Specifications and the requirements of this Section.

- a. Strength Tests. Strength tests shall be performed in accordance with ASTM C 39.

The frequency of sampling for each class of concrete placed each day shall be taken: not less than one(1) time per day, or not less than one(1) time for each fifty(50) cubic yards of concrete, or not less than one(1) time for each one thousand three hundred fifty(1,350) square feet of surface area for slabs or walls, or

a minimum of one(1) for every five(5) columns. On a given project, if the total volume of concrete is such that the frequency of testing required would provide less than five(5) strength tests for a given class of concrete, tests shall be made from at least five(5) randomly selected batches or from each batch if fewer than five(5) batches are used. Each sampling shall consist of four(4) 6-inch x 12-inch test cylinders or five(5) 4-inch x 8-inch cylinders; however, 4-inch x 8-inch cylinders are not permitted for concrete with a maximum aggregate size greater than 1-inch. For 6-inch x 12-inch cylinders, one(1) test cylinder shall be tested at seven(7) days, two(2) test cylinders tested at twenty-eight(28) days and one(1) test cylinder held. For 4-inch x 8-inch cylinders, one(1) test cylinder shall be tested at seven(7) days, three(3) test cylinders tested at twenty-eight(28) days and one(1) cylinder held. A strength test shall be the average of the strengths of at least two(2) 6-inch x 12-inch cylinders or at least three(3) 4-inch x 8-inch cylinders made from the sample of concrete and tested at twenty-eight(28) days.

- b. Slump Tests. Slump tests shall be performed in accordance with ASTM C 143. Slump tests shall be performed on the first concrete of each class placed each day, whenever the appearance of the concrete indicates a change in consistency, and whenever samples are taken for strength tests.
- c. Air Content Tests: Air content tests shall be performed in accordance with ASTM C 173 or ASTM C 231. Air content tests shall be performed whenever slump tests are performed.
- d. Unit Weight Tests: Unit tests shall be performed in accordance with ASTM C 138. Unit weight tests shall be performed whenever slump tests are performed.
- e. Temperature Measurement: During hot weather or cold weather concrete placement, the temperature of concrete shall be taken at each truck. At other times, temperature shall be taken whenever slump tests are performed.

#### 4.1.4 Concrete Placement:

4.1.4.1 Conveying. Concrete shall be conveyed from mixer to forms as rapidly as practicable by methods which will prevent segregation or loss of ingredients. It shall be deposited as nearly as practicable in its final position. There shall be no free vertical drop greater than four(4) feet.

4.1.4.2 Placing. Concrete shall be placed before initial set has occurred and, unless otherwise authorized by the Engineer, before it has contained its water content for more than ninety(90) minutes or the drum completes two hundred-fifty(250) revolutions, whichever comes first. Concrete that has partially hardened shall not be retempered with additional water.

Unless otherwise specified, all concrete shall be placed upon clean, damp surfaces free from running water. Where concrete is placed against soil, the

soil shall meet or exceed the required relative compaction requirements specified in **Section 2B** of these Special Provisions. Concrete shall not be placed upon mud or dry porous earth.

Concrete shall not be placed in water, nor shall water be allowed to rise over freshly placed concrete until the concrete has set sufficiently to prevent it from being damaged thereby.

Concrete shall not be placed until all reinforcement is securely and properly fastened in its correct position; the form ties at construction joints have been retightened; all sleeves, hangers, pipe, bolts, conduits, and any other items required to be embedded in the concrete have been placed and anchored; and forms cleaned and coated as specified, inspected, and accepted as ready for concrete.

In dropping concrete through reinforcement, care shall be taken that no segregation of the coarse aggregate occurs.

4.1.4.3 Placement Sequence. Any floor, wall, or roof section showing continuous reinforcing through the joints, which are not considered expansion joints, shall be placed in a sequence to minimize the effects of shrinkage. The concrete shall be placed in units as bounded by construction joints as shown on the Contract Drawings. The construction of units shall be done by placing alternate units in a manner such that each unit placed shall have cured ten(10) days before the contiguous unit or units are placed, except that vertical walls shall not be placed until the wall footings have cured a minimum of fourteen(14) days, and the corner sections of vertical walls shall not be placed until all the adjacent wall panels have cured a minimum of fourteen(14) days. Contractor shall submit placement sequence to the Engineer and obtain the Engineer's acceptance prior to placing concrete.

4.1.4.4 Vibrating. Concrete shall be placed with the aid of accepted mechanical vibrating equipment. Vibration shall be transmitted directly to the concrete; in no case shall it be transmitted through the forms. Vibrators shall be applied at uniformly spaced points not farther apart than 2/3 the visible effectiveness of the machine. For wall placements 3-foot, 0-inch or greater in thickness, the Contractor shall provide at least two(2) vibrators and operators working in tandem.

The vibrator shall at all times be inserted through the newly placed layer into the next lower course, to ensure a proper integration of one course to another, and shall then be pulled up slowly, the speed of which is then dependent upon mix design and type of vibrator. Because of the high density and strength requirements, only experienced and accepted vibrator operators shall be used for any concrete placed. All vibrator operators shall be listed and shall have a minimum of two(2) years' experience placing and vibrating concrete. The vibrator operator shall vibrate the concrete systematically from one point to another without skipping any areas or without having to move backwards and forwards in any one single pass. Particular care shall be given to vibrating concrete at horizontal and vertical construction joints to eliminate any possibility of honeycomb around waterstops and in corners. Every effort shall be made to avoid any contact of vibrator to reinforcing steel. At all times,

the intensity and duration of vibration shall be sufficient to accomplish thorough and uniform consolidation. The Contractor shall submit a vibration plan to the Engineer for acceptance prior to proceeding with any concrete placement operations.

Vibrators shall not be used to flow or transport concrete inside of forms. Where necessary, vibration shall be supplemented by forking or spading by hand adjacent to the forms on exposed faces in order to secure smooth, dense, even surfaces. The concrete shall be compacted and worked in an accepted manner into all corners and angles of the forms and around reinforcement and embedded fixtures.

Only high frequency internal vibrators, with operating speeds of preferably 21,000 vpm, but not less than 14,000 vpm, shall be used unless otherwise accepted in writing by the Engineer. The Contractor shall have a backup vibrator available on-site for each vibrator in use during concrete placement.

#### 4.2 Joints.

4.2.1 Construction Joints: Construction joints shall be in accordance with **Section 303-1.8.6** of the Standard Specifications and the requirements specified in this Section. Construction and other joints shall be placed where indicated on the Contract Drawings. Construction joints, other than those shown on the Contract Drawings, may be used only with the written permission of the Engineer.

The surfaces of joints shall be given a compacted, roughened surface for good bonding. Joint surfaces shall be cleaned of laitance, loose or defective concrete, foreign material, and be roughened to a surface profile of CSP6 or rougher. Such cleaning and roughening shall be accomplished by hydroblasting or sandblasting (exposing aggregate) followed by thorough washing. Pools of water shall be removed from the surface of construction joints before the new concrete is placed.

#### 4.2.2 Expansion Joints:

Expansion joints in concrete structures shall be formed where shown on the plans. No reinforcement shall be extended through the joints except where specifically noted or detailed on the plans. Expansion joint fillers shall be installed as detailed on the plans and in strict accordance with the Manufacturer's instructions.

Where expansion joint material is to be attached to the surface of concrete, a suitable adhesive shall be used. Mechanical methods of attachment are not acceptable.

#### 4.3 Forms.

4.3.1 General: Forms shall be in accordance with **Section 303-1.3** of the Standard Specifications, and as specified in this Section. Wall forms may be removed no sooner than 24 hours after concrete placement and shall not be removed prior to the concrete achieving a compressive strength of 1500 psi.

Falsework and formwork for overhead, or suspended slabs, beams and girders, shall be removed no sooner than ten days after concrete placement and may not be removed prior to the concrete achieving a compressive strength of 70 percent of the specified 28-day compressive strength. Prior to setting reinforcing steel for walls, one(1) side of the forms shall be set and braced to line and grade. The reinforcing steel shall then be set accurately and secured firmly in place.

4.3.2 Tolerances of Forms: Form work shall be constructed to ensure that concrete surfaces will conform to the following tolerances.

4.3.2.1 Variation from Plumb. In the lines and surfaces of columns, piers and walls, and in arrises:

In ten(10) feet	1/4-inch
In any story of twenty(20) feet max.	3/8-inch
In forty(40) feet or more	3/4-inch

For exposed corner columns, control joint grooves, and other conspicuous lines:

In any bay or twenty(20) feet max.	1/4-inch
In forty(40) feet or more	1/2-inch

4.3.2.2 Variation from Level or Grades Indicated. In floors, ceiling, beam soffits, and in arrises:

In ten(10) feet	1/4-inch
In any bay or twenty(20) feet max.	3/8-inch
In forty(40) feet or more	1/2-inch

For exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines:

In any bay or twenty(20) feet max.	1/4-inch
In forty(40) feet or more	1/2-inch

Variation of Linear Building Lines: From established position in plan and related position of columns, walls and partitions:

In any bay or twenty(20) feet max.	1/4-inch
In forty(40) feet or more	3/8-inch

Variation in Cross Sectional Dimensions: Of columns and beams and in the thickness of slabs and walls, except precast:

Minus	1/8-inch
Plus	1/8-inch

#### 4.4 Finish of Formed Surfaces.

4.4.1 General: The classes of surface finish described in **Section 303-1.9** of the Standard Specifications, shall be applied to the various parts of concrete structures as specified therein and in this Section.

4.4.2 Filling of Tie Holes: All tie holes shall be thoroughly sandblasted or roughened, then coated with a water insensitive epoxy binder and filled with a mortar of dry consistency and a mix of one(1) part cement to one(1) part plaster sand. The amount of water to be added to the cement sand mix shall be such that the mortar can be driven into the voids by hammer and will compact properly.

Taper tie holes shall be roughened from the large end of the hole and sealed with a neoprene or polyurethane plug driven to a tight fit near the center of the wall. The taper tie holes shall then be coated with an epoxy binder and dry packed with a mortar mix as specified above beginning with the large end of the tie hole first. Inside wall surfaces at tie holes, which have been damppacked, shall be covered with an accepted 10 mil thick layer of a water insensitive nonsag epoxy coating.

Additives shall not be used in the mix unless accepted by the Engineer. Calcium chloride shall not be mixed with the mortar or be part of a prepackaged mortar.

Tie holes, which have been filled, shall be kept moist for a period of not less than twenty-four(24) hours.

4.4.3 Repair of Honeycombed Areas: Defective surfaces, such as honeycomb, shall be cut out entirely until homogenous concrete is met. Such areas shall be coated with an epoxy binder, applied in accordance with the Manufacturer's printed instructions, before damp-packing the area with a mix consisting of one(1) part cement to two(2) parts of sand and fine gravel, epoxy and sand mix, or any combination of material and mixes as the situation dictates in the opinion of the Engineer.

The water content of the damp-pack material shall be such that a ball of the mix may be squeezed in the hand without bringing free water to the surface. Damp-pack material shall be tamped into place and finished to match concrete surfaces. Particular care should be taken that no sagging of the material will occur.

The bond between any two(2) layers of damp-pack shall be improved through the use of an epoxy binder. Surfaces, which have been damp-packed, shall be kept continuously wet during and for a period of not less than seven(7) days after completing the damp-pack operation. Calcium chloride shall not be mixed with the damp pack material or be part of a prepackaged damp pack material.

Under no circumstances shall Contractor apply a plaster coat over the honeycomb areas to conceal the existence of the honeycomb in the concrete. Calcium chloride shall not be added to the damp-pack material and shall not be part of a prepackaged damp-pack material.

4.4.4 Ordinary Surface Finish: Ordinary surface finish shall be the final finish for vertical and soffit surfaces of structures which are not exposed to the view of District operators during normal use, and surfaces which are to receive protective coatings except where a higher-class finish is specified in this Section.

4.4.5 Class 1 Surface Finish: Class 1 surface finish shall be a preparatory finish for surfaces designated in this Section to receive the Class 2 surface finish.

4.4.6 Class 2 Surface Finish: Class 2 surface finish shall be the final finish for the following surfaces which, in general, includes all concrete exposed to the view of District operators during normal use. This work shall be completed prior to installation of miscellaneous metals, equipment, ducts, fixtures, and piping which are fastened to the concrete surfaces. At a minimum, a Class 2 Finish is required for the surfaces identified in this Section:

4.4.6.1 Exposed exterior vertical and soffit surfaces above finished ground and to a least one(1) foot below finished ground.

4.4.6.2 Exposed vertical surfaces of columns, pilasters and equipment pedestals.

4.4.6.3 Exposed interior vertical and soffit surfaces of pump stations and similar structures.

4.4.6.4 Exposed interior wall and soffit surfaces of stairwells, galleries, drywells, and similar structures.

4.5 Finish Of Flatwork.

4.5.1 Finishing: Flatwork finish shall be in accordance with **Section 303-1.9.5** of the Standard Specifications as amended by the District. Flatwork finish shall be the final finish for all slabs, all sidewalks, and all horizontal concrete surfaces, except where shown otherwise on the Contract Drawings, or where backfill is placed on top of the slab.

4.5.2 Tolerance: Finish work shall contact a ten(10)-foot straight edge in any direction with 1/8-inch maximum tolerance.

4.6 Stairway Non-Slip Finish. Stairway and steps shall receive a non-slip finish by applying a broom finish perpendicular to the path of travel and of a texture accepted by the Engineer. Finish shall be provided at the proper time after placing and troweling operations are complete.

4.7 Curing. Curing of concrete shall be in accordance with **Section 303-1.10** of the Standard Specifications and as specified in this Section. Concrete shall be protected from loss of moisture for a minimum of ten(10) days after placement. All concrete as specified in this Section, shall be cured using a membrane curing compound in accordance with the Standard Specifications.

4.8 Payment for Concrete Placement. Payment for concrete placement shall not be made until water curing has been complete and accepted by the Engineer.

4.9 Setting And Building-In Work. Unless otherwise specified under other Sections of these Special Provisions, the Contractor shall set and build-in materials, which are required for, concrete construction. This includes structural anchors, anchor slots, bolts, plates, brackets, etc., which are

specified in other Sections of these Special Provisions, but which are to be embedded in concrete. The Contractor shall become familiar with and be responsible for work, which is to be set and built-in under this Section, as well as that which will be set by other trades and built-in under this Section.

The Contractor shall see that work specified to be set under other Sections of these Special Provisions is secured properly for concrete placing operations and shall be responsible for maintaining the proper position of work after having been set.

Pipes and conduits shall not be embedded in structural concrete except where specifically detailed. Where specifically detailed to be embedded, the pipes and conduits shall be located within the middle third of the slab. Embedded pipes and conduits shall be spaced such that they have at least three(3) times their diameter clear to the next conduit.

The surfaces of metalwork to be in contact with concrete shall be thoroughly cleaned of dirt, grease, loose scale and rust, grout, mortar, and other foreign substances immediately before the concrete is placed.

After having been placed, concrete shall not be cut to place work left out through oversight, except by acceptance of the Engineer.

4.10 Corrosion Protection. Pipe, conduit, dowels, anchor bolts, and other ferrous items required to be embedded in concrete construction shall be so positioned and supported prior to placement of concrete that there will be a minimum of 2-inches clearance between these items and any part of the concrete reinforcement. Securing these items in position by wiring or welding them to the reinforcement will not be permitted.

4.11 Provisions and Connections for Others. The Contractor shall guard against delay by notifying subcontractors and the Engineer well in advance of the time when their work or equipment is to be furnished or installed. The Contractor shall coordinate all work specified in this Section with work specified under other Divisions or Sections of these Special Provisions.

The Contractor shall install sleeves and provide boring or other devices necessary to form openings for the passage of pipes and conduits. Sleeves shall be removed prior to the Contractor grouting the void between the sleeve opening and the conduit or pipe.

4.12 Weather Conditions and Protection. Concrete placing and protection shall conform to **Section 303-1.8.8** of the Standard Specifications. Concrete shall not be placed during inclement weather without the prior acceptance of the Engineer as described in **Section 1A** of these Special Provisions.

The Contractor shall submit detailed procedures for the production, transportation, placement, protection, curing, and temperature monitoring of concrete during cold and hot weather. Subject to Districts' acceptance, the Contractor shall incorporate applicable preventative measures conforming to ACI 306R Cold Weather Concreting and ACI 305R Hot Weather Concreting for placing concrete during cold or hot weather to meet project requirements.

4.12.1 Cold Weather Placement: Work shall conform to the requirements of ACI 306.1, Standard Specification for Cold Weather Concreting. Frozen subgrade shall be thawed to a minimum depth of 4-inches prior to placement of concrete. Do not allow concrete temperature to decrease below 50 degrees F. Obtain Districts acceptance prior to placing concrete when the ambient temperature is below 40 degrees F or when concrete is likely to be subjected to freezing temperatures within twenty-four(24) hours. Cover concrete and provide sufficient heat to maintain 50 degrees F minimum adjacent to both the formwork and the structure while curing. Limit the rate of cooling to 5 degrees F in any hour and 50 degrees F in twenty-four(24) hours after heat application. Temperature of protected concrete shall be recorded not less than every hour.

4.12.2 Hot Weather Placement: The temperature of concrete when it is being placed shall be not more than 90 degrees F. If concrete is placed when the weather is such that the temperature of the concrete would exceed 90 degrees F, the Contractor shall employ means which include but is not limited to precooling of aggregates and mixing water, using ice, placing at night, proper attention to ingredients, production methods, handling, placing, and protection as necessary to maintain the temperature of the concrete, as it is placed, below 90 degrees F. Maintain required concrete temperature using **Figure 4.1.4 per** ACI 305R-20 to prevent the evaporation rate from exceeding 0.2 pounds of water per square foot of exposed concrete per hour.

4.12.3 Temperature Tests: Test the concrete delivered and the concrete in the forms. Perform tests in hot or cold weather conditions (below 50 degrees F and above 80 degrees F for each batch (minimum) or every twenty(20) cubic yards of concrete, until the specified temperature is obtained, and whenever test cylinders and slump tests are made.

4.13 Inspection. The District will provide Special Inspections of the concrete construction items outlined on **Sheet No. S-2** of the Contract Drawings. The Contractor shall provide access to the concrete batch plant for the Engineer to observe the batching of the concrete including the addition of water and admixtures. If a water reducer is added at the batch plant, slump tests shall be taken prior to its addition and results shall be recorded on the batch documentation.

All welding of reinforcing steel shall receive special inspection. The Special Inspector shall be an AWS Certified Welding Inspector. All special inspections shall be in accordance with the AWS Code latest edition. A written report of each special inspection shall be submitted to the Engineer within five(5) working days of the inspection.

The District will provide a Special Inspector for preparation of all samples of the concrete for the testing specified in **Part 4.1.3** of this Section, including the making and protection of the test specimens. The Special Inspector shall be certified by the County of Los Angeles Department of Public Works and shall notify the District of any deviations or discrepancies that are observed.

## 5. SUBMITTALS

Complete fabrication, assembly, and installation drawings, together with details and data governing materials used, and other accessories furnished, shall be submitted for acceptance in accordance with the procedure set forth in the General Conditions. Data submitted shall include, but not be limited to the following:

5.1 Concrete Mix Designs and Supporting Test Data.

- a. Quantities by weight of each constituent of the mix.
- b. Aggregate gradation.
- c. Trial batch test results.
- d. Slump.
- e. Water to cementitious material ratio.
- f. Air Content.
- g. Mill certificates for each cementitious material.
- h. Certificate of compliance for fly ash.
- i. Laboratory test results for the tests required by **Part 4.1.3.1** of this Section.
- j. Statement of the source of the mix water, and when required, laboratory test results for the change in the time of set and amount of chloride and sulfates.
- k. Manufacturer's information for each admixture.

5.2 Concrete Delivery Tickets. Provide delivery tickets at the time of delivery of each load of concrete. Each ticket shall show the state-certified equipment used for measuring and the total quantities, by weight, of cement, sand, each class of aggregate, admixtures, the amount of water in the aggregate added at the batching plant, and the amount allowed to be added at the jobsite for the specific design mix. In addition, each ticket shall state the mix number, total yield in cubic yards, and the time of day, to the nearest minute, corresponding to the times when the batch was dispatched, when it left the plant, when it arrived at the jobsite, when unloading began, and when unloading was finished.

5.3 Field Test Results.

- a. Compressive Strength.
- b. Cement Content.
- c. Slump.
- d. Air Content.
- e. Unit Weight.
- f. Temperature.

5.4 Reinforcing Steel.

5.4.1 Mill Certificates, when requested by the Engineer.

5.4.2 Reinforcing steel placing drawings: The placing drawings shall show plans and sections detailing the size, spacing, and location of the bars in the structure. Reinforcing steel pattern shall accommodate required pour pattern and shall allow shrinkage to occur prior to following pours. The placing drawings shall be in accordance with ACI 315 – Details and Detailing of Concrete Reinforcement.

5.4.3 Reinforcing steel bar lists: Bar lists shall be in accordance with Standard Specifications **Section 303-1.7.1** and shall show the number of pieces, size, length, grade of steel, mark of bars, and bending details of all bent bars. The reinforcement list shall be a complete summary of materials required. The list shall be submitted with the placing drawings.

5.5 Joint Materials.

a. Epoxy Binder.

5.6 Non-Shrink Grout.

5.7 Epoxy Grout.

5.8 Bond Breaker.

5.9 Form Ties.

5.10 Full Tension Mechanical Splice.

a. Manufacturer's Information.

b. ICC Evaluation Service Report.

5.11 Placement Sequence.

5.12 Curing Method, Procedure, and Materials.

5.13 Cold Weather Concrete Procedure.

5.14 Hot Weather Concrete Procedure.

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SECTION 3G

CONCRETE REPAIR

1. SCOPE

The Work shall consist of:

- 1.1 Cleaning and inspection of the existing concrete;
- 1.2 Removing the deteriorated concrete including saw cutting the perimeter of the repair area;
- 1.3 Preparing the surface of the concrete for the repair, cleaning of existing reinforcement;
- 1.4 Supplying and installing supplemental and replacement reinforcement, and applying corrosion inhibitor to the reinforcement;
- 1.5 Supplying repair materials and the mixing and placing of concrete repair mortar or concrete including vibrating, finishing and curing;
- 1.6 Supplying, fabricating, constructing, maintaining and removing temporary works, including falsework, formwork, shoring and bracing;
- 1.7 Removal and reinstallation of guardrail, pipe supports and miscellaneous items in repair areas;
- 1.8 The quality control testing of all materials.

2. GENERAL

Concrete repair work shall conform to the requirements specified in this Section and to the applicable requirements of **Sections 201** and **303** of the Standard Specifications.

2.1 Qualifications of Concrete Repair Contractor. The Concrete Repair Contractor shall submit documentation of the completion of three(3) concrete repair projects at water treatment plants, wastewater treatment plants or similar facilities with water retaining concrete structures. The three(3) projects shall have been completed within the last seven(7) years. The repair related costs of at least one(1) of the three(3) projects shall have been greater than \$1,000,000. The Contractor shall complete and submit the Bidder Qualification Form as part of the Proposal Form as evidence of qualifications. Failure to provide the completed Bidder Qualification Form or failure of references to substantiate the specified qualifications may result in the bid being declared non-responsive. The field personnel for the concrete repair Contractor shall have completed training in the installation of the concrete repair material by the material manufacturer and have a minimum of five(5) years of experience installing the concrete repair materials.

2.2 Areas to be Repaired. The repair areas designated on the Contract Drawings are approximate and shall be used for establishing the bid price.

2.3 Existing Piping, Pipe Supports, Guardrail and Miscellaneous Items.

The Contractor shall remove existing piping, pipe supports, guardrail and miscellaneous items as necessary for the concrete repair work, in accordance with **Section 5B** of these Special Provisions.

3. PRODUCTS

3.1 Concrete Repair Materials.

3.1.1 Repairs Three(3) Inches Deep or Less.

3.1.1.1 Repairs on Horizontal Surfaces. Concrete repair material for horizontal surfaces with a repair depth of less than 3-inches deep shall be a cementitious mortar with an integral corrosion inhibitor. When tested in accordance with ASTM C 109, the twenty-eight(28) day compressive strength shall be a minimum of 6,700 psi. When tested in accordance with ASTM C 1202, the permeability shall be "very low". When tested in accordance with ASTM C 882, with the mortar scrubbed into the substrate, the slant shear bond strength shall be a minimum of 2000 psi. The concrete repair material shall be SikaTop 122 Plus by Sika Corporation; VersaSpeed LS100 by The Euclid Chemical Company; MasterEmaco S 488CI by Masterbuilders Solutions by BASF; or equal.

3.1.1.2 Repairs on Vertical or Overhead Surfaces. Concrete repair material for vertical or overhead surfaces with a repair depth of less than 3-inches deep shall be a cementitious mortar with an integral corrosion inhibitor. When tested in accordance with ASTM C 109, the twenty-eight(28) day compressive strength shall be a minimum of 6,000 psi. When tested in accordance with ASTM C 882, the slant shear bond strength shall be a minimum of 2000 psi. SikaTop 123 Plus by Sika Corporation; Speed Crete PM by The Euclid Chemical Company; MasterEmaco S 488CI by Masterbuilders Solutions by BASF by Master Builders Solutions by BASF; or equal.

3.1.2 Repairs 3-Inches Deep to 6-Inches Deep.

3.1.2.1 Repairs on Horizontal Surfaces. Concrete repair material for repair depths of between 3-inches and 6-inches shall be a cementitious mortar with an integral corrosion inhibitor. When tested in accordance with ASTM C 109, the twenty-eight(28) day compressive strength shall be a minimum of 6,500 psi. When tested in accordance with ASTM C 1202, the permeability shall be a maximum of 1,000 coulombs. When tested in accordance with ASTM C 882, with the mortar scrubbed into the substrate, the slant shear bond strength shall be a minimum of 2,000 psi. The concrete repair material shall be SikaTop 111 Plus, or Sikacrete 211 SCC Plus by Sika Corporation; Eucocrete Supreme by The Euclid Chemical Company; MasterEmaco S 466CI by Masterbuilders Solutions by BASF; or equal.

3.1.3 Repairs Greater Than 6-Inches Deep. Concrete repair material for repairs deeper than 6-inches shall be a pea gravel concrete conforming to 560-EF-4000 in accordance with **Section 3A** "Concrete" of these Special Provisions. In lieu of using a pea gravel concrete, the concrete repair material for repairs deeper than 6-inches shall be a cementitious mortar with an integral corrosion inhibitor. When tested in accordance with ASTM C 109,

the twenty-eight (28) day compressive strength shall be a minimum of 8,000 psi. When tested in accordance with ASTM C 1202, the permeability shall be a maximum of 1,100 coulombs. The concrete repair material shall be Eucocrete Supreme by The Euclid Chemical Company, MasterEmaco S 466CI by Masterbuilders Solutions by BASF, or equal.

3.2 Contraction Joint Material. Contraction joint material shall be Everlastic 1300 Series Concrete Gray Rubber Sponge Joint Filler by Williams Products; Bondtex No. 941 neoprene joint filler as distributed by Rubberite Cypress Sponge; or equal. Joint fillers shall conform to AASHTO M153, Type 1 and ASTM D 1752 Type I, and shall be neoprene. The thickness shall match the thickness of the existing contraction joint material.

3.3 Water. Water used in mixing and curing concrete repair material and for surface preparation shall conform to the requirements of **Section 3A, Part 3.6** of these Special Provisions.

3.4 Corrosion Inhibitor for Reinforcing Steel. Corrosion inhibitor for reinforcing steel shall be a three (3) component, epoxy-modified cementitious product that acts as a bonding agent and corrosion inhibitor. The corrosion inhibitor shall be two (2) coats of 20 mils each (40 mils total minimum) of Sika Armatec 110 Epocem by Sika Corporation; Two (2) coats of 20 mils each (40 mils total minimum) of Duralprep A.C. by The Euclid Company; two (2) coats of 10 mils each (20 mils total minimum) of MasterEmaco P124 by BASF Corporation; or equal, and shall be applied in accordance with the Manufacturer's written instructions. The corrosion inhibitor for reinforcing steel shall be by the same manufacturer as the concrete repair material that is placed around the reinforcing steel.

#### 4. EXECUTION

4.1 Cleaning, Inspection and Testing of Existing Concrete Surfaces. The surfaces of walls from the normal water surface and above and the undersides of suspended slabs where deteriorated concrete has been identified shall be cleaned to remove growth and stains and to expose cracks and spalls in the existing concrete to view. Cleaning shall be accomplished by low pressure wash and detergent scrubbing. The District's Engineer shall be the sole authority for determining the extent of the washdown operation. The washdown shall be done prior to the removal of any corroded concrete.

4.1.1 After cleaning the existing concrete surfaces, the Contractor shall, in the presence of the District's Field Engineer, inspect the concrete. The inspection shall be visual and shall include hammer sounding or chain dragging to identify potentially delaminated areas. During inspection, the District's Field Engineer shall identify the locations that require repair and the initial extent of the repair areas. During concrete removal, additional concrete may require removal to expose corroded reinforcing or to remove damaged concrete or concrete with a pH that is too acidic.

4.2 Not Used.

4.3 Concrete Removal. The perimeter of the removal areas shall be sawcut to a minimum depth of 1-inch. Reinforcing steel shall not be cut.

4.3.1 Acceptable methods of concrete removal are abrasive (sand) blasting, chipping, grinding, pneumatic hammering, steel shotblasting, scarifying, needle scaling, and high- and ultra-high-pressure water jetting. A pneumatic hammer greater than fifteen(15) pounds (7 kg) shall not be used. Scabbling, milling/rotomilling, bush-hammering ,and flame blasting shall not be used.

4.3.2 Where scarifiers, needle scalers, or pneumatic hammers are used, the final 0.10-inch of concrete shall be removed by steel shotblasting or wet abrasive (sand) blasting.

4.3.3 Additional Concrete Removal: After initial concrete removal at each repair area, the Engineer will inspect the repair area to determine if additional concrete removal is required. The concrete surfaces will be tested for acidity (pH). If the pH of the surface is less than ten(10), additional concrete shall be removed to a depth where only hard gray concrete remains, and the surface reading for the pH is equal to or greater than ten(10).

4.3.3.1 If corroded reinforcing steel has been exposed, concrete removal shall continue until the reinforcing steel has been exposed around its full perimeter. Corroded reinforcing steel shall have a minimum of 3/4-inch of clearance between the cleaned reinforcing steel and the nearest concrete.

4.3.3.2 If more than half of the perimeter of a reinforcing bar is exposed for 12-inches or more, concrete removal shall continue until the reinforcing steel has been exposed around its full perimeter. The reinforcing steel shall have a minimum of 3/4-inch of clearance to the nearest concrete.

4.3.3.3 If mechanical couplers are used to splice replacement reinforcement to existing reinforcement, the mechanical coupler shall have a minimum of 3/4-inch of clearance to the nearest concrete.

4.3.3.4 Concrete removal shall extend along the reinforcing steel to locations free of bond-inhibiting corrosion and where the bar is well bonded to the surrounding concrete. If supplemental reinforcing or replacement reinforcing is required, the concrete removal shall extend to a minimum of 2-inches beyond the end of the splice or coupler.

4.3.3.5 If non-corroded reinforcing steel is exposed during the undercutting process, care shall be taken not to damage the reinforcing steel's bond to surrounding concrete. If the bond between the reinforcing steel and concrete is broken, that reinforcing steel shall be undercut to provide a minimum of 3/4-inch clearance between the reinforcing steel and the concrete.

4.3.4 After concrete removal, the Contractor shall thoroughly clean the surfaces to remove all fines and deleterious materials that will adversely affect the bond of the proposed concrete repair material.

4.4 Reinforcing Steel.

4.4.1 Any reinforcing steel which is exposed during concrete removal and is found to be loose shall be secured in place by tying to other secure reinforcing steel.

4.4.2 Supplemental reinforcing steel shall be securely tied to the existing corroded reinforcing steel bar it is supplemental to.

4.4.3 Reinforcing bars with less than 50 percent of the original cross-sectional area remaining after cleaning shall be removed by cutting. The cut ends shall be at locations where the reinforcing bar has at least 85 percent of the original cross-sectional area if a lap splice or welded splice is used between the replacement reinforcing bar and the existing reinforcing bar. If mechanical couplers are used, the existing reinforcing bar shall be cut at locations where the reinforcing bar is uncorroded and has 100 percent of the original cross-sectional area.

4.4.4 Where an existing reinforcing steel bar has been completely corroded away, the concrete shall be removed at either end to locations where the reinforcing steel bar is exposed, free of bond-inhibiting corrosion, and where the bar is well bonded to the surrounding concrete. A replacement reinforcement steel bar shall be installed using lap splices, welded splices or mechanical couplers.

4.4.5 If reinforcing steel is damaged during concrete removal, it shall be repaired or replaced at the direction of the District's Field Engineer. Reinforcing that is to be replaced shall be cut out, and replaced with new reinforcing steel of the same diameter bar as the removed bar. The new reinforcing steel shall be spliced to the remaining cut reinforcing with mechanical splices or welded splices.

4.4.6 The Contractor shall provide special inspection for all welding of reinforcing steel in accordance with **Section 3A, Part 4.13** of these Special Provisions.

4.4.7 Clean steel to an SSPC-SP10 commercial finish, just prior to applying a corrosion inhibitor. The Contractor shall apply a corrosion inhibitor to all reinforcing steel and mechanical couplers. Concrete repair material shall be placed in the repair area within three(3) hours of the second coat of the corrosion inhibitor.

4.5 Surface Preparation. Surface preparation after concrete removal shall achieve a concrete surface profile CSP 6 minimum, in accordance with the International Concrete Repair Institute (ICRI) Guideline No. 310.2. The Contractor shall verify the surface profile using the ICRI's surface profile chips. All surfaces where structural concrete repair materials will be placed against existing concrete shall be in a saturated surface dry (SSD) condition at the time the repair material is placed. To achieve a SSD condition, water shall be delivered to the surface continuously for a minimum of four(4) hours or as required by the repair material manufacturer's written instructions, whichever is more stringent, prior to placing the concrete repair material. Where large surface areas are to be repaired, fog spray nozzles mounted on stands shall be provided in sufficient numbers such that the entire surface

to be repaired is in contact with the fog spray cloud. The concrete shall be prevented from drying until after the concrete repair material has been placed. All standing water in areas to be repaired shall be removed prior to placement of repair material. The Contractor shall provide a means to remove excess water from the structure.

4.6 Repair of Concrete Surfaces.

4.6.1 The Contractor shall rebuild the concrete surfaces to their original lines and shapes in the repair areas.

4.6.2 The Contractor shall follow the instructions and recommendations of the concrete repair material Manufacturer for the application. Where multiple lifts are required, the top surface of each lift shall be scored to produce a roughened surface for the next lift. The preceding lift shall reach final set before applying the next lift. The roughened surface shall be saturated with potable water, and new repair material scrubbed into the preceding lift.

4.7 Repair of Existing Contraction Joints. Where concrete repairs occur on one(1) side of an existing contraction joint, the Contractor shall remove any contraction joint material damaged by the demolition. New contraction joint material shall be adhered to the remaining existing surface prior to placing new concrete repair material. Where concrete repairs occur on both sides of an existing contraction joint, the Contractor shall place and cure concrete repair material on one(1) side of the joint and adhere contraction joint material to the new joint face prior to placing concrete repair material on the opposite side of the contraction joint.

4.8 Finish of Repaired Surfaces. The repaired concrete surface shall, in general, have a finish that will match the surrounding uncorroded concrete surface.

4.8.1 The final finish shall be flat and smooth by wood float or steel troweling. The requirements of the concrete repair material Manufacturer, with regards to finishing, shall be strictly adhered to.

4.8.2 Finish work shall contact a ten(10)-foot straight edge in any direction with a 1/8-inch maximum tolerance.

4.9 Curing. Curing of the repaired concrete shall be in accordance with **Section 303-1.10** of the Standard Specifications and as specified in this Section, and shall begin immediately after finishing the repair material. Concrete repair material shall be water cured. Membrane curing compounds are not acceptable. The Contractor shall protect the concrete repair material from direct sunlight, wind, rain and scarring or other damage. Concrete repair material shall be cured for ten(10) days. Curing in hot weather shall conform to the hot weather curing requirements of ACI 308.1 Standard Specification for Curing Concrete.

4.10 Not Used.

4.11 Mechanical Couplers. Mechanical couplers shall be in accordance with "Full Tension Mechanical Splice (Coupler)" in **Section 3A** "Concrete" of these Special Provisions.

4.12 Reinforcing Steel. Reinforcing steel shall be in accordance with **Section 3A** "Concrete" of these Special Provisions.

4.13 Cleanup. The Contractor shall provide a continuous cleanup operation for the concrete repair work. Sand or other blast material, debris and other materials shall be removed daily from areas that affect plant operation and employee safety.

At completion of the concrete repair work, remove and dispose of all construction equipment, surplus material, debris and sand or other blast material; wash down and sweep the area clean. The Contractor shall provide a collection system to prevent sand, air-placed concrete or mortar, debris and other materials from entering the flow of any part of the plant that remains in operation.

5. SUBMITTALS

5.1 General. The Contractor shall submit the following information in the form required in **Section 1A, Part 9** of these Special Provisions to the Engineer for review and acceptance prior to commencing work.

5.1.1 Structural calculations and detailed drawings showing the design of temporary shoring and bracing for the channel suspended slabs and transverse walkways. The calculations and drawings shall be stamped and signed by a Civil or Structural Engineer currently registered in the State of California.

5.1.2 Complete fabrication, assembly and installation drawings together with details and data governing materials used and other accessories furnished shall be submitted for acceptance in accordance with the procedure set forth in the General Conditions. Data submitted shall include, but not be limited to, the following:

- a. Qualifications of the Field Personnel.
- b. Concrete Repair Materials.
- c. Contraction Joint Material.
- d. Concrete Removal and Surface Preparation Procedures.
- e. Corrosion Inhibitor for Reinforcing Steel.
- f. Epoxy for Crack Injection, and Other Submittals Required by ACI 503.7.
- g. Concrete Curing Materials.

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## SECTION 4A

### MASONRY

#### 1. SCOPE

This Section sets forth the requirements for all masonry work shown on the Contract Drawings.

#### 2. GENERAL

2.1 The Contractor shall provide all the materials, equipment and labor required to construct the masonry as shown on the Contract Drawings and specified in this Section.

2.2 Masonry construction and materials shall conform to the requirements of TMS 602 Specification for Masonry Structures published by The Masonry Society, Boulder, Colorado except as modified by the requirements of these Contract Documents.

#### 2.3 Summary.

##### 2.3.1 Work Included in this Section:

- a. Concrete masonry units (CMUs).
- b. Mortar and grout.
- c. Reinforcing steel.
- d. Control joint materials.

##### 2.3.2 Work Not Included in this Section:

- a. Masonry painting.
- b. Masonry waterproofing.

2.4 Inspection. The District will provide special inspection for masonry construction. The Special Inspector shall be certified by the International Code Council (ICC) and the County of Los Angeles Department of Public Works Building and Safety Division. All special inspections shall be in accordance with TMS 602. A written report of each special inspection shall be submitted to the Engineer within five(5) working days of the inspection.

2.4.1 Where masonry structures are fabricated offsite, the Districts will provide special inspection for masonry at the fabrication facility and on site following installation of the structure.

#### 2.5 Requirements.

2.5.1 Provide materials to achieve a net compressive strength of concrete unit masonry equal to or greater than 2000 psi. The compressive strength,  $f'_m$ , shall be determined by the Unit Strength Method.

2.5.2 Masonry work of the types indicated shall be provided. Masonry work shall be properly coordinated with the work of other trades. The source of supply for materials which will affect the appearance of the finished work shall not be changed after the work has started.

### 3. PRODUCTS

3.1 Concrete Masonry Units. Concrete masonry units shall be medium weight and shall conform to ASTM C 90. Masonry units' style (split face or smooth face) and color shall be as shown on the Contract Drawings or selected by the Engineer from Manufacturer's standard color chips. Masonry units shall be manufactured by Angelus Block Co. or Orco Block Co.

3.1.1 Shapes: Provide shapes as indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless indicated otherwise.

3.1.1.1 Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.

3.1.1.2 Provide square-edged units for outside corners unless indicated otherwise.

3.1.1.3 Masonry lintels shall be prefabricated, or built-in-place lintels made from bond beam CMUs.

3.2 Mortar Materials. Mortar shall be Type M or S in compliance with the property specification in ASTM C 270. Mortar color shall be as shown on the Contract Drawings or selected by the Engineer from Manufacturer's standard color chips.

### 3.3 Grout Materials.

3.3.1 Grout for masonry shall conform to ASTM C 476.

- a. The compressive strength of the grout shall be 2000 psi minimum as tested per ASTM C 1019.
- b. Provide grout with a slump of 8- to 11-inches per TMS 602 Article 2.6 B.

3.3.2 Water: Water for mixing shall be potable.

3.3.3 Admixtures: The use of admixtures shall not be permitted except as specified in this Section, or as accepted by the Engineer.

3.4 Reinforcement. Steel shall be deformed bars and shall conform to ASTM A 615 Grade 60.

### 3.5 Miscellaneous Masonry Accessories.

3.5.1 Rubber Preformed Control-Joint Gaskets: per ASTM D 2000, Designation M2AA-805.

3.5.2 PVC Preformed Control-Joint Gaskets: per ASTM D 2287, Type PVC 654-4.

3.6 Masonry Cleaner. Use potable water and detergents to clean masonry unless otherwise accepted. Do not use acid or caustic solutions unless otherwise accepted.

4. EXECUTION

4.1 Delivery, Storage, And Handling.

4.1.1 All materials of this Section shall be protected to maintain quality and physical requirements. Masonry units shall be handled with care to avoid chipping and breakage.

4.1.2 All masonry units shall be stored on the jobsite so that they are protected from rain, stored off-ground and kept free of contamination. Materials stored on newly constructed floors on grade shall be stacked in such a manner that the uniformly distributed loading does not exceed 300 psf.

4.1.3 Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

4.1.4 Store aggregates where grading and other required characteristics can be maintained, and contamination avoided.

4.1.5 Store masonry accessories, including reinforcing, ties, and metal items, to prevent corrosion and accumulation of dirt and oil.

4.2 Field Conditions.

4.2.1 Cover top of unfinished masonry work with waterproof sheeting to protect it from the weather at the end of each workday and when construction is not in progress. Extend cover a minimum of 24-inches down both sides of walls and hold cover securely in place.

4.2.2 Cold-weather procedures when ambient temperature falls below 40 degrees F (4 degrees C) or the temperature of masonry units is below 40 degrees F (4 degrees C):

- a. Wet or frozen units shall not be laid.
- b. Implement cold weather construction procedures in accordance with TMS 602 Article 1.8 C.

4.2.3 Hot-weather procedures when ambient temperature exceeds 100 degrees F (38 degrees C), or exceeds 90 degrees F (32 degrees C) with a wind velocity greater than 8 mph:

- a. Implement hot weather construction procedures in accordance with TMS 602 Article 1.8 D.

4.3 Examination.

4.3.1 Prior to the start of masonry installation, verify all conditions pertinent to the performance of work in this Section are acceptable.

- a. Verify foundations are constructed within a level alignment tolerance of  $\pm 1/2$ -inch.
- b. Verify that reinforcing dowels are positioned in accordance with the Contract Drawings.

4.3.2 Masonry work shall not proceed until unsatisfactory conditions have been corrected or accepted by the Engineer.

4.4 Preparation.

4.4.1 Clean reinforcement and shanks of anchor bolts by removing mud, oil, or other materials that will adversely affect bond to mortar or grout. Reinforcement with rust and/or mill scale is acceptable provided attributes of a cleaned sample are in accordance with the applicable ASTM specification.

4.4.2 Prior to laying masonry, remove laitance, loose aggregate, and any other material that would prevent mortar from bonding to the foundation.

4.4.3 Do not wet units before laying, unless otherwise required. Wet cutting is permitted.

4.4.4 Cut units as required to fit; use a motor-driven masonry saw. Install cut units with cut surfaces concealed as much as possible.

4.5 Installation.

4.5.1 Select and arrange units to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

4.5.2 Comply with construction tolerances in TMS 602 Article 3.3F.

4.5.3 Construct grout spaces free of mortar dropping, debris, and any material deleterious to grouting.

4.5.4 Construct cleanouts in the bottom course of masonry for each grout pour when the grout pour height exceeds 5-feet, 4-inches.

- a. Hollow-unit masonry: create cleanout by cutting off entire face shell of the unit. Replace face shell after inspection and before grouting.
- b. Brace cleanout closure to resist grout pressure.

4.5.5 All masonry shall be laid true, level, plumb, and in accordance with the Contract Drawings.

4.5.6 Ensure all vertical cells to be grouted are aligned and unobstructed openings for grout are provided in accordance with the Contract Drawings.

4.5.7 Masonry shall be laid in running bond unless otherwise indicated in the Contract Drawings.

4.5.8 Brace masonry during construction to assure stability. Design, provide, and install bracing.

4.5.9 Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Remove forms and shores only after reinforced masonry members have hardened sufficiently to carry their own weight and other loads imposed during construction.

4.6 Mortar Bedding And Jointing.

4.6.1 Place mortar in accordance with TMS 602 Article 3.3 B.

4.6.2 Initial bed joint shall not be less than 1/4-inch nor more than 3/4-inch.

4.6.3 All head and bed joints, except as in Article 3.6 B., shall be a nominal 3/8-inch thick, unless otherwise required.

4.6.4 Thickness of bed joints shall not exceed 5/8-inch.

4.6.5 Lay hollow units with head and bed joints filled with mortar for the thickness of the face shell.

4.6.6 Remove mortar protrusions extending 1/2-inch or more into cells to be grouted.

4.6.7 Fully mortar webs in all courses of piers, columns and pilasters, in the starting course on foundations, and when necessary to confine grout.

4.6.8 All mortar joints on walls shall be concave, unless otherwise indicated, and struck to produce a dense, slightly concave surface well bonded to the surface of the masonry unit.

4.6.9 Remove and re-lay in fresh mortar any unit that has been disturbed to the extent the initial bond is broken.

4.7 Embedded Items and Accessories.

4.7.1 Construct control joints as detailed in the Contract Drawings as masonry progresses.

4.7.2 Install pipes and conduits passing horizontally through nonbearing masonry partitions as indicated.

4.7.3 Place pipes and conduits passing horizontally through piers, pilasters, or columns as indicated.

4.7.4 Place horizontal pipes and conduits in and parallel to plane of walls.

4.7.5 Install and secure connectors, flashing, weep holes, weep vents, nailing blocks, and other accessories as required.

4.8 Installation Of Reinforcing Steel. Install reinforcing steel and anchors in accordance with TMS 602 Article 3.4.

4.8.1 Place reinforcement as detailed on the Contract Drawings.

4.8.2 Support and fasten reinforcement to prevent displacement beyond specified tolerances during construction and grouting operations.

4.8.3 Maintain clear distances between reinforcement and any interior face of masonry unit or formed surface, but not less than 1/4-inch for fine grout, or 1/2-inch for coarse grout.

4.8.4 Completely embed reinforcing bars in grout.

4.8.5 Place reinforcing bars maintaining minimum cover of:

- a. Where masonry is exposed to weather, 2-inches for bars larger than No. 5, 1-1/2-inch for No. 5 or smaller.
- b. Where masonry is not exposed to weather, 1-1/2-inch.

4.8.6 Tolerances for placement of reinforcing bars in walls and flexural elements shall be  $\pm 1/2$ -inch when the distance from the centerline of reinforcing bars to the opposite face of masonry,  $d$ , is equal to 8-inches or less,  $\pm 1$ -inch for  $d$  equal to 24-inches or less but greater than 8-inches, and  $\pm 1-1/4$ -inch for  $d$  greater than 24-inches.

4.8.7 Foundation dowels that interfere with unit webs are permitted to be bent to a maximum of 1-inch horizontally for every 6-inches of vertical height.

4.9 Installation of Anchor Bolts. Install anchor bolts as detailed on the Contract Drawings and in accordance with TMS 602 Article 3.4 D.

4.9.1 Embed headed anchor bolts in grout. Anchor bolts of 1/4-inch or less may be placed in mortar bed joints at least 1/2-inch in specified thickness.

4.9.2 Maintain clear distance between anchor bolts and any face of masonry unit or formed surface of at least 1/4-inch when using fine grout, and of at least 1/2-inch when using coarse grout.

4.9.3 Maintain a clear distance between parallel anchor bolts not less the diameter of the anchor bolt, nor less than 1-inch.

4.9.4 Bent-bar anchor bolts are not permitted to be used in masonry.

4.10 Grouting. Comply with grout placement requirements in TMS 602 Article 3.5.

4.10.1 Place grout within 1-1/2-hours from introducing water in the mixture and prior to initial set.

4.10.1.1 Discard field-mixed grout that does not meet specified slump without adding water after initial mixing.

4.10.1.2 For transit-mixed grout:

- a. Addition of water is permitted at time of initial discharge to adjust consistency to a slump between 8- and 11-inches.
- b. Discard transit-mixed grout that does not meet specified slump without adding water, other than as allowed in **Part 4.10.1.2, Item a.** in this Section.
- c. Transit-mixed grout may be used beyond the time limit as long as it meets the specified slump.

4.10.2 Grout pour height: Do not exceed the maximum grout pour height as given in TMS 602 Table 6, or as otherwise specified.

4.10.3 Conventional grout lift height:

- a. Limit the grout lift height to the bottom of the lowest bond beam that is more than 5-feet, 4-inches above the bottom of the lift, but do not exceed a grout lift height of 12-feet, 8-inches when the following conditions are met:
  1. The masonry has cured for a minimum of four(4) hours.
  2. Grout slump is maintained between 10- and 11-inches.
- b. When **Part 4.10.3, Item a.** in this Section is not met, limit grout lift height to 5-feet, 4-inches.

4.10.4 Conventional grout consolidation:

4.10.4.1 Consolidate grout pours 12-inches or less by mechanical vibration or puddling.

4.10.4.2 Consolidate grout pours exceeding 12-inches by mechanical vibration and reconsolidate after initial water loss and settlement have occurred.

4.10.5 Grout keys are required between grout pours, or between lifts when the previous lift is permitted to set prior to placement of the subsequent lift.

4.10.5.1 Form grout key by terminating the grout a minimum of 1-1/2-inches below a mortar joint.

4.10.5.2 Do not form grout keys within beams.

4.10.5.3 At beams or lintels laid with closed bottom units, terminate the grout pour at the bottom of the beam or lintel without forming a grout key.

4.11 Tolerances. Erect masonry based on the site tolerances provided in TMS 602 Article 3.3 F.

4.12 Field Quality Control Tests.

4.12.1 Unless indicated otherwise, perform one(1) set of tests for each 5000 square feet of wall area or portion thereof.

4.12.2 Concrete Masonry Units: Test per ASTM C 140.

4.12.3 Grout: Test per ASTM C 1019.

4.13 Repairing, Pointing, and Cleaning.

4.13.1 Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining unit; install in fresh mortar, pointed to eliminate evidence of replacement.

4.13.2 Point and tool holes in mortar joints to produce a uniform, tight joint.

4.13.3 During construction, minimize any mortar or grout stains on the wall. Immediately remove any staining or soiling that occurs. For precision or textured units, except as noted below, clean masonry by dry brushing before tooling joints.

4.13.4 Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry surfaces of stains, efflorescence, mortar or grout droppings, and debris.

4.13.5 At completion of masonry work, remove all scaffolding and equipment used during construction, and remove all debris, refuse, and surplus masonry material from the site. Do not dispose of masonry waste as fill on site.

## 5. SUBMITTALS

5.1 Data and details governing materials used, and other accessories furnished, shall be submitted for acceptance in accordance with the procedure set forth in the General Conditions, **Section 1A** of these Special Provisions.

5.2 Statement of Compressive Strength of Masonry. For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602.

5.3 Obtain written acceptance of submittals prior to use of the following:

5.3.1 Mortar: Mix design and mortar test performed in accordance with the property specification of ASTM C 270.

5.3.2 Conventional grout: Mix design and grout strength test performed in accordance with ASTM C 476.

5.3.3 Concrete masonry units: Submit two(2) physical sets of Manufacturer's standard masonry unit and mortar color chips for color selection before starting work. All manufacturer's stock and special-order colors shall be included. Electronic copies are not acceptable.

5.3.4 Steel reinforcing bars:

- a. Reinforcing bars placing drawings shall be submitted. The placing drawings shall show plans and sections detailing the size, spacing and location of the bars in the structure.
- b. Bar lists prepared from the placing drawings used in cutting, bending tagging, and shipping shall be submitted. The bar lists shall show the number of pieces, size, length, grade of steel, mark of bars, and bending details of all bent bars. The reinforcement list shall be a complete summary of materials required.

5.3.5 Preformed control joint gaskets.

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SECTION 5B

MISCELLANEOUS METALS

1. SCOPE

This Section sets forth the requirements for miscellaneous metals shown on the Contract Drawings.

2. GENERAL

2.1 The Contractor shall provide all the materials, equipment and labor required to complete the miscellaneous metal work shown on the Contract Drawings and specified in this Section.

2.2 Summary.

2.2.1 Work Included in this Section:

- a. Steel, iron or metal items listed in, but not limited to, the American Institute of Steel Construction (AISC) Standard 303 "Code of Standard Practice for Steel Buildings and Bridges", Section 2.2, latest edition.
- b. Welding and finishing for the above items.

2.2.2 Work Not Included in this Section:

- a. Anchorage as part of the work of other Sections.
- b. Metal deck and siding; metal stud walls; metal doors, windows and frames; sheet metal; architectural metal.

2.3 The following list of national standards is to be used on this project where applicable. This list includes, but is not limited, to:

- a. American Welding Society (AWS) D1.1 "Structural Welding Code for Steel".
- b. AWS D1.2 "Structural Welding Code for Aluminum".
- c. AWS D1.6 "Structural Welding Code for Stainless Steel".

3. PRODUCTS

3.1 Wide Flanges and Tees. Steel wide flange-s and tees shall conform to ASTM A 992.

3.2 Channels, Angles and Plates. Steel channels, angles and plates shall conform to ASTM A 36.

3.3 Hollow Structural Sections (HSS). Steel rectangular, square and round hollow structural sections shall conform to ASTM A 500, Grade C.

3.4 Pipe. Steel pipe shall conform to ASTM A 53, Grade B.

3.5 Stainless Steel. All stainless-steel plates, shapes and bars shall be Type 316 conforming to ASTM A 240 or A 276, unless noted otherwise. Stainless steel which will be welded shall be Type 316L.

3.6 Aluminum. All aluminum plates, rods and shapes shall conform to the applicable Federal Specification for 6061-T6 alloy, unless noted otherwise. All aluminum bearing on or embedded in concrete shall have one coat of an epoxy primer in accordance with **Section 9A** of these Special Provisions.

3.7 Bolts. Unless noted otherwise, bolts for connecting steel shapes included in this Section shall be American Standard, hot-dip galvanized and shall conform to ASTM A 307 Grade A. ASTM A 563 Grade A nuts shall be used with ASTM A 307 Grade A bolts. Stainless steel bolts shall conform to ASTM F 593 Type 316 with stainless steel nuts and washers. Bolt holes shall be standard holes, unless noted otherwise.

3.8 Steel Grating. Grating shall be of welded construction as manufactured by IKG Borden Grating, McNichols Co., or equal.

3.9 Steel Treads. Steel treads shall be galvanized steel grating of welded construction conforming to the requirements of steel grating of this Section.

3.10 Aluminum Grating. Aluminum grating shall be cold forged and swaged construction as manufactured by IKG Borden, McNichols Co., Seidelhuber Metal Products, or equal.

3.11 Aluminum Treads. Aluminum treads shall be cold forged and swaged aluminum grating as described above.

3.12 Aluminum Tread Plate. Aluminum tread plate shall be diamond tread plate of aluminum alloy 6061-T6.

3.13 Aluminum Handrail. Aluminum handrail shall be fabricated from 1-1/2-inch Schedule 40 aluminum pipe alloy 6061-T6 and "Speedrail Slip-On Fittings" as manufactured by the Hollaender Mfg. Co.

#### 4. EXECUTION

4.1 Field Measurements. The Contractor shall field verify all dimensions pertaining to miscellaneous metal items and shall determine all modifications required for clearances and blockouts at equipment, piping, ducts and conduit prior to preparation and submittal of shop drawings and fabrication of the miscellaneous metal items.

4.2 Workmanship.

4.2.1 Ferrous metals shall be thoroughly cleaned of loose scale and rust before being fabricated. Finished members shall be free of twists, bends or open joints, and shall present a neat workmanlike appearance when completed. Steel work shall conform to the best practices set forth in the AISC Standard 360 "Specifications for Structural Steel Buildings", latest edition, and AISC Standard 303, latest edition. Aluminum work shall conform to the applicable requirements of "Specifications for Aluminum Structures, Aluminum Construction Manual" of the Aluminum Association, latest edition.

4.2.2 Bolt holes shall be as detailed and required to connect work of this and other trades. Burned holes are not allowed. Drifting is not permitted.

4.2.3 All welding including welding procedures, welder qualification requirements and welding electrodes shall be in accordance with the latest edition of approved national standards and shall follow all requirements and limitations contained within. The national standards shall be appropriate for the type of material being welded including the physical, geometrical, metallurgical and chemical properties.

4.2.4 Field welds are to be chipped, slagged, and wire-brushed clean for inspection. Field welds on exposed surfaces shall be ground and finished smooth. All welding shall be performed by welders certified by AWS.

4.3 Welding.

4.3.1 Welding for steel shall be in accordance with AWS D1.1.

4.3.2 Welding for aluminum shall be in accordance with AWS D1.2.

4.3.3 Welding for stainless steel shall be in accordance with AWS D1.6.

4.4 Finishing.

4.4.1 Unless noted otherwise on the Contract Drawings, all steel shall be galvanized. Galvanizing shall conform to the applicable requirements of **Section 210-3** "Galvanizing" of the Standard Specifications. Materials shall be galvanized by the hot-dip process. Galvanized zinc coating which has been cut, burned by welding, abraded, or otherwise damaged, shall be repaired and re-coated by methods as accepted by the Engineer, and in accordance with **Section 210-3.5** "Repair of Damaged Zinc Coatings" of the Standard Specifications.

4.4.2 Where galvanized steel is specified on the Contract Drawings to be painted, see **Section 9B** of these Special Provisions.

4.4.3 Aluminum surfaces bearing on or embedded in concrete shall be primed per **Section 9A, Part 7** of these Special Provisions. Before priming, surfaces shall be thoroughly cleaned. Shop coats shall be allowed to dry before materials are loaded for delivery to the job site. After erection, areas where the shop coats have been rubbed off or omitted for field bolting or welding

shall be primed and painted as specified in **Section 9B** of these Special Provisions.

4.5 Grating.

4.5.1 Grating shall conform to the details and dimensions shown on the Contract Drawings.

4.6 Handrail.

4.6.1 Aluminum handrail shall be easily demountable by removing the rails from the posts without removing the posts and shall be readily adaptable to adding more rails or deleting rails by use of slip-on fittings.

4.6.2 For top-mounted base flanges, the aluminum pipe sleeve shall have a total of two(2) Type 316 stainless steel socket set screws, 1/4-inch in diameter with a cupped point, set in tapped holes. The first tapped hole shall be 1-inch from the top of the sleeve and the second tapped hole shall be 1-inch from the bottom of the sleeve. There shall be a 1/4-inch diameter weep hole in the sleeve at 1/2 inch from the bottom of the sleeve.

4.6.3 For side-mounted base flanges, the aluminum pipe sleeve shall have the first tapped hole 1-inch from the top and the second tapped hole 3-inches below the first. There shall be a 1/4-inch diameter weep hole in the 1/4-inch thick cap plate welded at the bottom of the sleeve.

4.6.4 The Contractor shall be responsible for the proper fit of the 1-1/2-inch post into the pipe sleeve.

4.7 Testing and Inspection.

4.7.1 All welded fabrications shall have special inspection or be fabricated in a shop certified by AISC. Documentation from AISC, certifying the shop, shall be submitted to the Engineer for acceptance prior to shipment of assemblies containing shop welds. The special inspection shall be performed by a Special Inspector who is certified by the Los Angeles County Department of Public Works. All special inspections shall be in accordance with the AWS Code, latest edition.

4.7.2 A written report of each special inspection of the shop welds shall be submitted to the Engineer within five(5) working days of the inspection.

4.7.3 Inspection of Field Welds: All field welding shall receive continuous special inspection. The special inspection shall be performed by a Special Inspector who is certified by the Los Angeles County Department of Public Works.

4.8 Delivery, Storage and Handling. All materials of this Section shall be protected to maintain quality and physical requirements. All materials shall be handled with care to avoid overstressing, kinks and rusting.

4.9 Erection. Erection of the materials shall be in accordance with AISC Standard 303, Section 7, with due regard for safety, and as not to deflect or stress members beyond reasonable limits.

4.10 Cleanup. At completion of the work, remove all equipment, surplus material and debris, and leave premises broom clean.

5. SUBMITTALS

Complete fabrication, assembly, and installation drawings together with data and details governing materials used and other accessories furnished, shall be submitted for acceptance in accordance with the procedure set forth in the General Conditions, **Section 1A** of these Special Provisions. Data shall include, but not be limited to, the following:

5.1 Shop Drawings. Shop drawings shall be made prior to fabrication for all items in accordance with the latest edition of approved national standards appropriate for the type of material being submitted for acceptance. The Contractor shall be responsible for the accuracy of dimensions and proper fit. The shop drawings shall include a Bill of Materials.

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## SECTION 5C

### STRUCTURAL ANCHORAGE

#### 1. SCOPE

This Section sets forth the requirements for anchorage to concrete and masonry construction.

#### 2. GENERAL

2.1 The Contractor shall provide materials, equipment and labor necessary to complete anchorage work.

2.2 The Contractor shall field verify all dimensions pertaining to anchorage items and shall determine all modifications required for clearances prior to installation of anchorage items.

2.3 Stainless-steel anchors shall be used where indicated on the Contract Drawings and in all cases where anchors will be intermittently or continuously in contact with water or in a moist environment whether or not specifically indicated on the Contract Drawings. Hot-dip galvanized anchors shall be used in all locations except where anchors are specified to be stainless-steel or as noted above.

2.4 Product Test Report. All post-installed anchors including expansion anchors and adhesive anchors shall have a current ICC Evaluation Service Report or IAPMO Evaluation Service Report. Adhesive anchors in concrete shall be tested in accordance with ACI 355.4 and ICC-ES AC 308. Adhesive anchors in masonry shall be tested in accordance with ICC-ES AC 58. All installations shall comply with the product's test report and manufacturer instructions.

#### 3. PRODUCTS

3.1 Threaded Rod. Steel threaded rod shall conform to ASTM A 36 unless noted otherwise on the Contract Drawings and shall be hot dip galvanized. Stainless-steel threaded rods shall be Type 316 stainless-steel.

3.2 Nuts. Carbon steel nuts shall conform to ASTM A 563. Stainless-steel nuts shall be Type 316 stainless-steel.

3.3 Washers. Carbon steel washers shall conform to ASTM F 436. Stainless-steel washers shall be Type 316 stainless-steel.

3.4 Headed Anchor Bolts. Headed carbon steel anchor bolts shall conform to ASTM F 1554 Grade 36, with heavy hex heads, unless noted otherwise on the Contract Drawings and shall be hot dip galvanized. Headed stainless-steel anchor bolts shall be Type 316 stainless-steel, unless noted otherwise on the Contract Drawings.

Adhesive Anchors in Concrete. Adhesive anchor systems in concrete shall consist of a steel anchoring element and an adhesive product. The steel anchoring element shall be a threaded rod per **Part 3.1** of this Section or reinforcing steel bar per **Section 3A** of these Special Provisions, unless noted otherwise on the Contract Drawings. Adhesive anchors are not permitted for use in fire-rated construction except when anchors are used to support nonstructural components or are used to resist wind or seismic forces exclusively.

3.4.1 Slow Cure Adhesive Products: SET-3G by Simpson Strong-Tie Company, Inc., HIT-RE 500 V3 by Hilti Corporation, or Pure 110+ by Dewalt/Powers.

3.4.2 Fast Cure Adhesive Products: HIT-HY 200 V3 by Hilti Corporation or AC200+ by Dewalt/Powers.

3.5 Adhesive Anchors in Masonry. Adhesive anchor systems in masonry shall consist of a steel anchoring element and an adhesive product. The steel anchoring element shall be a threaded rod per **Part 3.1** of this Section, unless noted otherwise on the Contract Drawings. Adhesive anchors are not permitted for use in fire-rated construction except when anchors are used to support nonstructural components or are used to resist wind or seismic forces exclusively.

3.5.1 Slow Cure Adhesive Products: SET-3G by Simpson Strong-Tie Company, Inc.

3.5.2 Fast Cure Adhesive Products: HIT-HY 270 by Hilti Corporation or AC100+ Gold by Dewalt/Powers.

#### 4. EXECUTION

4.1 General. Cast-in-place anchor bolts shall be located accurately and secured in formwork prior to concrete placement using templates or another means of securing bolts in place. Post-installed anchors including expansion anchors and adhesive anchors shall be located accurately prior to installation. The Contractor shall identify position of reinforcing steel and other embedded items using a rebar locator or other non-destructive means prior to drilling holes for anchors. Reinforcing steel shall not be damaged by the installation. The Contractor shall exercise care when coring or drilling to avoid damage to existing reinforcing steel or embedded items and shall notify the Engineer if reinforcing steel or embedded items are encountered during drilling. Under no circumstance shall drilling for anchors damage prestressing tendons, water lines, electrical and telecommunications conduits, and gas lines.

4.1.1 Bent bar anchors, J-bolts, or L-bolts are not permitted to be used in concrete or masonry construction.

4.1.2 Cast-in-place Anchor Bolts: Where cast-in-place anchors are specified, the Contractor may utilize either headed anchor bolts or threaded rods with standard plate washers and nuts. If a threaded rod with plate washer

and nuts is utilized, the nuts shall be tack welded to the body of the threaded rod.

4.2 Post-Installed Anchor Installation. Anchor installations shall be performed by qualified personnel in accordance with the Contract Drawings and with the manufacturer's printed installation instructions. Holes shall be drilled using a rotary-impact drill (roto-hammer) using carbide-tipped bits. Core-drilling or rock-drilling is permitted with the Engineer's written acceptance. The Contractor shall arrange for an anchor manufacturer representative to provide on-site installation training for all of their anchoring products specified. The Contractor shall provide the Engineer with documented confirmation that the anchor installer received training prior to commencement of anchor installation.

4.2.1 Adhesive Anchors Installation in New Concrete: Adhesive anchors shall not be installed in new concrete until the concrete substrate has aged at least twenty-one(21) days. No deviations to this requirement will be allowed without receiving written acceptance by the Engineer for the location requested prior to installation.

4.2.2 Adhesive Anchor Installation Orientation: Adhesive anchors shall only be installed in horizontal or downwardly-inclined orientations. Adhesive anchors in ceilings or soffits will not be allowed.

4.3 Handling, Transport, and Storage. All materials in this Section shall be protected to maintain quality and physical requirements. Store anchors in accordance with manufacturer's recommendations. All materials shall be protected from rain and kept free of contamination. All threaded elements shall be protected from damage.

4.4 Anchor Bolt Installation in Masonry Construction. Install anchor bolts as detailed on the Contract Drawings and in accordance with TMS 602/ACI 530.1/ASCE 6 Article 3.4D

4.4.1 Embed anchor bolts in grout. Anchor bolts of 1/4-inch or less may be placed in mortar bed joints at least 1/2-inch in specified thickness.

4.4.2 Maintain clear distance between anchor bolts and any face of masonry unit or formed surface of at least 1/4-inch when using fine grout, and of at least 1/2-inch when using coarse grout.

4.4.3 Maintain a clear distance between parallel anchor bolts not less than the diameter of the anchor bolt, nor less than 1-inch.

4.5 Inspection. The District will provide special inspection of concrete fasteners (both cast-in-place and post-installed) as outlined on **Sheet S-2** of the Contract Drawings. The Special Inspector shall be certified by the County of Los Angeles Department of Public Works. All special inspections shall be in accordance with the latest edition of the County of Los Angeles Building Code and findings of the test report for products used on this project. A written report of each special inspection shall be submitted to the Engineer within five(5) working days of the inspection.

4.5.1 Post-installed anchors installed shall be inspected on a periodic basis except as noted in **Part 4.5.2** of this Section.

4.5.2 Adhesive anchors installed in horizontal orientations that are designed to resist sustained tension loads shall receive continuous inspection.

4.6 Testing. Post-installed anchors shall be tested in accordance with the latest edition of the County of Los Angeles Building Code. Anchor testing shall be performed in the presence of the Special Inspector and a report of the test results shall be submitted to the Engineer. The Contractor shall schedule the required testing by the District-hired testing laboratory at the project site by submitting a written request to the Engineer a minimum of three(3) working days in advance of the date the testing is required. The Contractor shall properly schedule the work and submit timely requests for testing in order for the District to schedule the District-hired testing laboratory to be onsite for the requested testing. Any costs or delays resulting from the Contractor’s failure to properly schedule the work and/or to submit timely requests for testing shall be the sole responsibility of the Contractor and shall not be the basis for additional compensation or time extension.

4.6.1 Test Load:

4.6.1.1 Tension (Proof) Testing for Adhesive Anchors into Concrete. Tension test load shall be as indicated in **Table 1**.

**Table 1:** Tension Test Loads

MATERIAL	DIAMETER	EMBEDMENT	TEST LOAD <sup>1</sup>
Carbon or Stainless-steel Threaded Rod	3/8 in	2.375 in	1500 lbs.
		7.5 in	1500 lbs.
	1/2 in	2.75 in	3000 lbs.
		10.0 in	3000 lbs.
	5/8 in	3.125 in	4000 lbs.
		15.5 in	5000 lbs.
	3/4 in	3.5 in	5500 lbs.
		15.0 in	8000 lbs.
	1 in	3.5 in	5000 lbs.
		17.5 in	11000 lbs.
Deformed Rebar	#3	4.0 in	6500 lbs.
		20.0 in	14500 lbs.
	#4	2.375 in	2000 lbs.
		7.5 in	5000 lbs.
	#5	2.75 in	3000 lbs.
		10.0 in	9000 lbs.
	#6	3.125 in	4000 lbs.

MATERIAL	DIAMETER	EMBEDMENT	TEST LOAD <sup>1</sup>
		15.5 in	14500 lbs.
	#7	3.5 in	5500 lbs.
		15.0 in	21000 lbs.
	#8	3.5 in	5000 lbs.
		17.5 in	26000 lbs.
1. Where anchor embedment differs from that shown above, use linear interpolation for test load.			

4.6.2 Test Frequency: Anchor testing shall be performed on a daily basis during installation. If any anchor fails testing on a given day, all anchors of the same type, installed by the same trade, shall be tested except those that were previously tested. Post-installed anchors shall be tested at a rate of 25 percent, except as follows:

4.6.2.1 When post-installed anchors are used for anchorage of equipment weighing less than or equal four hundred(400) pounds, testing is not required.

4.6.2.2 When post-installed anchors are used for anchorage of handrails, testing is not required.

4.6.2.3 Testing of shear dowels across construction joints in slabs on grade, where the slab is not part of the lateral force-resisting system is not required.

4.6.2.4 Exceptions to the frequencies stated above can be made only with the Engineer's written acceptance.

4.6.3 Test Acceptance Criteria: Acceptance criteria for post-installed anchors shall be based on the product-specific test report. If no criteria is specified in the test report, the following minimum requirements shall apply:

4.6.3.1 Tension (Proof) testing shall be performed by the hydraulic ram method. Anchors tested with a hydraulic jack or spring-loaded devices shall maintain the test load for a minimum of fifteen(15) seconds and shall exhibit no discernible movement during the tension test as evidenced by loosening of the washer under the nut.

## 5. SUBMITTALS

5.1 Data and details governing materials used, and other accessories furnished shall be submitted for acceptance in accordance with the procedure set forth in the General Conditions.

5.2 Submit the following in accordance with the procedure set forth in the General Conditions:

5.2.1 Product specifications with recommended design values and physical characteristics for post-installed anchors.

5.2.2 Product-specific test report.

5.2.3 Manufacturer's printed installation instructions for each product to be utilized on this project.

5.2.4 Installer qualifications and a letter stating method of drilling, the product proposed for use, the complete installation procedure, manufacturer training date, and a list of personnel to be trained on anchor installation.

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## SECTION 6A

### ROUGH CARPENTRY

#### 1. SCOPE

This Section sets forth requirements of all work for rough carpentry as shown on the Contract Drawings and as specified in this Section.

#### 2. GENERAL

The Contractor shall provide all materials, equipment and labor necessary to complete the rough carpentry work shown on the Contract Drawings and specified in this Section. The principal items of work in this Section include, but are not necessarily limited to the following:

2.1 Structural Carpentry. Furnishing and installing wood framing as shown on the Contract Drawings.

2.2 Miscellaneous Carpentry. Include, but not limited to, wood bucks, backing, nailers, blocking, stripping, grounds and other miscellaneous rough carpentry as shown, specified, and required to complete entire project, except for items specified under other Sections of these Special Provisions.

2.3 Preservative. Pressure-preservative treatments as required and approved to be used in California Rough Hardware. Include, but not limited to, bolts, nails, lag screws, washers, plates, standard products such as joist hanger connections, and similar items employed in erection and construction of rough work, bolt anchorages embedded in concrete by concrete trade prior to erection of forms. Provide rough hardware as shown and required to complete work, including installation of such items that in connection with work of this Section, and furnished under other Sections of these Special Provisions.

2.4 Fabricated Hardware. Installation of specially fabricated rough hardware items that are in connection with work of this Section, and furnished under other Sections of these Special Provisions.

#### 3. PRODUCTS

3.1 Lumber. All lumber shall be Douglas Fir S4S, Grade No. 1, unless otherwise noted. Lumber classification shall conform to American Softwood Lumber Standard PS 20-15.

3.2 Used Form Lumber. Used form lumber (excepting plywood), which is sound and complies with requirements specified in this Section, if accepted by the Engineer, may be reused for concealed non-load bearing purposes. Do not reuse plywood.

3.3 Pressure Treated Lumber.

3.3.1 General: Treat all wooden nailing blocks, sills, and plates resting on or embedded in concrete with waterborne wood preservatives conforming to American Wood Protection Association (AWPA) P5. Pressure treatment of wood products shall conform to the requirements of AWPA BOOK Use Category System Standards U1 and T1. Pressure-treated wood products shall not contain arsenic, chromium, or other agents classified as carcinogenic, probably carcinogenic, or possibly carcinogenic to humans (compounds in Groups 1, 2A, or 2B) by the International Agency for Research on Cancer (IARC), Lyon, France. Pressure-treated wood products shall not exceed the limits of the U.S. EPA's Toxic Characteristic Leaching Procedure (TCLP) and shall not be classified as hazardous waste. Each piece of treated lumber shall bear mark of an accepted testing agency.

3.3.2 Cuts: Wherever necessary to cut, notch, dap, drill, or frame treated lumber, treat newly cut or bored surfaces with two(2) heavy coats of same preservative used in original treatment, in conformance with AWPA M4, latest edition.

3.3.3 Kiln Drying: Lumber treated with water-borne preservative to maximum 15 percent moisture content before and after treatment.

3.4 Rough Hardware.

3.4.1 Common Nails: Commercial Standard, 16d unless otherwise noted to be specified; galvanized or aluminum where exposed to weather.

3.4.2 Threaded Nails: "Screw-Tite" or "Stronghold", or equal, either spiral thread or annular-grooved.

3.4.3 Screws: Commercial Standard, galvanized where exposed.

3.4.4 Bolts and Nuts: American Standard, unfinished, except galvanized where exposed. Provide with matching cut or pressed steel washers for both bolts and nuts, where bearing on wood, unless otherwise shown.

3.4.5 Anchors into Concrete: Acceptable anchors are cast-in-place anchors (with hex heads), adhesive anchors, and expansion anchors. All anchors shall be galvanized. Concrete nails, powder-driven fasteners, power-driven fasteners and hooked cast-in-place anchors are not acceptable.

3.4.6 Special Fabrication Rough Hardware and Connectors: Furnished under **Section 5B**, "Miscellaneous Metals", of these Special Provisions and installed under this Section.

3.4.7 Standard Product Hardware: As manufactured by Simpson Strong-Tie or United Steel Products of the catalog designations indicated, or equal.

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#### 4. EXECUTION

4.1 Priming, Back Painting and Finish Painting. Priming, back painting, and finish painting are specified and included in the work of **Section 9B, "Paint for Buildings"**, of these Special Provisions. Coordinate with painting subcontractor so that work is coated in proper sequence of construction prior to installing, covering, or enclosing, as applicable.

##### 4.1.1 Connections.

4.1.1.1 Nailing: Drive nails not closer together than half their length unless driven in drilled holes, not closer to edge of member than one quarter nail length; drill holes slightly smaller than nail diameters when necessary to prevent splitting. Penetrate second or farther member not less than half length of nail. Use common nails where threaded nails are not shown or specified.

4.1.1.2 Bolts and Nuts: Provide malleable or cut steel washers under heads and nuts except where bearing on steel plates or other steel attachments, or where flat-head countersunk are shown. Clamp members together and bore holes of same diameter as bolts, true to line; drive bolts in place, and draw nuts up tight. Immediately prior to enclosing with finish, or if left exposed, upon completion of other work, draw bolts tight again and nick threads next to nut to prevent loosening. Holes in members at anchor bolts embedded in concrete may be 1/16-inch larger than bolt diameter.

4.1.1.3 Screws: Screw (do not drive) lag and wood screws into place. Bore hole to receive lag screw, first of same diameter and depth as shank, then continue to depth equal to length of screw with diameter equal to base of thread. Screw shall penetrate a distance equal to at least seven(7) times diameter of screw shank into far member. Install washer under each lag screw head bearing on wood.

4.2 Cleanup and Disposal. The Contractor shall maintain the site in a neat and orderly condition, to the satisfaction of the Engineer, throughout the construction period, free from litter, trash and waste material. Upon completion of all work, the Contractor shall remove falsework, temporary structures and equipment used in execution of the work and he shall dispose of all rubbish, debris, and excess materials off the site.

#### 5. SUBMITTALS

5.1 Product Data. Submit manufacturer's printed descriptions of materials, components, treatment systems, performance criteria, fasteners, brackets, hangers, gusset plates, adhesives, finishes, use limitations, recommendations and installation information.

5.2 Shop Drawings. Submit drawings for installed products indicated to comply with design loads including structural analysis data prepared, signed and stamped by a Civil or Structural Engineer currently registered by the State of California.

5.3 Quality Assurance Submittals. Certificates of Grade and kiln drying;  
and wood treatment Test and Evaluation Reports.

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## SECTION 7C

### CAULKING AND SEALANT

#### 1. SCOPE

This Section sets forth the requirements for caulking and sealant for buildings as shown on the Contract Drawings and as specified in this Section. The caulking and sealant specified in this Section shall not be used in areas, which may be immersed in water.

#### 2. GENERAL

The Contractor shall provide materials, equipment and labor required to complete the caulking and sealing work as shown on the Contract Drawings and specified in this Section.

Caulking shall be provided in open joints exposed to the weather, and in areas normally requiring sealing with caulking compounds to provide water and weather-tight construction, including interior and exterior perimeter joints; joints in wash surfaces, copings and sill members; joints and penetration in fire resistive assemblies and elsewhere where indicated on the Contract Drawings.

#### 3. PRODUCTS

3.1 Construction Sealant. The construction sealant shall be construction silicone as manufactured by General Electric, Dow Corning Corporation, or equal construction sealant. The material shall be delivered to the site in the Manufacturer's unopened containers bearing a "Tested and Approved" seal, the Manufacturer's name and product designation. The sealant shall be of the one-component type, non-sag elastomeric sealant meeting the requirements of Federal Specifications TT-S-00230C, Type II and ASTM C 920, Type S, Grade NS, Class 25, Use NT or better.

3.2 Primer. Primer type and use shall be as recommended by the Manufacturer of the sealant.

3.3 Back Stops. Polyethylene foam sealant shall be used as back stops or recommended by the Manufacturer. Oakum and other types of absorptive materials shall not be used.

#### 4. EXECUTION

4.1 Before caulking work is started, a sample opening of each type of joint shall be caulked where directed by the Engineer. The samples shall show the workmanship, bond, and color of caulking materials as specified or selected for the work. The workmanship, bond and color of caulking work throughout the project shall match that as designated by the Engineer.

4.2 Joint Preparation. Surfaces to which primer and caulking are to be applied shall be clean, dry to the touch, free from frost, moisture, grease, oil, wax, lacquer, paint and other foreign matter that would tend to destroy or impair the adhesion. Joints shall be enclosed on three sides. Where grooves for adequate caulking have not been provided, provide suitable grooves cleaned out to a depth of 2-inches and ground to a minimum width of 1/4-inch without damage to the adjoining work. No grinding shall be performed on metal surfaces. Where necessary to provide suitable back stops, the back of joints over 2-inches in depth shall be packed tightly with an accepted back stop material to within a depth of 1/4-inch from the surface. Loose particles shall be cleaned out just prior to caulking and the grooves shall be given a uniform coating of primer. Primer shall not be applied to exposed finish surfaces.

4.3 Application.

4.3.1 Caulking and sealant compound shall be applied in accordance with the Manufacturer's recommendations and printed instructions, using a gun with a nozzle of proper size to fit the joint width. Compounds shall be forced into the grooves with sufficient pressure to fill the grooves solidly, shall be uniformly smooth, free of wrinkles, tooled as necessary, and left sufficiently convex to result in a flush joint when dry.

4.3.2 Caulking compound shall not be applied to joint when air temperature below 50 degrees F or above 120 degrees F will be encountered before the caulking has set.

4.3.3 Compounds shall not be used when jelled and cannot be discharged in a continuous flow from the gun. Modification of the compound by addition of liquids, solvents or powders will not be permitted.

4.4 Protection and Cleaning. Materials and surfaces adjacent to joints to be filled shall be protected from smearing and staining. Paper masking tape may be used for this purpose, if removed five(5) to ten(10) minutes after the joint section is filled. Any compound, which has been smeared on masonry, concrete or plaster shall be immediately scraped off and rubbed with a suitable solvent. Surfaces shall be left in a clean and neat condition.

5. SUBMITTALS

5.1 Product Data. Include, but not limited to, Manufacturer's specifications, surface preparation and application instructions, recommendations for each application, and protection and cleaning instructions.

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## SECTION 7D

### SHEET METAL

#### 1. SCOPE

This Section sets forth the requirements for sheet metal for the buildings as shown on the Contract Drawings and as specified in this Section.

#### 2. GENERAL

The Contractor shall provide material, equipment and labor necessary to complete the sheet metal work as shown on the Contract Drawings and specified in this Section. Sheet metal work shall be provided in accordance with the technical guidelines and accepted industry practices indicated in the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) Architectural Sheet Metal Manual, latest edition.

Contractor shall examine the Contract Drawings and Special Provisions and include sheet metal items, which are not specifically mentioned in other Sections of these Special Provisions.

#### 3. PRODUCTS

Galvanized Steel. Galvanized steel shall be used for sheet metal work except where otherwise specifically indicated. Steel shall be zinc-coated sheet steel conforming to ASTM A 653 (G90), Commercial Class, Hot Dipped, 24-gauge unless otherwise indicated.

3.1.1 Flashings: Flashings and counter-flashing shall be 22-gauge galvanized steel, except as shown on the Contract Drawings.

Solder. Solder shall be alloy grade Sn50 in accordance with ASTM B 32 latest edition.

Flux. Flux shall be resin type or a non-corrosive flux.

Fastenings. Fastenings shall be hot-dipped galvanized, tinned or cadmium-plated steel.

Caulking Compound. Caulking compound shall be silicone base material and shall comply with **Section 7C "Caulking and Sealant"** of these Special Provisions.

#### 4. EXECUTION

General.

4.1.1 Contractor shall examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.

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

4.1.3 All items shall be securely fastened and made completely watertight. The work shall be designed and anchored to prevent distortion and serious expansion and contraction stresses. All items shall be formed accurately to dimensions indicated and finished with true sharp lines and angles. Exposed edges of sheet metal shall be hemmed.

4.1.4 Contact surfaces of dissimilar metals shall be insulated from each other to prevent electrolytic action. Sheet metal items in connection with roofing shall be installed concurrently with, and in conjunction with, the roofing work. The roofing applicator shall direct the installation of sheet metal items in connection with his work.

Flashings. Furnish and install flashings as shown on the Contract Drawings and specified in this Section. Provide types to suit the indicated conditions. Flashings shall be lapped 3-inches on ends. Flashing shall be secured to wall 12-inches on center.

Laps and Seams. Except as otherwise shown, laps shall be at least 3-inches and soldered at horizontal joints. Single lock seams shall be filled with sealant where soldering is not practicable. Flanges extending onto vertical and horizontal surfaces shall be a minimum of 4-inches. Edges of sheet metal shall be pre-tinned for a distance of at least 1-1/2-inches before soldering. Do not use torches for soldering. Soldering work shall be performed slowly immediately after application of flux. At least 1-inch of evenly flowed solder shall be made at seams. After installation, all work shall be thoroughly cleaned and made ready for final painting.

Painting. All surfaces of sheet metal, except those to be embedded in asphalt or concrete, shall be primed and allowed to dry before installation. All sheet metal shall be painted. Painting shall be as specified in **Section 9B** of these Special Provisions.

5. SUBMITTALS

Shop Drawings. Submit shop drawings for approval before starting fabrication. Drawings shall show construction details including but not limited to expansion joints and expansion-joint covers, profiles, shapes, seams, supporting, and securing at reasonably large scales, material thickness, joining methods, reinforcement and anchorage features. Show complete information regarding concealed joints. All dimensions shall be verified at the jobsite before fabrication.

Submit qualification data for fabricator

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## SECTION 9A

### PAINTING

#### 1. SCOPE

This Section covers painting for aluminum, galvanized surfaces, ferrous surfaces, ductile iron, stainless steel, fiberglass, PVC and all other plastics except as noted below. The term "painting" shall include application of protective coatings. Unless otherwise noted in the Contract Documents or specified in this Section, this Section applies to, but is not limited to, items such as: equipment specified in **Divisions 11** and **18** of these Special Provisions and appurtenant miscellaneous metalwork; metalwork in corrosive atmospheres, areas subject to washdown, flooding or abrasion; structural steel; and tanks, vessels, hoppers, piping, pipe supports, racks, etc., constructed of aluminum or ferrous metals. All surfaces specified in this Section shall be painted by a single Manufacturer's paint system.

#### 2. GENERAL

2.1 The Contractor shall provide equipment, materials, and labor required to complete the preparation and painting of aluminum, ductile iron, stainless steel, fiberglass, PVC and all other plastics, ferrous, and galvanized surfaces as indicated in the Contract Documents and as specified in this Section.

2.2 Work done under this specification shall be subject to inspection by the District. All parts of the work shall be accessible to the District. The Contractor shall correct defective work as directed by the District. Conformance of the work to the specification shall be determined solely by the District's Engineer.

2.3 The Contractor shall comply with all federal, state, and local regulatory requirements dealing with coatings in effect at the time when the coatings are applied. Specifically, the Contractor shall comply with all requirements established by South Coast Air Quality Management District (SCAQMD) for the surface preparation, application of coating systems, and execution of all other related work.

Although the District intends to list only compliant coating systems in the Contract Documents, the regulations or coating systems may change. If a listed coating system does not meet all regulatory requirements at the time when the coating is applied, the Contractor shall resubmit a compliant substitute coating system for District's acceptance. Any changes in the coating systems required by the changes in the SCAQMD regulations shall be the responsibility of the Contractor and shall be made at no cost to the District.

2.4 All equipment in **Divisions 11** shall be field painted per the requirements of this Section or as otherwise indicated in the Contract Documents. All equipment and materials in **Division 18** of these Special Provisions shall be field painted, with the exception of valves, which shall be shop painted and then field painted with a finish coat as specified in **Part 9** of this Section.

2.5 The Contractor shall set up a completely enclosed area on-site for sandblasting and painting and shall exercise dust control measures. The Contractor may perform the sandblasting and painting off-site at its own shop but shall submit documentation of certified independent inspection of the surface preparation and painting of all surfaces for District's acceptance. The certified independent inspection services shall be provided by CSI Services, or equal. The inspector conducting the inspection shall be an employee of the independent services company and shall be a National Association of Corrosion Engineers (NACE) International, from here on known as NACE, certified inspector. The NACE certificate shall be submitted for District's acceptance. The inspection services company shall be independent of the Contractor, its subcontractors, and all vendors supplying for this project. The independent inspection services company shall have been in the above business for at least seven(7) years. The NACE certified inspector shall have an experience of at least five(5) years in the above field and have had the NACE certification for at least five(5) years.

### 3. PAINTING OF ELECTRICAL EQUIPMENT

See **Division 16** of these Special Provisions.

### 4. SURFACES NOT TO BE PAINTED

4.1 Aluminum surfaces except those in contact with concrete and all faying surfaces of bolted aluminum joints.

4.2 Stainless steel surfaces (except piping and equipment, if specified in this Section and other corresponding Divisions of these Special Provisions).

4.3 Ferrous surfaces to be cast in concrete.

4.4 Unless otherwise shown or specified, galvanized surfaces.

4.5 Piping that is to be insulated or covered with lagging shall not be painted but shall be wire-brushed to remove rust prior to insulation application.

### 5. PRINCIPAL ITEMS OF WORK

The principal items of work may include, but are not necessarily limited to, the following:

- a. Prepare all surfaces to be painted as specified.
- b. Apply coatings to aluminum surfaces in contact with or embedded in concrete and to all faying surfaces of bolted aluminum joints, as specified in this Section.
- c. Apply primer, intermediate coats, and finish coats as specified for ferrous surfaces (including structural steel) not submerged.

- d. Apply primer and finish coats as specified for submerged ferrous surfaces.
- e. Not Used.
- f. Repair shop coats, prepare surfaces, and field paint Contractor-furnished equipment as specified.
- g. When shown or specified, galvanized surfaces shall be painted as specified in this Section. The following post treatments shall not be performed for galvanized surfaces that are to be painted: water quenching, chromate quenching, and phosphating. Galvanized surfaces shall not be shop primed prior to delivery to the jobsite.

Galvanized surfaces to be painted shall be prepared in accordance with ASTM D 6386. The surfaces shall be smoothed per Section 5.2 of ASTM D 6386, cleaned with an aqueous alkaline solution per **Section 5.3.1** of ASTM D 6386, and if necessary, cleaned per SSPC-SP2 or SP3 and **Section 5.3.3** of ASTM D 6386. The galvanized surfaces to be painted shall be checked for chromate conversion coating or wet surface stain and treated accordingly per **Section 6** of ASTM D 6386. If there is no indication of either chromate conversion coating or wet surface stain, the surface shall be prepared by sweep blasting per SSPC-SP7 and **Section 5.4.1** of ASTM D 6386. If the surface cleaning or surface preparation methods specified cannot be performed, one(1) of the alternate methods specified in ASTM D 6386 shall be used instead, after obtaining acceptance of the Engineer. Paint shall be applied immediately after surface preparation in accordance with the time frames specified in ASTM D 6386. Painting of the prepared galvanized surfaces shall be per **Part 12** of this Section of these Special Provisions, except that the prime coat shall be of the same material as the intermediate coat.

- h. Complete sandblasting of all ferrous surfaces, except for equipment provided through **Divisions 11** of these Special Provisions, and painting of all surfaces per the requirements of this Section.
- i. Solvent cleaning of all equipment provided in **Divisions 11** of these Special Provisions and finish painting of all surfaces per the requirements of this Section, unless otherwise indicated in the Contract Documents.

## 6. WORKMANSHIP AND PROCEDURES

6.1 The Contractor shall perform the painting work of this Section with journeyperson painters. All materials specified by name, brand, or Manufacturer shall be delivered unopened to the jobsite in their original containers. The paint shall be applied in strict accordance with the recommendations of the Manufacturer using accepted equipment.

6.2 With the exception of components that might be damaged by sandblasting and equipment provided through **Divisions 11** of these Special Provisions, shop-applied protective coatings shall be completely removed at the jobsite by sandblasting per SSPC-SP10, unless otherwise specified. All non-insulated piping shall be sandblasted and painted at the jobsite.

6.3 All equipment and piping to be painted at the jobsite shall be placed on raised supports at least two(2) feet above the ground. The prime coat shall be applied as quickly as possible after blasting and/or solvent cleaning. In no case shall bare metal surfaces be allowed to sit for more than eight(8) hours before applying the prime coat. Each coat of paint shall be applied at proper consistency, be sprayed or brushed evenly, and be free of brush marks, pinholes, sags, and runs with no evidence of poor workmanship. Care shall be exercised to prevent paint from being spattered on surfaces that are not to be painted. If paint is dropped or spattered on surfaces not to be painted, the paint shall be removed as directed by the District. All equipment nameplates and valve stems shall be masked prior to painting.

6.4 Heavy deposits of grease or oil shall be removed from all surfaces to be coated using the paint Manufacturer's specified cleaner prior to any other surface preparation. Any chemical contamination shall be neutralized and/or flushed off prior to any other surface preparation.

6.5 Multiple coats shall be applied in conformance with the paint Manufacturer's recommendations for minimum drying time and maximum curing time between coats. Each coating of a multiple-coat system shall be inspected and accepted by the Engineer before subsequent coats are applied. The Contractor shall provide forced ventilation in areas where inadequate ventilation exists. If removal of moisture from the atmosphere is required in areas provided with forced ventilation to ensure no condensation occurs on the surface being coated, the Contractor shall provide a dehumidifier to provide atmospheric conditions in strict conformance with the Manufacturer's printed recommendations.

6.6 In addition to the limitations imposed in **Section 310-1** of the Standard Specifications, no surface preparation or coating shall be performed during periods of excessive wind, which, in the opinion of the District, would affect the quality of the work or produce nuisance conditions in adjacent areas. All coatings shall be applied in strict conformance with the Manufacturer's printed recommendations regarding minimum and maximum allowable air and surface temperatures. No coatings shall be applied when the relative humidity is higher than 80 percent or when the temperature is less than or equal to 5 degrees F above the dew point. No coatings shall be applied if any moisture is detectable on the surface to be coated.

6.7 If thinning is required for proper application of a coating, it shall be done only in accordance with the recommendations of the paint Manufacturer and with the acceptance of the District.

6.8 When protective coatings are applied in the shop, the requirements of **Section 4-3** of the Standard Specifications shall apply. If the shop is located more than fifty(50) miles from the project site, the Contractor shall obtain the services of the same independent inspection company accepted by the District, as specified in **Part 2.5**. The inspection company shall inspect all coating work and submit reports certifying the work is in accordance with these Special Provisions.

## 7. PRIMING ALUMINUM

Aluminum surfaces bearing on or embedded in concrete and faying surfaces of bolted aluminum joints, except anchor bars and anchor bolts, shall be prepared per SSPC-SP1 and SSPC-SP3 or by etching, in accordance with the coating Manufacturer's recommendation, and then given one coat of an epoxy primer using one(1) of the intermediate coatings defined in **Part 12** of this Section. The coating shall be allowed to cure before concrete is poured against it. The total dry film thickness shall be 3.0 mils minimum.

## 8. PROTECTION OF DISSIMILAR METALS CONTACT SURFACES

Where aluminum metals are placed in contact with or fastened to ferrous metals, the contact surfaces of each metal shall receive the protective coating specified for that metal and a gasket shall be placed between the two(2) contact surfaces. The gasket material shall be a nonconductive commercial grade neoprene, 60 durometer, 1/16-inch in thickness unless otherwise specified. Bolts shall be isolated using one-piece nonconductive sleeves and double-washer sets as manufactured by PSI Products, Inc., Calpico, or equal.

## 9. SHOP PAINTING

9.1 Unless a shop coating system is defined in the specific Section within **Divisions 11** of these Special Provisions, equipment supplied in **Divisions 11** and valves supplied in **Division 18** of these Special Provisions shall be shop primed and intermediate and/or finish coated per the equipment manufacturer's standard coating system, which is compatible with the environment in which the equipment will be subjected. After delivery to the job site, all painted surfaces for all equipment from the Divisions listed above, unless otherwise indicated in the Contract Documents, shall be solvent cleaned per **Section 310-2.3** of the Standard Specifications, lightly sanded to roughen the shop coating, and painted with one of the finish coats described in **Part 12** of this Section. The Contractor shall verify compatibility of field applied coatings with the shop coating system and, if not compatible, shall apply an accepted "tie coat" at no cost to the District which is compatible with both shop and field coatings.

9.2 All other ferrous components from Divisions of these Special Provisions not identified in **Part 9.1** of this Section shall be shop primed prior to delivery to the jobsite unless otherwise specified in the appropriate Section of these Special Provisions. All surfaces shall be prepared per SSPC-SP6. Steel and iron surfaces shall be shop primed with one of the intermediate coatings listed in **Part 12** of this Section, in accordance with the recommendations of the paint Manufacturer. The minimum dry film thickness shall be 3.0 mils. After delivery to the job site, all painted surfaces shall be prepared to near white blast per SSPC-SP10 and painted as specified in this Section immediately before installation. All shop painting shall conform to applicable air pollution control regulations.

9.3 Surfaces of equipment, which will be inaccessible after assembly, shall be painted per **Part 9.1** of this Section. Contractor shall furnish brand

new, factory fresh equipment to replace any equipment, which the Engineer determines to be damaged beyond repair by rust or by mishandling, etc.

9.4 Machined, polished, and other ferrous and non-ferrous surfaces which are not to be painted shall be coated with rust preventative compound, Dearborn Chemical "No-Ox-Id", Houghton "Rust Veto 344", Rust-Oleum "R-9", or equal.

10. NOT USED

11. PREPARATION OF FERROUS SURFACES

11.1 Ferrous metal surfaces to be painted shall be prepared by shop or field blast cleaning as specified below, unless specified otherwise in these Special Provisions or on the Contract Drawings.

11.2 Prior to blast cleaning, all rough welds shall be ground smooth and sharp steel edges shall be ground to approximately 1/8-inch radius. Weld spatter shall be removed. Paint, mill scale, rust, flux, fume, and slag from weld deposits shall be removed by blast cleaning. All grease or oil shall be removed by steam or solvent cleaning.

11.3 Surface to be blast cleaned shall be dry sandblast cleaned to a near-white, blast-cleaned surface finish conforming to SSPC-SP10. Surface profile for surfaces not subject to submergence shall be 1.5 to 1.9 mils. Surface profile for surfaces subject to submergence shall be 3.0 to 4.0 mils.

11.4 All dust shall be removed by brushing, vacuuming, or air blasting. The prime coat shall be applied as soon as possible after blasting. In no case shall bare metal surfaces be left for more than eight (8) hours before applying the prime coat.

11.5 Sandblasting and painting shall not be performed concurrently in the same area. No sandblasting will be allowed in areas adjacent to equipment that might be damaged by sandblasting.

12. PAINTING FERROUS METALS NOT SUBJECT TO SUBMERGENCE

12.1 Except as specified otherwise in these Special Provisions or shown on the Contract Drawings, all items not subjected to submergence as defined in **Part 13** of this Section, including ferrous metals, but excluding stainless steel, shall be painted with one(1) of the following coating systems, or equal.

12.1.1 Ameron System:

Prime coat - Dimetcote 21-5; 3.0 mils dry minimum

Intermediate coat - Amerlock 2 VOC or 400 VOC; 5.0 mils dry minimum

Finish coat - Amershield VOC; 3.0 mils dry minimum

Total dry film thickness; 11.0 mils minimum

## 12.1.2 Tnemec System:

Prime coat - Tnemec 94H<sub>2</sub>O Hydro-zinc; 3.0 mils dry minimum  
Intermediate coat - Tnemec L69 Hi-Build Epoxoline II; 5.0 mils dry minimum  
Finish coat - Tnemec 1095 Endura-Shield; 3.0 mils dry minimum  
Total dry film thickness; 11.0 mils minimum

## 12.1.3 Devoe System:

Prime coat - Devoe Catha-Coat 302V; 3.0 mils dry minimum  
Intermediate coat - Devoe Devran 224V; 5.0 mils dry minimum  
Finish coat - Devoe Devthane 379H; 3.0 mils dry minimum  
Total dry film thickness; 11.0 mils minimum

## 13. PAINTING FERROUS METALS SUBJECT TO SUBMERGENCE

Except as otherwise specified in these Special Provisions, all ferrous metals, except stainless steel which are subject to submergence or are in contact with water, and items above the water surface within structures or other enclosed or partially enclosed areas containing water, shall be painted with one(1) of the following coating systems. Application shall be in strict accordance with the Manufacturer's instructions using accepted spray equipment. All sharp edges, nuts, bolts or other items difficult to coat shall receive a brush-applied coat of the specified coating prior to application of each complete coat.

Surfaces to be coated shall be prepared as specified in **Part 11** of this Section.

The system shall consist of a minimum of two(2) finish coats, which shall be applied to a minimum dry film thickness of 30 mils total. Each coat shall be applied per the Manufacturer's recommendations.

- a. Madewell Products Corporation (formerly Mainstay Corp.) - Mainstay DS-4
- b. PPG Protective & Marine Coating (formerly Ameron) - Amercoat 133
- c. Tnemec - Vinester Series 120
- d. International - Interline 984

All surfaces to be coated shall first receive a prime coat.

## 14. SPECIAL TESTING REQUIREMENTS FOR SUBSTITUTE COATING SYSTEM

If the Contractor wants to substitute another coating system than those specified in another Part of this Section, the proposed coating must successfully pass special testing listed in this Part prior to District's acceptance.

The Contractor shall submit detailed data sheets for each coating and fully documented test reports for District's acceptance. The reports shall include a complete test procedure with all parameters specified, material and equipment used, material and thickness of the test panels, testing equipment used, test

environment, paint curing time, reference ASTM standards, surface preparation of each panel, quantity of panels used for each test, exact duration of the tests, number of panels tested for which results were averaged, and dry film thickness of each layer of different coating applied.

The following are the tests required to be performed on each paint type and the minimum results that will qualify the paint for District's acceptance. Test results previously performed in conformance with the procedures below for the paints specified in this Section or equivalents submitted will be acceptable. Any paint tests previously performed which do not meet the procedures set forth below shall be repeated at the Contractor's expense.

14.1 General. All panels used for testing shall be 1/8-inch thick hot rolled steel. All paints shall be cured per Manufacturer's specification not to exceed fourteen(14) days at ambient conditions. The District will interpret all results as having been performed on fully cured paints. All panels shall have a surface preparation as specified per Steel Structures Painting Council (SSPC) standard.

14.2 Substitution for Ferrous Metals Coatings Subject to Submergence (Section 9A, Part 13). In case the Contractor submits an equivalent paint in lieu of the specified paints in **Part 13** of this Section, then the following tests and their corresponding results shall be submitted for both the specified paint and its equivalent substitute for District's acceptance. The Contractor shall clearly identify which one of the District specified paints above is equivalent to the Contractor's proposed paint. The testing shall be per the latest version of the NACE Standard TM0174 "Laboratory Methods for the Evaluation of Protective Coatings and Lining Materials in Immersion Service" (NACE Standard, hereinafter). The testing shall be conducted on both the Contractor proposed paint and the equivalent specified paint. The testing procedures and requirements shall be as follows:

1. The testing method shall be per **Section 2**, Procedure B of NACE Standard.
2. The test panels shall be hot rolled steel, 1/8-inch thick and dimensions in accordance with **Section 4** of NACE Standard. The panels shall have a surface preparation of SSPC SP-5 (white metal blast), as specified in NACE Standard, and shall be coated with 30 mils (dry film thickness) of the specified and the proposed paint.
3. Two(2) test panels shall be prepared and tested for each chemical specified below. One(1) test panel shall be coated with the District specified paint in **Part 13** of this Section and the other with the Contractor proposed equivalent paint. One(1) additional panel shall be prepared, coated, and kept as a control.
4. All panels shall be tested for six(6) months and shall be subject to the inspections and tests as specified in NACE Standard.
5. All panels shall be tested at 72 degrees F as specified in Part 5.1 of NACE Standard.
6. After one(1) month and three(3) months of exposure, all panels shall be subject to the testing and inspection requirements set forth by the

NACE Standard, specifically for ASTM D 714, ASTM D 610, and ASTM D 1654.

7. After the completion of the tests at the end of six(6) months, all panels shall be subject to all the visual and physical tests as described in the NACE Standard specifically ASTM D 714, ASTM D 610, ASTM D 1654, ASTM D 3363, and ASTM D 1474.

The testing of the panels shall be performed in the following solutions, for complete immersion:

- a. Sulfuric Acid, 2 percent concentration.
- b. Hydrogen Peroxide, 10 percent concentration.
- c. Acetic Acid, 1 percent concentration.
- d. Lactic Acid, 1 percent concentration.
- e. Sodium Hypochlorite, 6 percent concentration.
- f. Sodium Hydroxide, 10 percent concentration.
- g. Ammonium Hydroxide, 10 percent concentration.

The Contractor shall submit a complete submittal with all the specific details of the tests, which as a minimum shall include, but not be limited to, the following:

- a. Complete data sheets and appropriate information on the Contractor's proposed paints and the District specified paint. The data sheets shall clearly state the name of the Manufacturer, the paint identifying number, recommended service for the paint, recommended application thickness, and VOC content (unthinned and thinned).
- b. The quantity of the panels, materials of construction, thickness, surface preparation, and the corresponding dry film thickness of the paint applied to each.
- c. The detailed test procedure performed in testing the panels in the chemicals specified above with all detailed procedures, including the concentrations of each chemical and their corresponding test results, as required above, and at the intervals specified above and in NACE Standard.
- d. A comparison table listing each individual test result conducted with the chemicals above for the District specified paint and the Contractor's proposed paint.

The District will evaluate the test results submitted in accordance with the above procedures, and if, without exception, all test results for the Contractor proposed paint are equal to or better than the District specified paint, then the Contractor's proposed paint will be considered equivalent to that specified. If any test with any of the chemicals above has an inferior test result for the proposed paint than the District specified paint, then the Contractor's proposed paint will be rejected.

14.3 Substitution for Inorganic Zinc Primer. The panels shall have a surface preparation of SSPC-SP10. The inorganic zinc shall be applied as a single layer of 3.0 mils of dry film thickness. The following tests shall be performed on these panels:

- a. Salt Spray Test Per ASTM B 117 For 2000 Hours. The condition of the panel at the end of the test shall be reported and the rust creepage at the scribe shall not exceed 1/64-inch.
- b. Adhesion Test Per ASTM D 4541. The force to detach a plug of the coating shall be reported. The average result of five(5) pulls shall be reported. The adhesion test environment temperature shall be 72 degrees - 78 degrees F. Elcometer device shall be used for the adhesion test. The average of five(5) pulls shall not be less than 700 psi.

14.4 Substitution for Ferrous Metals Not Subject to Submergence (Section 9A, Part 12). The panels shall have a surface preparation of SSPC-SP10. The total dry film thickness of all three(3) coats shall be 11.0 mils dry film thickness, consisting of 3.0 mils of inorganic zinc, 5.0 mils of epoxy, and 3.0 mils of polyurethane. The following tests shall be performed on these panels:

- a. Salt Spray Test Per ASTM B 117 For 2000 Hours. The condition of the panel at the end of the test shall be reported and the rust creepage at the scribe shall not exceed 1/64-inch.
- b. Adhesion Test Per ASTM D 4541. The force to detach a plug of the coating system shall be reported. The average result of five(5) pulls shall be reported. The adhesion test environment temperature shall be 72 degrees - 78 degrees F. Elcometer device shall be used for the adhesion test. The average of five(5) pulls shall not be less than 800 psi.
- c. Impact Test Per ASTM D 2794. All items as required per ASTM D 2794, **Section 10** shall be reported and submitted. The Contractor shall specifically report the energy in inch-pounds at the impact failure end point. The failure impact energy shall be a minimum of 32-inch-pounds.
- d. Gloss Loss and Color Loss Per ASTM D 4587, After 2000 Hours. The color shall be Rutile Titanium Dioxide, pure white, untuned and untinted. The gloss loss shall be read at a 60-degree angle and shall be reported in percentage. The color loss shall be reported in McAdam units. Only UVA-340 lamps per ASTM G 154 shall be used for this test. The cycle for the test shall be four(4) hours of UV exposure at 60 degrees C and four(4) hours of condensation at 50 degrees C. For the above ASTM D 4587 test only, the Contractor may use a panel with only 3.0 mils of polyurethane coating applied on it. The gloss loss after 2000 hours of testing shall not be more than 80 percent. The color loss after 2000 hours shall not be more than 4.0.

The following are the required material as a minimum for the review of the test procedures and results for the coatings specified. All of these requirements shall be submitted for acceptance.

1. Complete test procedure with all parameters specified.
2. Material and equipment used.
3. Material and thickness of the test panels.
4. Testing equipment used.
5. Test environment parameters such as temperature, pressure and relative humidity.
6. Each paint's curing period.
7. Corresponding ASTM standard for the test.
8. Surface preparation of each panel.
9. Quantity of panels used for each test.
10. Exact duration of each test.
11. Number of panels tested.
12. Dry film thickness of each paint layer applied.
13. All the results as required above, meeting the minimum values specified. Any paint not meeting the minimum values specified will be grounds for rejection of the entire coating system.

15. PAINTING STAINLESS STEEL PIPING AND EQUIPMENT

All stainless steel piping and equipment shall be painted as specified in this Section. The surfaces shall be prepared per SSPC-SP6 "Commercial Blast" with a minimum surface profile of 1 mil. All surfaces shall be painted with an epoxy prime coat and a polyurethane top coat as specified here. The prime and top coats shall have a minimum dry film thickness of 3 mils and 2 mils minimum, respectively, with a total minimum dry film thickness of 5 mils. The prime and topcoats, respectively, shall be Amerlock 400 VOC and Amershield VOC; Devoe Devran 224V and Devthane 379H; Tnemec L69 Hi-Build Epoxoline II and Tnemec 1095 Endura-Shield.

All other requirements of **Section 9A** of these Special Provisions shall apply, except the shop painting. Stainless steel equipment shall not be shop primed.

All stainless steel paints shall be suitable for 200 degrees F temperature (continuous) and outdoor conditions.

16. PAINTING ABOVEGROUND FIBERGLASS, PVC, CPVC, AND ALL OTHER PLASTIC PIPING, VALVES EQUIPMENT, AND APPURTENANCES

All exterior surfaces of the piping and equipment shall be washed with a solvent to remove oil and grit and sanded to be ready to accept the coating. The prime coat shall be an epoxy of 3 mils minimum dry film thickness and the topcoat

shall be an aliphatic polyurethane with a minimum of 3 mils of dry film thickness. The Contractor shall submit complete data sheets of the paint Manufacturer and colors for District's acceptance. The prime coat shall be Amerlock 2 VOC or 400 VOC, Devoe Devran 224V, or Tnemec L69 Hi-Build Epoxoline II. The top coat shall be Amershield VOC, Devoe Devthane 379H, or Tnemec 1095 Endura-Shield.

17. PAINTING DUCTILE IRON PIPE

17.1 Surface Preparation. All above ground ductile iron pipe and fittings shall be supplied bare without any asphalt or any other kind of coating applied at the factory. Each piece of ductile iron pipe or fitting to be painted shall be tested in accordance with ASTM D 4417 to determine the surface profile. The surface of the pipe and fittings shall be prepared with the equivalent of SSPC-SP7 brush off blast cleaning and the procedures in accordance with National Association of Pipe Fabricators NAPF 500-03 standard.

17.2 Painting. After the above surface preparation, all ductile iron pipe and fittings shall be painted with one(1) of the following coating systems:

17.2.1 Ameron System:

Prime coat - Amerlock 2 VOC or 400 VOC; 8.0 mils dry minimum, one(1) coat minimum

Intermediate coat - Amerlock 2 VOC or 400 VOC; 8.0 mils dry minimum, one(1) coat minimum

Finish coat - Amershield VOC; 3.0 mils dry minimum, one(1) coat required  
Total dry film thickness; 19.0 mils minimum

17.2.2 Tnemec System:

Prime coat - Tnemec L69 Hi-Build Epoxoline II; 8.0 mils dry minimum, one(1) coat minimum

Intermediate coat - Tnemec L69 Hi-Build Epoxoline II; 8.0 mils dry minimum, one(1) coat minimum

Finish coat - Tnemec 1095 Endura-Shield; 3.0 mils dry minimum, one(1) coat required  
Total dry film thickness; 19.0 mils minimum

17.2.3 Devoe Coatings System:

Prime coat - Devoe Devran 224V; 8.0 mils dry minimum, one(1) coat required  
Intermediate coat - Devoe Devran 224V, 8.0 mils dry minimum, one(1) coat minimum

Finish coat - Devoe Devthane 379H; 3.0 mils dry minimum, one(1) coat required  
Total dry film thickness; 19.0 mils minimum

18. PIPE COLOR CODING

18.1 General. Piping shall be identified by color coding and by means of

lettering placed directly on the pipe or stamped into metal tags affixed to the pipe designating the service of each piping system.

18.2 Metal Pipe. Metal piping shall be painted in solid or banded colors and identified as specified in the Color Coding and Lettering Schedule shown below. Cleaning and painting of the metal pipe shall comply with the requirements specified in this Section for ferrous metals not submerged, except that the color of the final coat shall comply with the Color Coding schedule. Where banded colors are required on metal pipe, masking tape shall be used to obtain sharp, even lines at the interface of colors. All paints shall be compatible with service conditions.

18.3 Plastic Pipe. Plastic pipe shall be color coded as specified in the Color Coding and Lettering Schedule using face-proof plastic adhesive tape such as 3/4-inch "Scotch" type Vinyl Plastic Electrical Type. The tape shall be neatly wrapped continuously around the pipe to provide the required width of band. The ends of each band shall be terminated perpendicular to the axis of the pipe. Tape shall be suitable for temperature requirements of the particular piping system.

18.4 Pipe Markings. Flow direction arrows and identification lettering or tags shall be provided adjacent to valves, items of equipment, and at intervals of not more than twenty(20) feet. If, in the opinion of the Engineer, the foregoing requirements result in an excessive number of labels or arrows on a run of pipe, the required number shall be reduced as directed. The size and color of letters shall be as specified below. Where the outside diameter of pipe is 1-inch or smaller, metal tags shall be provided instead of lettering on the pipe. Tags shall have the specified identifying lettering stamped in and shall be fastened to the pipe with suitable chains. Metal tags and chains shall be aluminum or stainless steel and shall be as accepted by the Engineer.

Lettering on piping shall be painted or stenciled directly on the pipe. Letter sizes shall be as follows:

O.D. of Pipe	Height of Letters
1 inch and smaller	Metal tags
1-1/4 inches through 3 inches	3/4 inch
3 inches and larger	1-1/2 inches

18.5 Color Coding and Lettering Schedule.

Contents	Finish Color/Pattern	Color of Letters
Potable Water	Green	White
Sanitary Sewer	Green	White

In accordance with C.F.C. Chapter 80, piping and tubing shall be identified per color coding specified in ASME A13.1. Final selection of colors shall be submitted for District's acceptance.

## 19. COLOR

19.1 Multiple Coats. Unless otherwise specified, prime, intermediate, and finish coats of multiple-coat paint systems shall be of contrasting colors to facilitate visual inspection of the coating application.

19.1.1 Ferrous Metals Not Subject to Submergence and Ductile Iron Pipes: The Contractor shall submit two(2) samples of colors for each process system for District's acceptance and color selection before starting work.

19.1.2 Ferrous Metals Subject to Submergence: The first coat shall be red and the second coat shall be black.

19.2 Finish Coat Color Selection. The color for all painted finish surfaces covered by this Section, unless noted otherwise, shall be per AEROSPACE MATERIAL SPECIFICATION SAE-AMS-STD-595, "Colors Used in Government Procurement," #20318. Electrical equipment at pumping plants shall be per SAE-AMS-STD-595C, #22563. All dark trim shall be per AEROSPACE MATERIAL SPECIFICATION SAE-AMS-STD-595C, #20062.

## 20. INSPECTION

The Contractor shall furnish the following inspection equipment to the District before the start of painting of any portion of the project.

- a. A portable, low voltage, non-destructive holiday detector utilizing a wetted sponge to indicate pinholes and flaws in coatings. The equipment shall be suitable for coating thickness of 20 mils dry film thickness. The Manufacturer shall be Tinker-Razor model M-1, K-D Bird Dog, or equal.
- b. A magnetic flux and eddy current gage (Type II) shall be provided. The gage shall be for the measurement of the dry film thickness of coatings over ferrous metal substrate. The device shall be for easy, one-handed operation. The device shall be battery operated; no cables or plugs shall be necessary. The device shall have auto shutoff and shall have an LCD display. The device shall make the measurements in mils. The minimum range of the device shall be 0-60 mils. The accuracy of the device shall be  $\pm 2$  percent. The device shall be PosiTector 6000, Quanix 1200, or equal.

The Contractor shall submit both devices with complete details and catalog data sheets with all the characteristics and features of the devices clearly specified. The submittal shall clearly identify the Manufacturer and the model number of the device. The devices above shall be accurately calibrated by the factory prior to shipment and shall be provided to the District with no cost. The above devices shall become the District's property.

21. CLEANING

Cloths and cotton waste that might constitute a fire hazard shall be placed in closed metal containers or destroyed at the end of each day. Upon completion of the work, staging, scaffolding, and containers shall be removed from the site or destroyed in an accepted manner. Paint spots, oil, or stains upon adjacent surfaces shall be removed and the entire job left clean and acceptable.

22. SPECIAL MANDATORY REPORTING REQUIREMENTS FOR PAINT/COATING CONSUMPTION

See **Section 1A, Part 41** of these Special Provisions for reporting requirements.

23. SUBMITTAL REQUIREMENTS

The Contractor shall submit all the items below for District's acceptance for both shop and field painting.

- a. Complete, detailed data sheets for each type of paint submitted.
- b. Surface preparation for each type of paint.
- c. Dry film thickness of each paint type and/or layer and the total combined dry film thickness of the paint system.
- d. The VOC level of each paint with the actual intended dilution level which will be used in the field shall be submitted for acceptance. These levels shall be in strict compliance with the requirements of SCAQMD.
- e. Detailed paint testing procedures, conditions and results as specified in **Part 14** of this Section.
- f. Detailed catalog cut data sheets for the holiday detector and the paint dry film thickness measurement device. The detailed specification shall include all the features of the devices, materials of construction, measurement range, and the Manufacturers' names and model number.

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SECTION 9B

PAINT FOR BUILDINGS

1. SCOPE

This Section sets forth the requirements for the painting work for the buildings where specified on the Contract Drawings and in other sections of these Special Provisions.

2. GENERAL

2.1 The painting work shall conform to the requirements specified in this Section and the applicable requirements of **Section 310** of the Standard Specifications as amended by the Districts. The Contractor shall furnish materials, equipment and labor required to complete the painting work as indicated on the Contract Drawings and specified in this Section. The Contractor shall examine the other trade specifications within these Special Provisions applying to buildings for painting requirements. The painting of surfaces left unfinished therein shall be included as work in this Section.

2.2 Surface preparation and application of coatings shall be performed by the Contractor in compliance with all applicable federal, state and local occupational safety, health, and air pollution control regulations. The Contractor shall obtain and comply with all safety precautions recommended by the paint Manufacturer in printed instructions or special bulletins.

2.3 All coating systems shall be in accordance with the latest version of South Coast Air Quality Management District (SCAQMD) Rule(s). Any changes in the coating systems required by changes in the SCAQMD regulations shall be the responsibility of the Contractor and shall be made at no cost to the District.

3. PRODUCTS

3.1 General. This specification is based on PPG Glidden Professional (G-P), Sherwin-Williams (S-W), or equal for the purpose of establishing quality, kind, and character. Materials shall be high quality, factory mixed, and delivered to the job in the original unbroken packages bearing the Manufacturer's label.

3.2 Paint Schedule.

3.2.1 Exterior Surfaces:

3.2.1.1 Concrete and Cement Plaster-

Semi-Gloss	<u>G-P</u>	<u>S-W</u>
Surface Prep	Per Manufacturer	Per Manufacturer
1 <sup>st</sup> Coat: Primer	6001	A24W8300
2 <sup>nd</sup> Coat:	Devflex 4216HP	B66-650
3 <sup>rd</sup> Coat:	Devflex 4216HP	B66-650

3.2.1.2 Masonry-

Semi-Gloss	<u>G-P</u>	<u>S-W</u>
Surface Prep	Per Manufacturer	Per Manufacturer
1 <sup>st</sup> Coat: Primer	6001	A24W200
2 <sup>nd</sup> Coat:	Devflex 4216HP	B66-650
3 <sup>rd</sup> Coat:	Devflex 4216HP	B66-650

3.2.1.3 Aluminum and Galvanized Metal-

Semi-Gloss	<u>G-P</u>	<u>S-W</u>
Surface Prep	Per Manufacturer	Per Manufacturer
1 <sup>st</sup> Coat: Primer	Devflex 4020PF	B66-310
2 <sup>nd</sup> Coat: Primer	Devflex 4020PF	--
3 <sup>rd</sup> Coat:	Devflex 4216HP	B66-650
4 <sup>th</sup> Coat:	Devflex 4216HP	B66-650

Gloss	<u>G-P</u>	<u>S-W</u>
Surface Prep	Per Manufacturer	Per Manufacturer
1 <sup>st</sup> Coat: Primer	Devflex 4020PF	B66-310
2 <sup>nd</sup> Coat: Primer	Devflex 4020PF	--
3 <sup>rd</sup> Coat:	Devflex 4208QD	B66-600
4 <sup>th</sup> Coat:	Devflex 4208QD	B66-600

3.2.2 Interior Surfaces:

3.2.2.1 Drywall-

Semi-Gloss	<u>G-P</u>	<u>S-W</u>
Surface Prep	AWCI-Level 5	AWCI-Level 5
1 <sup>st</sup> Coat: Primer	1030N	B28W2600
2 <sup>nd</sup> Coat:	1416V	B31W2600
3 <sup>rd</sup> Coat:	1416V	B31W2600

Gloss	<u>G-P</u>	<u>S-W</u>
Surface Prep	AWCI-Level 5	AWCI-Level 5
1 <sup>st</sup> Coat: Primer	1030N	B28W2600
2 <sup>nd</sup> Coat:	3038	B66-600
3 <sup>rd</sup> Coat:	3038	B66-600

3.2.2.2 Aluminum and Galvanized Metal-

Semi-Gloss	<u>G-P</u>	<u>S-W</u>
Surface Prep	Per Manufacturer	Per Manufacturer
1 <sup>st</sup> Coat: Primer	Devflex 4020PF	B66-310
2 <sup>nd</sup> Coat:	Devflex 4216HP	B66-650
3 <sup>rd</sup> Coat:	Devflex 4216HP	B66-650

Gloss	<u>G-P</u>	<u>S-W</u>
Surface Prep	Per Manufacturer	Per Manufacturer
1 <sup>st</sup> Coat: Primer	Devflex 4020PF	B66-310
2 <sup>nd</sup> Coat:	Devflex 4208QD	B66-600
3 <sup>rd</sup> Coat:	Devflex 4208QD	B66-600

## 3.2.2.3 Ferrous Metal-

Semi-Gloss	<u>G-P</u>	<u>S-W</u>
Surface Prep	Per Manufacturer	Per Manufacturer
1 <sup>st</sup> Coat: Primer	Devflex 4020PF	B66-310
2 <sup>nd</sup> Coat:	Devflex 4216HP	B66-650
3 <sup>rd</sup> Coat:	Devflex 4216HP	B66-650

Gloss	<u>G-P</u>	<u>S-W</u>
Surface Prep	Per Manufacturer	Per Manufacturer
1 <sup>st</sup> Coat: Primer	Devflex 4020PF	B66-310
2 <sup>nd</sup> Coat:	Devflex 4208QD	B66-600
3 <sup>rd</sup> Coat:	Devflex 4208QD	B66-600

## 3.2.2.4 Masonry-

Semi-Gloss	<u>G-P</u>	<u>S-W</u>
Surface Prep	Per Manufacturer	Per Manufacturer
1 <sup>st</sup> Coat: Primer	3010	B25W25
2 <sup>nd</sup> Coat:	1416V	B66-650
3 <sup>rd</sup> Coat:	1416V	B66-650

3.3 Color Schedule. A color schedule will be issued by the Engineer prior to the start of painting to designate the various colors and locations for the job.

3.4 Painting of Roof Mounted Equipment. Except for ferrous metals to be painted per **Section 9A** of these Special Provisions, fans, ductwork and other roof mounted equipment shall be painted in accordance with **Part 3.2** of this Section, unless otherwise specified.

## 4. EXECUTION

4.1 Preparation.

4.1.1 General: Before starting work, the painting contractor shall inspect surfaces to be painted or finished. The painting contractor shall notify the Engineer in writing and the General Contractor of any defects or discrepancies, which will not allow the work to be completed properly. Commencing of work shall be construed as acceptance of the surfaces and it shall be the responsibility of the painter to correct any defect appearing in the painting work thereafter.

4.1.2 Shop Coated Metal Work: Thoroughly clean off oil, grease, dirt and foreign matter; spot coat field connections, welds, soldered joints, and

burned and abraded portions with the same materials as used in the shop coats. Sand the entire surface for the coat to follow. All metal shall receive the two(2) finish coats of paint as specified in this Section.

4.1.3 Uncoated Metal Work: Ferrous metal surfaces shall be thoroughly cleaned of rust, millscale, oil, grease, encrustations, and foreign matter by the use of wire brushes, solvents or other means as necessary or as directed by the Engineer. Clean pits to bright metal ready to receive prime and finish coats of paint.

4.1.4 Finish Hardware, Accessories, Light Fixtures, Plates, etc.: Finish hardware, accessories, light fixtures, plates and similar items shall be removed prior to primer coat. Doors shall be removed to paint tops and bottoms.

4.1.5 Sand smooth all surfaces of normal imperfections, dust off and to putty nail holes, cracks, or chip out after priming.

4.2 Application. Materials shall be mixed and applied in accordance with the Manufacturer's directions.

4.3 Cleanup and Touchup. The Contractor shall carefully follow manufacturer's cleanup instruction to remove spatters and traces of paint materials from adjoining work. The Contractor shall touch-up or refinish, to the satisfaction of the Engineer, abraded, stained, or otherwise disfigured portions thereof as required throughout.

5. SUBMITTALS

5.1 Product Data. Include, but not limited to, Manufacturer's specifications, surface preparation and application instructions, and protection and cleaning instructions.

5.2 Schedule. Submit a complete paint schedule if paint systems proposed are different from systems specified in this Section.

5.3 Color Charts. Submit two(2) hard-copy sets of Manufacturer's standard color selection chart for acceptance and color selection before starting work. Electronic copies are not acceptable.

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SECTION 11A

GENERAL EQUIPMENT STIPULATIONS

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SECTION 11A

GENERAL EQUIPMENT STIPULATIONS

1. SCOPE

These General Requirements for mechanical equipment apply, in general, to the equipment furnished under all Divisions of these Special Provisions. These General Requirements shall supplement the detailed equipment specifications. In case of conflict between specification sections, the more stringent specifications shall govern. All electrical equipment supplied under this Contract including control panels, instruments, appliances, J-boxes, motors, etc., shall meet the requirements of **Section 16A** of these Special Provisions with respect to codes, standards, and testing agency stamps and acceptance.

IT IS THE CONTRACTOR'S RESPONSIBILITY THAT ALL EQUIPMENT FURNISHED AND INSTALLED BE IN STRICT CONFORMITY WITH ALL CURRENT, APPLICABLE CODES AND REGULATIONS OF THE STATE OF CALIFORNIA. VIOLATIONS RESULTING FROM STIPULATIONS IN EXISTING CODES SHALL BE CORRECTED BY THE CONTRACTOR AT ITS OWN EXPENSE.

All equipment shall be new and shall not have been in service before.

2. ADAPTATION OF EQUIPMENT

2.1 General. The Contract Drawings are based on non-accepted equipment drawings. The Contractor may propose to substitute equipment that is not the same dimensions or layout as that shown on the drawings. In accordance with **Section 4-6** of the Standard Specifications, equipment accepted as being of equal quality, performance, etc., may be substituted for that specified. This substitute equipment may require different mounting, connections, installation and operation in the structures than shown on the Contract Drawings and as specified in this Section. Substitute equipment requiring alteration of the structures or layout will be considered only if the Contractor assumes responsibility for identifying, making, and coordinating all necessary alterations. Any alterations to structures, piping, ductwork, electrical or other work necessary to accommodate the substitute equipment, if accepted by the District, shall be made at the Contractor's expense.

This requirement includes all modifications necessary to install the substituted equipment in conformance with the final, certified vendor information at the Contractor's expense.

2.2 Manufacturers and Model Numbers. Manufacturer names and model numbers are for the convenience of the Contractor. Multiple manufacturers' products may not fit the same layout, foundation, enclosure, etc., thus requiring the Contractor to assume all financial burdens and responsibilities for any alterations and changes. The Contractor shall require vendors or suppliers to check and verify all layouts, arrangements, dimensions, etc., of equipment used in the preparation of the Contractor's bid. Any changes or alterations required in the Contract documents as a result of the use of a specific supplier's equipment shall be included in the Contractor's bid price. The Contractor is

responsible for checking the layout and dimensions of all equipment submitted for acceptance. The detailed performance and material specifications shall take precedence over a model number specified in the event of a conflict. If detailed specifications have not been given, the manufacturer's name and model number listed shall be the basis for the performance, design criteria, configuration, and quality for comparison, should an equal be submitted for District's review.

2.3 Electrical. Electrical design has been based on non-accepted vendor information regarding electrical requirements and use of energy efficient equipment. Motor horsepower shown is approximate. It is the Contractor's responsibility to verify the power requirements of equipment proposed by vendors. The Contractor shall include in its bid price all changes in electrical conduit and wire size, circuit breakers, motor control centers, etc., necessary to accommodate any increase in electrical requirements of proposed equipment.

### 3. PACKAGE SYSTEM REQUIREMENTS

Package systems to be provided from an equipment manufacturer (vendor) have been defined in the individual mechanical specifications and the Contract Drawings. Where applicable, these package systems shall be pre-piped, pre-wired, pre-painted, and assembled on a common structural steel skid. The Contractor is ultimately responsible for supply and installation of all required equipment, accessories, and related appurtenances.

The Contractor shall procure, install, modify as required, and make operable the package system as defined in the Contract Documents. Any changes required to meet these package specifications shall not be considered grounds for an extra work claim or time extension.

Package systems shall conform to the requirements of these Special Provisions and all referenced Contract Documents.

3.1 Piping Requirements. Piping furnished by an equipment manufacturer as an integral part of the mechanical equipment and shop-assembled and pre-packaged piping systems shall conform to the requirements of Division 18 of these Special Provisions and the following:

- a. Nominal pipe sizes (NPS) as indicated on the Contract Drawings shall be used for connections at interface points unless otherwise shown.
- b. Steel tubing with compression type fittings shall be Parker, "Swagelok," or equal, and shall be used for NPS 3/4-inch and smaller.
- c. Connections of 1-inch NPS piping and larger shall be flanged unless otherwise shown on Contract Drawings.
- d. Piping in package systems shall be arranged to provide flexibility and accessibility necessary for proper operation, maintenance and cleaning. All piping within the package system shall be securely supported to minimize vibration and allow for thermal expansion,

including the provision of expansion loops if required or recommended by the manufacturers' installation guidelines.

- e. Raised face steel flanges shall be utilized in accordance with ANSI B 16.5 for steel pipe. Gaskets shall be spiral wound stainless steel with non-asbestos filler, unless indicated otherwise.
- f. The package system shall be hydrostatically tested at 1.5 times the maximum operating pressure, unless specified otherwise, prior to delivery to the jobsite.
- g. The vendor providing the piping materials shall chemically clean all piping interiors after fabrication and testing using cleaning methods approved by the manufacturer.

3.2 Instrumentation and Control Requirements. Instruments and controls shall be provided in accordance with individual specifications, the Contract Drawings, and Division 17 of these Special Provisions. Instrumentation controls shall be compatible with the furnished distributed control system.

3.3 Electrical. Electrical switchgear, wiring, hardware, etc., shall be provided in accordance with the individual specifications, the Contract Drawings, and Division 16 of these Special Provisions.

#### 4. CODES AND STANDARDS

Equipment supplied shall meet the requirements of the codes and standards listed below. These codes and standards shall be referred to hereinafter by basic designation only and form a part of this specification. In the absence of reference to a specific issue, it shall be understood that the publication shall be of latest edition in effect at the time of bid. IN THE EVENT OF CONFLICT BETWEEN THE REFERENCED CODES AND STANDARDS AND THE SPECIAL PROVISIONS, THE MORE STRINGENT REQUIREMENTS SHALL GOVERN.

- Air Movement and Control Association, Inc. (AMCA)
- American Bearing Manufacturers Association (ABMA)
- American Gear Manufacturers Association (AGMA)
- American Institute of Steel Construction (AISC)
- American Iron and Steel Institute (AISI)
- American National Standard Institute (ANSI)
- American Petroleum Institute (API)
- American Society for Testing and Materials (ASTM)
- American Society of Civil Engineers (ASCE)
- American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
- American Society of Mechanical Engineers (ASME)
- American Water Works Association (AWWA)
- American Welding Society (AWS)
- ASME B31.1 Power Piping Code
- ASME Boiler and Pressure Vessels Codes

- ASME Power Test Codes
- Chlorine Institute (CI)
- Compressed Air and Gas Institute (CAGI)
- Hydraulic Institute Standards (HIS)
- Industrial Risk Insurers and applicable insurance agencies
- Institute of Electrical and Electronics Engineers (IEEE)
- Instrument Society of America (ISA)
- Insulated Power Cable Engineers Association (IPCEA)
- Los Angeles County Building Code
- Los Angeles County Electrical Code
- Los Angeles County Mechanical Code
- Los Angeles County Plumbing Code
- National Association of Corrosion Engineers (NACE)
- National Electric Code (NEC)
- National Electric Manufacturers Association (NEMA)
- National Fire Protection Association (NFPA)
- European Committee of Manufacturers of Compressors, Vacuum Technology, Pneumatic Tools, Air Treatment Equipment and Condensate Treatment Equipment (PNEUROP)
- Scientific Apparatus Makers Association (SAMA)
- Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
- South Coast Air Quality Management District - Rules and Regulations and Source Testing Manual (SCAQMD)
- State of California - California Code of Regulations (CCR)
- State of California - Construction Safety Orders (CAL/OSHA)
- Steel Structures Painting Council (SSPC)
- Tubular Exchanger Manufacturers Association (TEMA)
- U.S. Department of Labor - Occupational Safety and Health Administration (OSHA)

Equipment shall comply with all applicable requirements of Federal, State, and local codes and regulations. The Contractor shall adhere to the following code sections:

- Title 24, Title 8, Division 1, Chapter 4, Subchapter 4 (Construction Safety Orders)
- Subchapter 5 (Electrical Safety Orders)
- Subchapter 7 (General Industrial Safety Orders) of the California Code of Regulations (CCR)

The Division of Industrial Safety regulations are comprehensive and govern some of the equipment required to be furnished and installed under this Contract.

#### 5. WORKMANSHIP AND MATERIALS

The Contractor shall guarantee that the equipment furnished and work performed are in accordance with **Section 1A** of these Special Provisions.

Workmanship and materials shall conform to **Section 4-1** of the Standard Specifications in addition to the requirements specified in this Section.

5.1 Parts.

Equipment shall be new, designed, fabricated and assembled in accordance with the best modern engineering and shop practices. Individual parts shall be manufactured to standard sizes and gauges so that repair parts, furnished at any time, can be installed at the jobsite and not require that the equipment be returned to the manufacturer for factory installation. Like parts of duplicate units shall be interchangeable.

5.2 Materials.

Materials shall be suitable for service conditions. Iron castings shall be tough, close-grained gray iron free from blowholes, flaws, or excessive shrinkage and shall conform to ASTM A 48. Gray cast iron shall not be used for any parts in tension, parts normally subject to impact, parts with temperature above 400 degrees F, or pressure-containing parts handling hydrocarbons. Except where otherwise specified, structural and miscellaneous fabricated steel used in items of equipment shall conform to the Standards of the AISC and to **Part 8** of this Section.

5.3 Corrosion Due to Submergence.

All moving parts which will be submerged in water, and items in contact with these parts, shall be of corrosion-resistant materials. Parts shall be resistant to corrosion or abrasion by contacting chemicals and shall maintain their properties without deterioration due to the passage of time or exposure to light. Steel which will be submerged, all or in part, during normal operation of the equipment shall have a minimum nominal thickness of 1/4-inch.

5.4 Painted Surfaces. Painted surfaces shall be protected against impact, abrasion, discoloration, and other damage. All painted surfaces which are damaged prior to final acceptance of the Contract shall be repainted at Contractor's expense.

5.5 Warranty. The Contractor shall secure a warranty from the manufacturers of all equipment provided and installed in this Contract as defined in **Section 1A, Part 21** of these Special Provisions and **Section 3-13.3** of the Standard Specifications.

6. SAFETY GUARDS

Belt or chain drives, fan blades, couplings, exposed shafts, and other moving or rotating parts shall be covered on all sides by safety guards which conform to the General Industry Safety Orders of CCR Title 8 Division 1. Safety guards shall be fabricated from 16 US Standard (USS) gauge or heavier 316 stainless steel sheet metal, unless otherwise specified in these Special Provisions. Drawings and specifications of safety guards shall be submitted to the Engineer for acceptance prior to fabrication.

6.1 Guard Installation and Supports. Each guard shall be designed for easy installation and removal. In some cases, this may require a field check of the installation by the Contractor to avoid interferences and to assure easy

removal. Safety guards in outdoor locations shall be designed to prevent the entrance of rain and dripping water.

Necessary supports and accessories shall be provided for each guard to establish a stable, strong mounting of the guard as approved by the Engineer. Supports and accessories, including bolts, nuts, and washers, shall be 316 stainless steel.

Guards shall be secured to the driven machines or to foundations or floors by heavy structural angle supports and anchor bolts. Braces or supports secured to motors shall not be used. Braces and/or supports shall not bridge sound and vibration isolators.

6.2 Special Features. Guards shall be designed with adequate provision for movement of motors for adjustment of belt tension. Belt guards shall have a hole over both shaft centers to allow the shaft speed to be checked with a hand-held tachometer. The holes shall be 1-inch diameter with smooth edges and self-closing cover. Belt guards shall have a hinged front to allow easy access for changing belts and sheaves or chains and sprockets. Means shall be provided to permit lubrication, use of speed counters, and other maintenance and testing operations with the guard in the duty position.

## 7. EQUIPMENT BASES AND BEDPLATES

7.1 Materials and Appurtenances. A heavy, cast-iron or welded-steel base shall be provided for each item of equipment or package system that is to be installed on a concrete base.

Bases and bedplates shall be provided with the following:

- a. Machined support pads,
- b. Tapered dowels for alignment of mating or adjacent items,
- c. Adequate openings to facilitate grouting,
- d. Openings for electrical conduits,
- e. Threaded bedplate drain fittings,
- f. Seams and contact edges between steel plates and shapes shall be continuously welded and ground smooth.

Bedplate drains shall be piped with steel or PVC piping (or other material appropriate for contact with the fluid drained) to the nearest sump or designated drainage area, regardless of whether or not a detail is shown on the Contract Drawings.

7.2 Initial Leveling. Jacking screws shall be provided in the bases and bedplates of large equipment to aid in leveling prior to grouting. Jacking screws shall bear on a minimum 3-inch x 3-inch x 2-inch thick steel soleplate or larger and thicker as necessary not to exceed compressive strength of

concrete or as indicated on the Contract Drawings. Jacking or leveling screws shall not bear directly on concrete.

After assembly and installation on the concrete base, each unit shall be leveled and aligned in place using a precision level but not grouted until after the initial fitting and alignment of the connecting pipe(s). Pre-cut stainless steel shims shall be used for leveling. Leveling nuts shall not be allowed. Shims shall be installed so that tabs are easily accessible. A minimum of four(4) shims with a minimum total thickness of 0.015 inches shall be installed between the bedplate and the steel block at each anchor bolt. Each unit shall then be grouted to the concrete base.

7.3 Grouting. Each base and bedplate shall be completely filled with grout. Prior to grouting, all laitance, oil, dirt, etc., shall have been removed. Concrete surfaces for grouting under baseplates shall have a scratched surface roughened by raking before final set. The foundation area to be grouted shall be wetted thoroughly and standing water removed including any water in anchor bolt sleeves. Air holes shall be provided if required to avoid entrapping air and to allow full penetration of grout.

The grout shall extend to the edge of each base or bedplate and shall be beveled at 45 degrees all around the unit. Grout which is exposed at horizontal surfaces shall be rounded to provide drainage to appropriate points.

7.4 Leveling After Grouting. After grout has set, jacking screws shall be removed, and nuts on anchor bolts shall be tightened, followed by an overall check on leveling and alignment. Should equipment not meet tolerances of leveling and alignment, as recommended by the Manufacturer, corrective measures shall be taken to obtain the required tolerances.

7.5 Grouting for Special Cases. Reciprocating equipment, including instrument air compressors, shall always be grouted with epoxy grouts as manufactured by Carter-Waters, Master Builders, Inc., or equal.

7.6 Final Installation Check. No stresses shall be transmitted to equipment flanges. After final alignment and bolting, equipment connections shall be tested for applied pipe loads by loosening the flange bolts. If any movement of the joint occurs, the piping shall be adjusted to proper fit.

## 8. STRUCTURAL REQUIREMENTS

Structural steel shapes, built-up shapes, and steel plates shall conform to ASTM A 36 unless otherwise specified. Refer to **Division 5** of these Special Provisions for additional steel requirements. Required specific features of these structural elements include the following:

- a. All shop connections shall be welded. All field connections shall be bolted, unless otherwise specified.
- b. Fasteners on equipment that are subject to vibration and/or movement shall be self-locking type or shall be secured with cotter pins or safety wire.

- c. Thermal expansion and contraction for the temperature ranges indicated on the Contract Drawings, on the equipment data sheets, or as specified by the Engineer shall be considered in the design of the structural shapes.

Supports shall be designed, added, and/or modified as required to support the equipment at no additional cost to the District based on final certified manufacturer drawings or literature.

Drawings and calculations for equipment supports which may include, but are not necessarily limited to, foundations, footings, pads, and metallic superstructures shall be submitted to the District for acceptance in accordance with the requirements of **Division 1** of these Special Provisions.

#### 9. SEISMIC AND WIND RESTRAINT REQUIREMENTS

Equipment, components, and supporting structures furnished under this Section shall be provided with sufficient strength to prevent excessive motion or damage due to a wind or seismic event or vibrations. All equipment, components, appurtenances, and anchorage shall be designed to resist seismic forces in accordance with **Section 1K** of these Special Provisions, and wind forces in accordance with the County of Los Angeles Building Code and vibration isolation per **Part 11** of this Section.

#### 10. CONTROL REQUIREMENTS

Controls elements subject to damage shall be removed and packaged separately for shipment. Refer to **Division 17** of these Special Provisions for additional requirements.

#### 11. VIBRATION ISOLATION

All equipment, piping, and ductwork that vibrate during normal operation shall be provided with isolators.

11.1 Piping and Ductwork. For piping and ductwork isolation all penetration points shall be sleeved or otherwise formed to allow passage of piping or ductwork as well as maintain a minimum of 3/4-inch and maximum of 1-1/4-inch clearance around the outside surfaces. This clearance space shall be tightly packed with glass fiber followed by being caulked airtight.

11.2 Floor-Mounted Equipment. Isolator types for floor-mounted equipment shall conform to requirements of each equipment specification.

11.3 Air Handling Equipment. For air handling and HVAC equipment, in addition to vibration isolation, thrust restraints shall be provided.

11.4 Seismic Design. For earthquake protection, the spring mounts shall be furnished with rubber snubbers and all restraints shall be designed based on the acceleration levels of 0.5g in any horizontal direction and 0.35g in any

vertical direction as applied at the center of gravity. The most stringent of these design requirements or Los Angeles County Building Code design requirements shall be used.

11.5 Isolator Equipment Manufacturers. Isolation equipment shall be as manufactured by Mason Industries, Inc., Peabody Noise Control, Korfund, Amber Booth, Vibration Eliminator Company, Vibration Mountings, or equal. All vibration isolation materials shall be provided by a single manufacturer.

12. EQUIPMENT NOISE LEVEL LIMITATIONS, CONTROL, AND TESTING

12.1 Scope. This Section defines the noise level limitations and noise test requirements for the equipment in this project. The Contractor is responsible for enforcing vendor compliance with the noise level limitations defined in this Section.

12.2 References. The following publications are referred to in this Section:

- a. ANSI (American National Standards Institute) publications:
  - S1.1 - Acoustical Terminology
  - S1.2 - Method for Physical Measurements of Sound
  - S1.4 - Specifications for Sound Level Meters
  - S1.6 - Preferred Frequencies, Frequency Levels, and Band Numbers for Acoustical Measurements
  - S1.11 - Specification for Octave, Half-Octave and Third-Octave Band Filter Sets
  - S1.13 - Methods for Measurement of Sound Pressure Levels
  - S5.1 - Test Code for the Measurement of Sound from Pneumatic Equipment
- b. NEMA (National Electrical Manufacturer's Association) standard:
  - Standard Publication No. MG-1, Part 20, for Motors and Generators
- c. IEEE (Institute of Electrical and Electronics Engineers)
  - Standard 85 - Test Procedures for Airborne Sound Measurements on Rotating Electric Machinery
- d. Cal/OSHA (Occupational Safety and Health Administration Standards)
- e. AMCA (Air Movement and Control Association, Inc.)
  - 300 Standard - Reverberant Room Method for Sound Testing of Fans
  - 301 Standard - Methods for Calculating Fan Sound Ratings
  - 303 Standard - Application of Sound Power Level Ratings for Fans
- f. CAGI (Compressed Air and Gas Institute) and PNEUROP (European Committee of Manufacturers of Compressors, Vacuum Technology, Pneumatic Tools, Air Treatment Equipment and Condensate Treatment

Equipment) - Test Code for Measurement of Sound from Pneumatic Equipment

12.3 General. These noise limits are intended to provide a maximum combined equipment noise level of the facility that will satisfy in-plant, community, and governmental requirements.

- a. Process pipe lagging and/or insulation required to meet noise level criteria shall be installed by the Contractor as defined in the Contract Documents.
- b. Any equipment not meeting these noise requirement limits shall be equipped with removable sound enclosures and noise reduction insulation at the Contractor's expense. Any sound enclosure and/or insulation shall be easily removed and reassembled for regular maintenance.

12.4 Equipment Noise Level Limits.

- a. Sound pressure levels (SPL) specified in this Section are based on a reference pressure of 0.0002 microbar. The term dBA shall refer to the overall value of sound pressure level as measured by a sound level meter using the A-weighted network, slow response.
- b. Each item of equipment to be supplied for this project, unless otherwise noted, shall not exceed 85 dBA as measured at three(3) feet from the equipment and five(5) feet above the ground while the equipment is operating under all loads and/or speeds including full load and/or speed. Maximum sound pressure levels in the various octave bands are as indicated below and represent the maximum averaged upper limits. These maximum octave band sound pressure levels are not meant to occur concurrently. All equipment shall meet the maximum octave band sound levels specified while simultaneously complying with the overall sound pressure level of 85 dBA at three(3) feet and five(5) feet above the ground.

Equipment Group	Octave Band Center Frequencies, Hz							
	63	125	250	500	1000	2000	4000	8000
Group 1	80	80	80	80	77	77	73	73
Group 2	80	80	80	80	77	77	73	73
Group 3	—	See NEMA TR-1					—	—

- c. Equipment group descriptions are as follows:

Group 1

- Electric motors
- Compressors
- Blowers and fans
- Gear boxes

- Suction openings and silencers
- Pumps
- Control valves, restriction orifices, flow meters, piping systems
- Miscellaneous equipment including package units, etc.

Group 2

- Vents and silencers (intermittent operation)

Group 3

- Transformers
- Electrical switchgear
- Variable frequency controller (VFC)

12.5 Fan Noise Level Limits. Fan noise level limits and testing procedures shall comply with that of AMCA requirements as specified in this Section. All fans are subject to factory noise testing with the contract motor in accordance with the requirements specified in this Section. The factory sound power level rating calculations shall comply with AMCA Standard 301 and shall be the results of tests made in accordance with AMCA Standard 300 Test Code for Sound Rating. All fans shall be licensed to bear the AMCA Certified Sound Ratings Seal.

12.6 Submit Fan Test Procedure.

The Contractor shall submit the detailed factory noise testing procedure, configuration, and instruments to be used in the testing for District's acceptance. The Contractor shall clearly specify the configuration of the fan to be tested which shall be in compliance with Figures 1, 2, and 3 of AMCA Standard 300.

12.7 Fan Sound Pressure Calculation. The Contractor shall submit the total sound power level of the fan on an A-weighted network at each octave band in accordance with the above standards. The octave band sound power levels shall be combined logarithmically to obtain a single overall sound power level. The overall sound power level shall be converted to a sound pressure level, in dBA, assuming free field condition and using equation "B" of AMCA Standard 303. The term "4/R" in equation "B" of AMCA 303 shall be zero(0) for the free field calculation and the directivity factor "Q" shall be two(2) per AMCA 303. This calculated sound pressure level shall be submitted with all detailed calculations for District's acceptance. This free field condition shall be used for the sound pressure calculations of all fans in this project, unless one(1) of the installation types (A, B, C, or D) shown in AMCA 303 has been specified in the corresponding equipment specification section. If the installation is anything other than the AMCA 303 types, the Contractor shall conduct the sound pressure level calculations in accordance with equation "B" of AMCA 303 by submitting all formulas, values, and assumptions used for the environment where the fan is installed.

12.8 Compressor Noise Level Limits. All compressors furnished under this Contract shall be factory noise tested with their contract motor in accordance

with CAGI and PNEUROP Test Codes (whichever is applicable) and ANSI S 5.1 for the Measurement of Sound from Pneumatic Equipment. The Contractor shall submit the test procedure, setup, and instrumentation for District's acceptance. All the test results shall be submitted for District's acceptance.

12.9 Contractor and Vendor Responsibility.

12.9.1 Data Required:

- a. Each equipment vendor supplying motor-operated or noise-generating equipment shall complete the Equipment Sound Level Data Sheet (Attachment 1) attached at the end of this specification. This data sheet shall be completed by the vendor and submitted to the Contractor with a signed guarantee.
- b. When equipment is motor driven, data for both driven and driving equipment shall be submitted. The allowable SPL shall apply to the combined noise level of the driven and driving equipment, and the speed changer, if any. This also applies to package systems where the allowable SPL shall apply to the total combined noise level of the equipment package.
- c. The vendor's data sheet shall clearly indicate the conditions under which the noise tests were conducted, e.g., anechoic chamber, concrete block room, metal building, etc., and the measured ambient background noise level during testing. The data sheet shall also explain how the equipment will be modified to meet District criteria.
- d. The completed sound data sheet shall be submitted to the Engineer for review and acceptance.

12.9.2 Special Designs:

- a. When the specified noise levels cannot be met by the vendor's standard design, alternatives for a special design or for acoustic treatment of a standard design shall be provided and paid for by the Contractor.
- b. Acceptance of special acoustic treatment must be received from the Engineer prior to release to fabrication of the equipment.
- c. Abatement and/or lagging designs shall not limit equipment operation, maintenance, or accessibility and shall be easily removable. Abatement or lagging designs shall not create any safety or fire hazard. All lagging material must be accepted by the Engineer prior to installation.

12.9.3 Guarantee:

- a. The Contractor is ultimately responsible for guaranteeing sound levels and making all modifications at its expense to meet the sound level limitations.

- b. The Engineer reserves the right to reject any item which, when shop tested (using the specified test procedures), does not meet the required noise limits.

12.9.4 Guarantee Test:

- a. Noise guarantee acceptance tests shall be performed by the vendor for all equipment supplied. Mutual agreement between the Contractor and the Engineer as to the test date and time shall be reached in advance of the testing.
- b. Factory noise tests may be waived if specified in individual equipment sections of these Special Provisions. If the noise shop test has been waived and the equipment exceeds required noise limits on the field test, remedial action will be required at the Contractor's expense to meet the noise limits.

12.9.5 Installation Tests:

- a. The Contractor shall perform complete noise tests on all installed equipment and electrical items shown or listed in this project. The tests shall not be conducted without prior acceptance obtained from the Engineer. The tests shall determine whether the individual equipment item has met the guaranteed noise level quoted by the vendor or as defined in this Section. A noise test report shall be submitted to the Engineer for acceptance immediately following the test.
- b. Where said equipment does not meet the required noise levels, the Contractor shall modify the installation, including adding additional acoustical treatment, at no additional cost to the District, and retest the equipment until the noise limits can be reached. Failure to obtain successful noise limit certifications shall not constitute the basis of an extra work claim or time extension claim.

12.9.6 Test Procedure: Instrumentation to perform the noise shop tests and field tests shall meet ANSI Standards: S1.4, S1.6, and S1.11. Tests shall be performed in accordance with ANSI Standards S1.2 and S1.13.

13. EQUIPMENT WARRANTY

The Contractor shall warrant the equipment furnished and work performed in accordance with **Section 1A, Part 21** of these Special Provisions. Equipment shall be warranted against:

- a. Faulty or inadequate design,
- b. Improper assembly or erection,
- c. Defective workmanship or materials,

- d. Leakage, breakage, or other failures.

14. EQUIPMENT INSTALLATION

The Contractor shall obtain installation instruction booklets or other recommendations from the equipment manufacturers as to procedures for, sequences of, and tolerances allowed in equipment installation. One(1) copy of this information shall be given to the Engineer prior to installation of equipment. Whenever applicable, the Contractor shall obtain the services of a manufacturer's representative specifically trained in erection of its equipment to supervise the installation.

14.1 Grout. The manufacturer's recommendations as to grout spaces required, type of grout to be used, and tolerances for leveling and alignment, both vertical and horizontal, shall be obtained and followed.

14.2 Rivets. Rivets shall be set by hydraulic tools and shall be expanded to fill the holes completely. The surfaces of all riveted joints shall be in close contact throughout.

14.3 Access Openings. Where temporary openings are necessary through walls and partitions for the entry or installation of mechanical equipment, the permanent work at said openings shall be executed after equipment enters the building or after temporary facilities are removed. Permanent access panels shall be anchored into the building construction in accordance with the Contract Documents.

14.4 Connections. No rigid connections between equipment and the building structure shall be made that degrade the noise and vibration isolation system. Electrical conduit connections shall be looped to allow free motion of the isolation equipment.

14.5 Preparation for Installation. Skilled craftspeople (e.g., millwrights) experienced in installation of the equipment or similar equipment shall be used. Applicable specialized tools and equipment, such as precision machinist levels, dial indicators, and gauges, shall be utilized in the installations. Prior to installation of equipment, sacking and concrete preparation shall be completed, and the work area shall be maintained in a vacuum-clean condition during the equipment installation.

15. SPECIAL TOOLS AND ACCESSORIES FOR REGULAR MAINTENANCE

Equipment requiring periodic repair and adjustment shall be furnished complete with special tools, instruments, and accessories required for proper maintenance. Equipment requiring special devices for lifting or handling shall be furnished complete with those devices. Drawings and data on such devices shall be submitted to the Engineer for acceptance prior to delivery.

16. LUBRICATION

The following requirements apply to all mechanical equipment requiring

lubrication provided on this project.

16.1 Startup Lubrication. The Contractor shall provide, add, and drain flushing oil for each lubricant system where applicable for startup, preliminary operation, and testing. The Contractor shall supply and add lubricants required for the initial continuous operation of all equipment. Lubrication systems shall not require attention during startup or shutdown.

16.2 Future Lubrication Supply Need. The Contractor shall submit with the regular submittal equipment package, a list showing the proper lubricants for each item of mechanical equipment, approximate quantities needed per year of continuous operation, and recommended lubrication intervals. Wherever possible, the types of lubricants shall be consolidated with the manufacturer's approval to minimize the number of different lubricants required for plant maintenance. Lubrication systems shall not require attention more than once per week during continuous operation.

16.3 Lubrication Application Points. Where lubrication is provided by means of grease, a pressure-gun system with a separate nipple or zerk for each point shall be used where feasible. Equipment lubrication fittings shall be extended with piping beyond obstructions such as guards, covers, housings, and acoustic enclosures to provide ease of lubrication without disassembly or the stoppage of the operation of the unit.

## 17. DRIVE UNITS

17.1 General. Drive units shall be designed for twenty-four(24)-hour continuous-duty service and shall be constructed so that oil leakage around shafts is prevented.

17.2 V-Belt Drives. Each V-belt drive shall include a sliding base or other suitable tension adjustment that is accessible after grouting in accordance with **Part 7** of this Section. V-belt drives shall have a service factor of at least 2.0 at maximum speeds using the nameplate rating of the driving motor.

Positive tensioning devices shall have the following:

- a. Bearing lubrication points extended to accessible locations
- b. Adjustable motor bases with positioning screws
- c. Non-sparking guards to completely enclose all V-belts and sheaves.

17.3 Gears. Each gear reducer or increaser shall be oil lubricated and totally enclosed. Each gear shall have a nameplate service horsepower rating equal to the nameplate rating of the driving motor. Each gear box shall bear an AGMA nameplate which shows the service horsepower, actual service factor for the actual mechanical or thermal rating, as applicable, and the AGMA gear quality rating.

17.3.1 Thermal Capacity.

Each gear shall have a mechanical and thermal capacity equal to or greater than an equivalent horsepower, determined by multiplying the nameplate service horsepower rating by the specified service factor.

The thermal rating for the equivalent horsepower shall be obtained without auxiliary cooling equipment, such as heat exchangers. An exception to this would be a direct-connect fan mounted on each unit may be used to obtain the thermal rating. The units shall be designed to operate continuously for the conditions specified in a location where ambient temperatures vary from 40 degrees F to 100 degrees F.

17.3.2 Special Gears.

Helical, spiral-bevel, and combination gears shall have a service factor of at least 1.50. Worm gears shall have a service factor of at least 1.20.

18. ELECTRIC MOTORS

Electric motors furnished with equipment shall comply with the requirements of **Division 16** of these Special Provisions.

19. COUPLINGS

Motor couplings shall be either steel-tapered grid (steelflex) type, spacer type, gear type, or the flexible-metallic diaphragm type, unless otherwise specified.

Couplings shall be completely machined to a tolerance of not more than 0.001-inch on the radius and face-to-face. Both halves of the couplings shall be distinctly match-marked.

Couplings shall be keyed in place and cylindrical fittings shall be sufficiently light in weight to permit easy and rapid removal of the hub in the field without the need for heating.

Removable coupling guards shall be provided and shall be designed to prevent contact with the coupling or shaft. Guards shall be approved by Cal/OSHA and shall be as specified in this Section.

Coupling spacers of sufficient length shall be provided where required for maintenance of bearings, seals, and coupling hubs without disturbing the alignment and removal of equipment or driver.

20. BEARINGS

Ball bearings shall be oil-lubricated single-row, double-row, or shall be double-shielded. They shall be regreasable, single-row width, and made from vacuum degassed steel, unless otherwise specified in each equipment section of these Special Provisions (except for belted service frames where roller bearings

are furnished). Bearings, if specified as grease-lubricated, shall be equipped with readily accessible inlet and outlet plugs or fittings to allow for "in service" regreasing. Inner bearing protection shall consist of an internal shaft slinger or inner bearing cap.

21. SHAFTS

21.1 Critical Speed. The Contractor shall design the shafts for rotating equipment such that the critical speed of the shaft shall not be above 80 percent and below 130 percent of the normal operating speed of that shaft. In case of multi-speed operation of the equipment, the same limits apply to the lowest and highest operating speeds of the equipment.

21.2 Submittal. The Contractor shall submit detailed critical speed calculations for each individual shaft of all rotating equipment, for District's acceptance. The Contractor shall clearly specify the shaft diameter, length, material, weight, bearing, or other dynamic loads imposed on the shaft and their locations from the bearings. If the shaft is multi-diameter, the Contractor shall clearly show each individual shaft diameter with its corresponding length on the shaft sketch submitted. The Contractor shall clearly specify and submit all the formulas used in the calculations of the critical speed. Finished results without the calculations and formulas will not be acceptable. Computer-printed calculations with all the formulas will be acceptable.

22. GASKETS

Gaskets shall be provided in all flanged assemblies. Unless otherwise specified, gaskets shall be as specified in **Divisions 11** and **18** of these Special Provisions. Only non-asbestos type gaskets shall be installed.

23. CONNECTIONS

23.1 Dielectric Fittings. Dielectric fittings shall be provided for all dissimilar metal piping connections. Dielectric fittings shall be as manufactured by Capitol, Dresser Industries, or equal, as accepted by the Engineer. Fittings shall be flanged or union type and shall be capable of isolating currents at the 600 volt level.

23.2 Rivets. Rivets shall only be used where specified in the Contract Documents. Rivets on load bearing surfaces shall be flat headed, countersunk, and driven flush. Rivets used for general purposes shall be pan-headed. All rivets shall be 316 stainless steel.

23.3 Bolts. Bolts shall be flush or have the least practicable projection when in the fully tightened position. All bolts and nuts shall be 316 stainless steel.

23.4 Aluminum. Where aluminum metals are placed in contact with or fastened to ferrous metals, the contact surfaces shall be coated as specified in **Section 9A** of these Special Provisions.

24. SEALS

The Contractor shall procure seals and seal auxiliaries through the original equipment manufacturer. All sealing devices shall be installed by the original equipment manufacturer. Where packing is specified, only non-asbestos type packing shall be installed.

Where seals are not specified, the Contractor shall follow the recommendations of the equipment manufacturer suitable for the service specified.

The Contractor shall design, route, furnish, install, support, and anchor the seal or cooling water supply piping where specified as a barrier fluid or for cooling water for seals or bearings. Seal system guidelines outlined in the pump specifications or equipment manufacturer's installation information shall be followed by the Contractor.

The Contractor shall submit complete details of the seal water or bearing cooling water piping along with valves and instruments for District's acceptance. All items with their corresponding catalog cuts, materials of construction, complete pipe routing, and sizes shall be submitted for District's acceptance.

As a minimum, the water piping to each seal or bearing shall have the following:

- a. Inlet isolation ball valve,
- b. Needle valve for flow control,
- c. Flowmeter,
- d. Inlet pressure gage,
- e. Inlet thermometer,
- f. Outlet thermometer,
- g. Outlet isolation ball valve, and
- h. Outlet pressure gage.

Where mechanical seals are specified or used, the maximum shaft deflection to prevent damage to the seal and per ANSI/Hydraulic Institute Part 1.3 shall be identified and a shaft deflection calculation shall be submitted showing the maximum deflection at the seal does not exceed the maximum allowable for the mechanical seal.

25. EQUIPMENT ACCESS

All equipment, including valves, dampers, and trays, are required to be installed with adequate accessibility.

The facility has been designed to supply ample access for maintenance and operation, as indicated on the Contract Drawings. The Contractor shall conform to and maintain this access when redesign is required due to the Contractor submitting equipment that is not the same manufacturer and model as that shown on the Contract Documents. The Engineer may reject any proposed installation of alternate equipment should necessary access not be provided in the proposed alternate design.

The Contractor shall route electrical conduit in such a fashion that the motor/device can be removed without having to first move conduit or electrical fittings.

26. PAINTING

All shop painting of equipment shall be per **Section 9A** of these Special Provisions. All field painting shall be per **Section 9A** of these Special Provisions, if required.

27. PREVENTION OF CORROSION

Metallic materials shall be protected against corrosion. Equipment enclosures shall be given rust-inhibiting treatment and standard finish by the manufacturer. Aluminum shall not be used in contact with soil, and, where connected to dissimilar metal, shall be protected by accepted fittings and with treatment as specified in **Section 9A** of these Special Provisions. Parts such as anchors, bolts, braces, boxes, bodies, clamps, fittings, guards, nuts, pins, rods, shims, thimbles, washers, and miscellaneous parts shall be made of 316 stainless steel, unless shown otherwise.

28. STORAGE AND PRESERVATION OF MATERIALS AND EQUIPMENT

28.1 General. Equipment provided for this project shall be boxed, crated, or otherwise completely enclosed and protected during shipment, handling, and storage. Each container or piece of equipment shall be clearly marked with the Contractor's name, project name, and location. Equipment shall be stored on raised supports protected from exposure to the elements and shall be kept thoroughly dry at all times. Pumps, motors, drives, electrical equipment, and other equipment having anti-friction or sleeve bearings shall be stored in weathertight storage facilities such as warehouses. Covering with visqueen or similar material will not be considered a weather-tight enclosure.

Painted surfaces shall be protected against impact, abrasion, discoloration, and other damage. Painted equipment surfaces which are damaged prior to acceptance shall be repainted in entirety to the satisfaction of the Engineer.

28.2 Electrical Equipment. Electrical equipment, controls, and insulation shall be protected against moisture or water damage. Desiccants shall be provided for electric equipment that are not provided with space heaters. Space heaters provided in the equipment shall be connected and operating at all times until equipment is placed in operation.

28.3 Storage and Preservation at Construction Site. The Contractor shall erect and maintain on the site temporary storage facilities accepted by the Engineer. At its option and with the Engineer's acceptance, the Contractor may provide a suitable offsite storage space. The Engineer shall have access to the offsite storage facilities at any time to inspect the equipment stored therein.

28.3.1 Protective Procedures. The following procedure is to be used for the protection of equipment from the time of arrival at the construction site until it is placed in operation.

Any additional protective measures specified by the equipment manufacturer shall be performed by the Contractor. In the event of conflict between the manufacturer's recommendations and the requirements of this specification, the Engineer's decision will be the final determination. The Contractor's bid shall be based on the higher cost of the two options should there be in a conflict between manufacturer's recommendations and the requirements of this specification. The Engineer selecting the costlier of the two options shall not be the basis of an extra work claim by the Contractor.

The Contractor shall keep records to document the protection given the equipment while the manufacturer's guarantee is in effect.

28.3.1.1 Rust Prevention. The rust preventives referred to in this Section are Mobilarma compounds. Equal products may be accepted by the Engineer.

All interior and exterior surfaces shall be clean and dry before any rust prevention materials are applied. Mineral spirits such as VARSOL or Mobilarma 247, any Stoddard solvent, or equal, shall be used for cleaning of surfaces prior to application of any preservative compound. Kerosene or gasoline shall not be used as cleaning agents.

- a. Mobilarma 524 shall be used for all bearings and internal surfaces.
  1. Prime grade turbine oils, such as Terresso/Teresstic Turbine Oil, are not equivalent to Mobilarma 524.
  2. All rotating equipment protected by this compound shall be turned over weekly to keep bearings and other critical surfaces coated. Tools that will mar the shafts on equipment shall not be used for this operation.
  3. At two-week intervals, water shall be drained from all reservoirs protected with Mobilarma 524, and the required rust preventive shall be added to the proper level. If the fluid becomes dirty or contaminated with water, the reservoir shall be drained, flushed with solvent, and refilled with Mobilarma 524.

- b. Mobilarma 798 shall be used for all exterior surfaces.
  1. Mobilarma 798 does not have lubricating properties. Before placing the protected equipment part in service, the film shall be removed from the bearing surfaces, threads, or areas that come in contact with the lubricants.
  2. Coatings shall be inspected at two-month intervals and shall be renewed if there are any large breaks in the film.

28.3.1.2 Vapor Phase Inhibitors. If vapor phase inhibitors are used to protect the interiors of mechanical equipment the seals shall be examined when the equipment is received at the site. Any damaged vapor seals shall be repaired or replaced, and the inhibitor renewed if necessary.

Vapor seals shall be protected until the equipment is serviced for start-up. Any damage to seals prior to such time shall be immediately repaired.

Vapor phase inhibitors shall be renewed at the time intervals specified by the manufacturer.

28.3.1.3 Blanking Plates. All pumps, compressors, turbines, and blowers, after installation at their final service location and being thoroughly cleaned, shall be isolated from all piping by installing blanking plates between the pipe flanges. Gaskets shall be used on both sides of the blanking plates. The blanking plates shall not be permanently removed until after the pipes have been cleaned and tested.

28.3.1.4 Miscellaneous Mechanical Equipment. Other mechanical equipment, such as hoists, conveyors, monorails, cranes, elevators, flight scrapers, and other miscellaneous mechanical equipment, shall be protected as follows:

- a. Oil-lubricated bearing brackets and gear cases shall be flushed with solvent until clean. The units shall be filled with Mobilarma 524 to the level of the bottom of the shaft as a minimum. The shaft shall be turned several revolutions to apply a protective film coating, uniformly, to the entire shaft and bearings.
- b. A coating of Mobilarma 798 shall be applied to all shafts, couplings, and exposed machined surfaces.
- c. All exposed chains shall be removed. The chains shall be cleaned with a solvent, coated with Mobilarma 778, and wrapped in kraft paper. Each wrapped chain shall be labelled to provide the proper identification and stored with any accessories.

## 29. GALVANIZING

29.1 General. Galvanizing shall be by the hot-dip process and shall conform to the applicable requirements of **Section 210-3 "Galvanizing"** of the Standard Specifications, ASTM A 123/A 123M for structural steel members and

fabrications, and ASTM A 153/A 153M for bolt, nuts, washers, and hardware. Fabrication and galvanizing procedures for all steel products that are to be galvanized shall be in accordance with ASTM A 385. Fabrication techniques that would cause steel distortion or embrittlement shall not be used. If there are any conflicts between the specifications, the more stringent requirements shall apply.

29.2 Surface Preparation. Surface preparation prior to galvanizing shall be in accordance with standard industry practice (degreasing, pickling, and fluxing) to provide an acceptable surface for quality hot-dip galvanizing.

29.3 Repair of Coatings. Repair of damaged coatings shall only be allowable per Section 6.2 of ASTM A 123/A 123M. Any coatings with areas that require repair that do not meet the criteria specified in Section 6.2.1 or Section 6.2.2 of ASTM A 123/A 123M shall be rejected. Any repairs shall be in accordance with ASTM A 780.

29.4 Submittal. Prior to delivery, the Contractor shall submit for District's acceptance, a minimum of five(5) original copies, of the coating applicator's notarized Certificate of Compliance. This Certificate shall document that the hot-dip galvanized coatings meet or exceed the specified requirements of ASTM A 123/A 123M and/or ASTM A 153/A 153M as applicable in accordance with the requirements of **Section 1A, Part 9** of these Special Provisions.

In addition, the Contractor shall submit for District's acceptance certified coating thickness data in accordance with the sampling and testing methods outlined in ASTM A 123/A 123M and/or ASTM A 153/A 153M prior to delivery. For the purposes of the sampling and testing procedures in Sections 7 and 8 of ASTM A 123/A 123M, a "lot" shall be defined as all articles of the same size that are galvanized during a single batch in the galvanizer's kettle. The number of test specimens per lot shall be as specified in Section 7 of ASTM A 123/A 123M, and the number of measurements per specimen shall be as specified in Section 8 of ASTM A 123/A 123M.

The Contractor shall obtain the acceptance of the District on the Certificates of Compliance and the galvanized sample coating thickness data submittals prior to shipment authorization for the first batch of galvanized material to the job site. The galvanized coating thickness test data submittal shall clearly identify the lots used for the measurement, the quantity of the test specimens in each lot, the number of the measurements per specimen and the actual measurements taken. All of the required information shall be submitted in a single submittal for District's acceptance.

29.5 Verification. The District reserves the right to verify the coating thickness data of at least one(1) article of the same size per delivery, up to 10 percent of all articles of the same size per delivery, prior to installation at the jobsite using a magnetic thickness gage in accordance with ASTM E 376. This gage shall be submitted for District's acceptance in accordance with **Section 9A, Part 20** of these Special Provisions. The device shall be delivered to the District at least sixty(60) days prior to the arrival of the first batch of any galvanized steel at the job site. If any articles from a delivery load do not meet the required coating thickness, the District reserves the right to

test any additional articles of the same size in the delivery load in question or reject all of the articles of the same size in the delivery load in question. Any material that does not meet the required minimum coating thickness will be rejected. All costs for testing of galvanizing shall be paid by the Contractor.

30. WELDING

For welding of miscellaneous metals, refer to **Section 5B** of these Special Provisions. For welding of structural aluminum, refer to **Section 13C** of these Special Provisions.

30.1 Acceptable Welding Procedures. All pressure welds shall be made in accordance with Section IX of the ASME Boiler and Pressure Vessel Code, Welding and Brazing Qualifications. Only the following welding procedures are acceptable to the District:

- a. Shielded Metal Arc Welding (SMAW)
- b. Submerged Arc Welding (SAW)
- c. Gas Metal Arc Welding (GMAW/MIG)
- d. Gas Tungsten Arc Welding (GTAW/TIG)
- e. Gas-Shielded Flux Cored Arc Welding (FCAW-g)

Other welding processes shall not be used without prior acceptance from the District. All surfaces to be welded shall be free from loose scale, slag, rust, grease, paint, and any other foreign material.

30.2 Electrodes. Welding electrodes, automatic or manual, shall deposit a composition with chemical and mechanical properties corresponding to the material being welded. Where applicable, electrodes shall meet ASME specifications and AWS specifications. For welding between stainless steel parts, ER316 electrode type shall be used. For welding between dissimilar metals, E309L electrode shall be used. Electrodes classified in Group Nos. F1 and F2 in Table QW-432 of Section IX of the ASME Code shall not be used for pressure-retaining welds.

30.3 Welding Quality. Each weld shall be uniform in width and size throughout its full length. Each layer of welding shall be smooth, free of slag, cracks, pinholes, and undercut. Each layer of welding shall be completely fused to the adjacent weld beads and base metal. All welding seams and joints shall be airtight with a smooth interior surface.

30.4 Weld Repairs. Repair, chipping, and grinding of welds shall not gouge, groove, or reduce the base metal thickness.

Repairs to castings, by welding or other means, shall be performed only after obtaining written acceptance from the Engineer. No repairs shall be permitted on cast iron and/or ductile iron castings.

30.5 Not Used.

30.6 Not Used.

30.7 Not Used.

31. SYSTEM INTEGRITY TESTS

31.1 Scope. System integrity tests for the equipment furnished under this Contract shall be as follows:

- a. Static pressure test for non-pressure piping and equipment in accordance with **Section 18D** of these Special Provisions.
- b. Hydrostatic pressure test for pressure piping in accordance with **Section 18D** of these Special Provisions.

31.2 Damage During Tests. The Contractor shall be fully responsible for the proper operation of equipment during tests and shall not make any claim for damage which may occur to equipment prior to the time when the District formally accepts the Contract.

31.3 Rejection of Equipment. Should inspection, test, or analysis of equipment reveal faulty design, inferior or defective materials, excessive noise or vibration levels as defined by measurable levels defined in this Section, poor workmanship, improper installation, excessive wear or nonconformity with the requirements of the Contract Documents, such equipment will be rejected and shall be replaced with satisfactory work at the Contractor's expense.

Electrical equipment which has been subjected to damage by moisture, water, or other deleterious substances shall be thoroughly dried and have a dielectric test performed upon it as directed by the Engineer. Alternatively, the electrical equipment may be replaced by the Contractor at its expense.

32. COORDINATION

The work shall be coordinated with the work of all other trades. Coordination shall include adequate clearances for the installation and maintenance of equipment, physical and electrical requirements of equipment, and/or equipment requiring connections.

The Contractor shall perform all necessary work to join with and receive work of other trades, provide electric service, extend conduits, and make all necessary connections to minimize interruption of service in all areas.

33. FIELD ROUTING OF SMALL DIAMETER PIPING.

Design drawings are diagrammatic and do not show all offsets, bends, elbows, or other details which may be required for proper installation of the work. Field routing and support of piping smaller than four(4) inches in diameter is generally not shown and shall be proposed by the Contractor.

34. NOT USED

35. EQUIPMENT INSTALLATION SPECIFICS.

Equipment such as pumps, blowers, etc., shown on the Contract Drawings is representative only. Actual dimensions and electrical requirements will depend on equipment actually supplied by the Contractor.

The Contractor shall take measurements for its work at the installation sites, verify subcontractor's drawings, and be responsible for the proper installation within the available space of the equipment specified and shown on the Contract Drawings. The best possible headroom and space conditions for the installation shall be provided. The most orderly arrangement of conduit, piping, valves, fixtures, hangers, etc., shall be provided.

The Contractor shall secure the acceptance of the Engineer for any variations before making any changes to the design.

36. INSTALLATION CHECK AND START-UP

The Contractor shall perform all work required to install and place into operation the equipment in accordance with the manufacturer's recommendations. An experienced, competent, and authorized representative of the manufacturer or supplier of each item of equipment shall visit the site of the work and inspect, check, and approve the equipment installation. The equipment supplier's representative shall be present when the equipment is placed in operation. The equipment supplier's representative shall revisit the job site as often as necessary until the equipment installation and operation is satisfactory to the Engineer.

Each equipment supplier's representative shall submit to the District a written report certifying that the equipment:

- a. has been properly stored and maintained since delivery to the jobsite
- b. has been properly installed and lubricated
- c. is in accurate alignment
- d. is free from any undue stress imposed by connecting piping or anchor bolts, and
- e. has been operated under full load conditions and operated satisfactorily.

37. STANDARD PRODUCTS

Except as modified in this Section, materials and equipment shall be standard catalog products of manufacturers regularly engaged in the manufacture of the products. The material and equipment provided shall have been in satisfactory use at least two(2) years in other installations.

If in the Contract Documents a particular brand or make of material is shown or specified, such brand or make of material is to be regarded as a standard. The Contractor shall make every effort to procure the standard material.

37.1 Alternates to Standard Products. If the Contractor desires to submit a brand or make of material other than the standard for acceptance, it shall make such request in writing. The request shall refer to the section number of the Special Provisions and shall compare the Contractor's proposed substitution with the specified standard with respect to the composition, characteristics, workmanship, operational economy, maintenance, and coordination with other materials. Any other brand or make of the material may be accepted if it is, in the opinion of the Engineer, the recognized equal of that specified with respect to composition, characteristics, performance, workmanship, operational economy, maintenance, coordination with other materials, and if it is suitable for the purpose intended. The Engineer's decision as to whether or not a substitution will be permitted shall be final and conclusive. Any requested substitution is subject to the requirements of **Section 4-6** of the Standard Specifications.

37.2 Preference for Materials Made in the USA. It is preferred that all materials incorporated in the work be, wherever available, manufactured in and made from products of the United States. Any foreign manufactured equipment or components shall be clearly stated in the Contractor's proposal. The Contractor shall insure the availability of spare parts for any foreign made items as well as compatibility of necessary maintenance tools in English measurement units.

38. SUBMITTAL DATA

All submittals shall be submitted complete and in accordance with the requirements of **Section 1A** of these Special Provisions.

Each submittal shall have a statement to the effect that the equipment is in accordance with all requirements as set forth in the specification and related documents. Deviations or exceptions taken by the Contractor to any part of the specifications or related documents shall be grounds for the District to reject the equipment. The Contractor shall include a listing of all deviations or exceptions to the specifications or related documents in the submittal package.

Unless otherwise specified, the following information shall be submitted with each complete submittal. Additional submittal data is required by individual equipment Sections of these Special Provisions.

38.1 Mechanical Equipment Submittals Prior to Fabrication. The equipment submittal shall be submitted to and accepted by the Engineer prior to fabrication of equipment. The equipment submittal shall as a minimum contain the following data:

- a. Name of equipment manufacturer.
- b. Equipment type and model.
- c. Equipment full load speed or capacity.
- d. Design temperature and pressure.
- e. Service factor for motors and gear reducers.
- f. Minimum AMBA (L<sub>10</sub>) bearing life and shaft critical speed calculations.
- g. Shaft deflection calculations when required.
- h. Shop drawings detailing individual equipment items and erection drawings showing as-built equipment locations and connections.
- i. All principal dimensions, including those required for the foundation, maintenance, and piping.
- j. Direction of rotation and maximum rotative speed (where applicable).
- k. All horizontal and vertical clearances necessary for dismantling.
- l. Size, type, location, and identification of all major and minor pipe connections for vents, drains, lube oil, instruments, controls, etc. including those to be plugged.
- m. Auxiliary piping, fittings, and equipment furnished.
- n. List of reference drawings.
- o. Certified performance curves (where applicable).
- p. Electric motor submittal information shall conform to the requirements of **Division 16** of these Special Provisions.
- q. Drawings and complete design data showing the construction of vibration isolation devices to be used including isolators.
- r. Equipment Manufacturers Quality Control and Welding Procedures. This submittal shall include a description of all procedures for welding, weld repairs, weld equipment, and qualification weld tests.
- s. Equipment guarantee from defects in design, materials, and workmanship.
- t. Nameplate drawings.

- u. Drawings of safety guards for belt or chain drives, fan blades, couplings exposed shafts, and other moving or rotating parts.
- v. Equipment manufacturer's recommendations and instructions for equipment storage, handling, and installation.
- w. Weights of electric motor and the heaviest piece of equipment that must be handled for normal maintenance.
- x. Any required special tools, instruments and accessories for proper maintenance.
- y. Detailed drawings with substantiating seismic and wind load calculations for equipment support and anchorage details. These calculations shall be performed by a Civil or Structural Engineer currently registered in the State of California.
- z. Allowable forces and moments data on pump and vessel nozzles and other types of connections on all equipment supplied.
- aa. Completed Equipment Sound Level Data Sheets (Attachment 1) as attached at the end of this Section for motor operated or noise generating equipment. Where applicable the Contractor shall submit alternatives for special design of acoustical treatments for equipment unable to meet specified noise levels. Noise test reports shall be submitted on all installed equipment and electrical items listed in the Special Provisions within thirty(30) days following the test.
- bb. Any special protection (for rain, dust, cold, etc.) required for startup, operation, and periods of idleness under environmental conditions specified for this jobsite.
- cc. Lubrication schedules for equipment, including lubricant types, quantities needed, and lubrication intervals required per year of continuous operation. This shall include the names and addresses of lubrication material suppliers.

38.2 Operation-Maintenance Training.

Course outlines for operation training shall be submitted thirty(30) days prior to training session for acceptance.

Resumes and proof of experience of each instructor for operation training shall be submitted thirty(30) days prior to the training session for acceptance. The Engineer shall be the sole judge as to the sufficiency of experience of the proposed instructor.

38.3 Shop and Field Testing.

Test procedures for shop tests shall be submitted with the first submittal for review and acceptance.

Pressure testing procedures shall be submitted with the first submittal for review and acceptance.

Results of shop and field tests including samples, test procedures, list of equipment used for testing, and test data including tables and curves shall be submitted for acceptance. The results of shop testing may be required prior to the District authorizing shipment of equipment to the jobsite.

38.4 Spare Parts Lists. Spare parts lists shall be submitted for equipment provided under this Contract. The lists shall include manufacturer's designation or identification of any spare parts recommended by each equipment manufacturer for operation of the equipment for a period of three(3) years following expiration of the equipment guarantee unless otherwise specified. The recommended spare parts shall be in a table format and shall include the address nearest to the jobsite where the spare part can be obtained, the ordering nomenclature, and current price of each recommended spare part.

<b>Local Parts and Service Contact:</b>	Name: _____			
	Address: _____			
	Phone: _____			
<b>Equipment Identification/Designation</b>	<b>Quantity</b>	<b>Name of Part/Description</b>	<b>Part Number</b>	<b>Price/Date</b>

38.5 Operation, Maintenance and Service Manuals. One(1) electronic copy of operation, maintenance, and service manuals shall be submitted through Unifier™ for all mechanical equipment provided under this Contract and as specified in the Equipment Schedule in this Section. The electronic manuals shall be in text-searchable PDF format (Adobe Acrobat latest version) with a "Table of Contents" for each document and "Thumbnail" images for each page or image in the document.

All material shall be scanned at a minimum resolution of 300 dpi. For color text, charts, drawings, graphs and/or photographs, the images shall be scanned using a color scanner. Black and white charts, drawings, graphs, and/or photographs shall be scanned in black and white unless grayscale is necessary to achieve a superior quality image. Grayscale shall NOT be used for the entire document.

All scanning shall conform with the following ANSI/AIIM standards: ANSI/AIIM MS44-1988 (R1993), Recommended Practice for Quality Control of Image Scanners, and AIIM TR38-1996, Compilation of Test Targets for Document Imaging Systems.

The manuals shall include the following information:

- a. Complete operating instructions including start-up, normal operation, and emergency shut-down for all equipment installed.
- b. Legible copies of all accepted shop drawings.
- c. All equipment maintenance and service instructions including a list of preventive maintenance items and their frequency of occurrence.
- d. Complete parts list of each piece of equipment.
- e. Recommended parts list for preventive maintenance.
- f. All available equipment descriptive literature.
- g. Operating characteristics, performance data, and ratings for each piece of equipment.
- h. All documentation, in accordance with **Division 16** and **Division 17** of these Special Provisions for electrical devices, instruments, and apparatus furnished as part of mechanical equipment.
- i. Final factory test reports and curves where applicable.
- j. All other information pertinent to the proper maintenance and servicing of equipment and systems provided in the project.
- k. Name, address, and telephone number to obtain service for each manufacturer's equipment.

These manuals shall be in addition to any instructions packed with the equipment and shall be submitted to the Engineer for acceptance within sixty(60) days after shipment of the equipment and at least four(4) weeks before equipment startup.

In addition to the electronic copy of the manuals, three(3) paper copies of all operation and maintenance manuals which have incorporated all District comments and have received the final acceptance of the District shall be submitted to the Districts in accordance with **Section 1A, Part 54** of these Special Provisions.

#### 39. MANUFACTURER'S NAMES

The use of manufacturers' names and catalog numbers in the Contract Documents shall not supersede the detailed specifications. The detailed specifications shall apply in the event of a conflict. If detailed specifications have not been given, the manufacturer's name and catalog number shall determine the design criteria and quality for comparison should an equal be submitted.

#### 40. OPERATION-MAINTENANCE TRAINING

The Contractor shall arrange, or have individual Equipment Manufacturers arrange, to have experienced representatives to train the District's operating personnel in both operation and maintenance of the various systems within the

facility. Scheduling and coordination of the training sessions shall be by the District.

As a minimum, two(2) eight(8)-hour sessions shall be provided to instruct the District personnel for each major equipment item as specified in the Special Provisions. Major equipment shall be considered to be at least those items that are listed in the Equipment Schedule of this Section. The training instruction time indicated above shall be separate and apart from any other vendor service time provided under this Contract, e.g., installation checks by vendor representatives, etc. The instructors shall be supplied by the Contractor, or the Equipment Manufacturer where specified, at a cost included in the Contractor's initial bid at no additional cost to the District.

The Contractor shall provide resumes and other proof of sufficient experience of each instructor to the District for review and acceptance prior to start of instruction. The Engineer will determine if the proposed instructor is sufficiently experienced to do the training. The Contractor shall replace any proposed instructor with a more experienced, knowledgeable instructor at no additional costs.

Outlines of the instructor's lectures and training exercises shall be submitted to the District in writing prior to start of the instruction period. The District may video/audio record each instructor's lecture and training period.

The training sessions may be scheduled during normal working hours, night shifts, weekends, etc. in order to meet District's personnel requirements. The sessions shall include both classroom instruction and field "hands-on" equipment training. The Contractor shall include in this initial bid the cost of multiple training sessions for the same equipment should it be required to meet the District's personnel working hours.

#### 41. NAMEPLATES

Nameplates shall be provided and mounted on or adjacent to each item of mechanical equipment. The nameplates shall be manufactured of 18 Cr-8 Ni stainless steel. They shall be a minimum of 1-1/2 inches by 4-inches, 1/16-inch thick, with engraved or embossed lettering not smaller than 3/16-inch and laminated in white. They shall be easily visible.

The following information shall be given on nameplates:

- a. Equipment tag number.
- b. Name, address, and service contact phone number of manufacturer.
- c. Manufacturer's serial number.
- d. Design temperature and pressure (where applicable).
- e. Equipment performance data (capacity, pressure, etc.).
- f. Lubricant required (if applicable).
- g. Maximum operating speed or other pertinent information.

h. Year built.

42. INSPECTIONS AND SHOP TESTING

The Contractor shall not use any material or equipment which has not been inspected, tested, and accepted. The Contractor shall keep the Engineer advised of the progress of the work away from the jobsite requiring inspection or witnessing of tests so that arrangements may be made for District's inspection.

Inspection, tests, or acceptance of any materials prior to shipment shall not be deemed as a final acceptance of the materials. The Engineer may inspect or require tests or analysis of any portion of the materials at any time after delivery to the site either before or after installation. Any material found to be defective or not otherwise conforming to the requirements of the Contract Documents will be rejected and shall be removed from the site. The District reserves the right to test each identical unit of a multiple unit installation or piece of equipment and is not obligated to test only one(1) component or accept a prototype factory test.

The performance of such inspections and acceptance of the work by the District representatives or the Engineer will in no way release the Contractor of his complete responsibility for construction means, methods, and techniques and for performing the work in accordance with the Contract Documents.

Work shall not be enclosed until it has been inspected, tested, and accepted. Any work that is enclosed before such inspection and test shall be uncovered for inspection and restored to enclosed condition at no additional cost to the District.

Unless otherwise specified in each individual equipment Section of these Special Provisions:

- a. The District reserves the right to witness each and every shop test of the equipment specified in this Contract. The Contractor shall notify the District, in writing, at least three(3) weeks in advance of the scheduled shop test for major equipment.
- b. Test procedures shall be submitted sixty(60) days prior to the tests to the District and accepted in writing by the District prior to notification of the scheduled shop test date.
- c. Results of all shop tests shall be submitted to the District for acceptance. Equipment shall not be shipped until the District has reviewed and accepted in writing the test result report submittal. The District will complete review of shop test results within ten(10) working days after receiving the submittal. The Contractor shall make all modifications to equipment and repeat all required tests at no additional cost to the District to produce an acceptable test submittal in accordance with the specified criteria.

- d. The District will witness the shop testing of equipment in accordance with the Major Equipment Schedule. The shop tests shall be witnessed by two(2) District representatives. All costs for the District representatives to witness the shop tests such as transportation, meals, hotel, etc., shall be arranged and borne by the Contractor. If the shop tests are not conducted as scheduled or do not successfully demonstrate compliance with the specifications, another shop test shall be required, and the Contractor shall pay all costs for the District representatives to witness subsequent shop tests.

43. DELIVERY OF SPARE PARTS AND SPECIAL TOOLS

The Contractor shall be responsible for proper storage and protection of all spare parts and special tools required by these Special Provisions. The Contractor shall deliver all required spare parts and special tools to the District at the same, single time at the end of the Contract. The District will inspect the spare parts and special tools prior to acceptance. Any deficiencies noted by the District shall be corrected by the Contractor at no cost to the District prior to final acceptance of the Contract.

44. FORCES AND MOMENTS DATA

Allowable force and moment data on pumps, fans, compressors, vessel nozzles, and other types of connections shall be submitted for District's acceptance for all equipment submitted. The Contractor shall clearly mark "X", "Y", and "Z" directions with arrows in positive directions for each equipment appurtenance. This information shall be provided for all equipment regardless of it being specified in other Sections of these Special Provisions.

\* \* \* \* \*



### EQUIPMENT SOUND LEVEL DATA SHEET

Sound pressure levels (SPL) in decibels (re 0.0002 microbars) shall be measured at three(3) feet from major bounding surfaces, excluding minor projections such as conduit boxes and bearing housings, at one-half the vertical height for equipment up to ten(10) feet high and at three(3) feet above the top following the standards of ANSI S1.2 1962 (R1976) "Physical Measurement of Sound" or equivalent.

Exceptions: \_\_\_\_\_  
 \_\_\_\_\_

SPL shall be measured at specified design point.

Exceptions: \_\_\_\_\_

Instructions to Suppliers, Manufacturers, or Vendors:

Complete all items below.

Octave Band Center Frequency (Hz)	Sound Levels in Decibels					
	Supplier's Guaranteed Maximum Level at 3'					
	Stock Item		Special Design		Acoustic Treatment	
	SPL	PWL	SPL	PWL	SPL	PWL
63						
125						
250						
500						
1000						
2000						
4000						
8000						

Describe special design (if any): \_\_\_\_\_

Describe acoustic treatment (if any): \_\_\_\_\_

We guarantee  our equipment will not exceed District's maximum acceptable sound pressure levels.

SPL are continuous broad band in nature and non-directional.

Exceptions: \_\_\_\_\_

Supplier, manufacturer, or vendor \_\_\_\_\_

Represented by \_\_\_\_\_ Title \_\_\_\_\_

Signature \_\_\_\_\_ Date \_\_\_\_\_

Equipment Description \_\_\_\_\_

Equipment Tag No. \_\_\_\_\_



## SECTION 11A

### GENERAL EQUIPMENT STIPULATIONS

#### 1. SCOPE

These General Requirements for mechanical equipment apply, in general, to the equipment furnished under all Divisions of these Special Provisions. These General Requirements shall supplement the detailed equipment specifications. In case of conflict between specification sections, the more stringent specifications shall govern. All electrical equipment supplied under this Contract including control panels, instruments, appliances, J-boxes, motors, etc., shall meet the requirements of **Section 16A** of these Special Provisions with respect to codes, standards, and testing agency stamps and acceptance.

IT IS THE CONTRACTOR'S RESPONSIBILITY THAT ALL EQUIPMENT FURNISHED AND INSTALLED BE IN STRICT CONFORMITY WITH ALL CURRENT, APPLICABLE CODES AND REGULATIONS OF THE STATE OF CALIFORNIA. VIOLATIONS RESULTING FROM STIPULATIONS IN EXISTING CODES SHALL BE CORRECTED BY THE CONTRACTOR AT ITS OWN EXPENSE.

All equipment shall be new and shall not have been in service before.

#### 2. ADAPTATION OF EQUIPMENT

2.1 General. The Contract Drawings are based on non-accepted equipment drawings. The Contractor may propose to substitute equipment that is not the same dimensions or layout as that shown on the drawings. In accordance with **Section 4-6** of the Standard Specifications, equipment accepted as being of equal quality, performance, etc., may be substituted for that specified. This substitute equipment may require different mounting, connections, installation and operation in the structures than shown on the Contract Drawings and as specified in this Section. Substitute equipment requiring alteration of the structures or layout will be considered only if the Contractor assumes responsibility for identifying, making, and coordinating all necessary alterations. Any alterations to structures, piping, ductwork, electrical or other work necessary to accommodate the substitute equipment, if accepted by the District, shall be made at the Contractor's expense.

This requirement includes all modifications necessary to install the substituted equipment in conformance with the final, certified vendor information at the Contractor's expense.

2.2 Manufacturers and Model Numbers. Manufacturer names and model numbers are for the convenience of the Contractor. Multiple manufacturers' products may not fit the same layout, foundation, enclosure, etc., thus requiring the Contractor to assume all financial burdens and responsibilities for any alterations and changes. The Contractor shall require vendors or suppliers to check and verify all layouts, arrangements, dimensions, etc., of equipment used in the preparation of the Contractor's bid. Any changes or alterations required in the Contract documents as a result of the use of a specific supplier's equipment shall be included in the Contractor's bid price. The Contractor is

responsible for checking the layout and dimensions of all equipment submitted for acceptance. The detailed performance and material specifications shall take precedence over a model number specified in the event of a conflict. If detailed specifications have not been given, the manufacturer's name and model number listed shall be the basis for the performance, design criteria, configuration, and quality for comparison, should an equal be submitted for District's review.

2.3 Electrical. Electrical design has been based on non-accepted vendor information regarding electrical requirements and use of energy efficient equipment. Motor horsepower shown is approximate. It is the Contractor's responsibility to verify the power requirements of equipment proposed by vendors. The Contractor shall include in its bid price all changes in electrical conduit and wire size, circuit breakers, motor control centers, etc., necessary to accommodate any increase in electrical requirements of proposed equipment.

### 3. PACKAGE SYSTEM REQUIREMENTS

Package systems to be provided from an equipment manufacturer (vendor) have been defined in the individual mechanical specifications and the Contract Drawings. Where applicable, these package systems shall be pre-piped, pre-wired, pre-painted, and assembled on a common structural steel skid. The Contractor is ultimately responsible for supply and installation of all required equipment, accessories, and related appurtenances.

The Contractor shall procure, install, modify as required, and make operable the package system as defined in the Contract Documents. Any changes required to meet these package specifications shall not be considered grounds for an extra work claim or time extension.

Package systems shall conform to the requirements of these Special Provisions and all referenced Contract Documents.

3.1 Piping Requirements. Piping furnished by an equipment manufacturer as an integral part of the mechanical equipment and shop-assembled and pre-packaged piping systems shall conform to the requirements of Division 18 of these Special Provisions and the following:

- a. Nominal pipe sizes (NPS) as indicated on the Contract Drawings shall be used for connections at interface points unless otherwise shown.
- b. Steel tubing with compression type fittings shall be Parker, "Swagelok," or equal, and shall be used for NPS 3/4-inch and smaller.
- c. Connections of 1-inch NPS piping and larger shall be flanged unless otherwise shown on Contract Drawings.
- d. Piping in package systems shall be arranged to provide flexibility and accessibility necessary for proper operation, maintenance and cleaning. All piping within the package system shall be securely supported to minimize vibration and allow for thermal expansion,

including the provision of expansion loops if required or recommended by the manufacturers' installation guidelines.

- e. Raised face steel flanges shall be utilized in accordance with ANSI B 16.5 for steel pipe. Gaskets shall be spiral wound stainless steel with non-asbestos filler, unless indicated otherwise.
- f. The package system shall be hydrostatically tested at 1.5 times the maximum operating pressure, unless specified otherwise, prior to delivery to the jobsite.
- g. The vendor providing the piping materials shall chemically clean all piping interiors after fabrication and testing using cleaning methods approved by the manufacturer.

3.2 Instrumentation and Control Requirements. Instruments and controls shall be provided in accordance with individual specifications, the Contract Drawings, and Division 17 of these Special Provisions. Instrumentation controls shall be compatible with the furnished distributed control system.

3.3 Electrical. Electrical switchgear, wiring, hardware, etc., shall be provided in accordance with the individual specifications, the Contract Drawings, and Division 16 of these Special Provisions.

#### 4. CODES AND STANDARDS

Equipment supplied shall meet the requirements of the codes and standards listed below. These codes and standards shall be referred to hereinafter by basic designation only and form a part of this specification. In the absence of reference to a specific issue, it shall be understood that the publication shall be of latest edition in effect at the time of bid. IN THE EVENT OF CONFLICT BETWEEN THE REFERENCED CODES AND STANDARDS AND THE SPECIAL PROVISIONS, THE MORE STRINGENT REQUIREMENTS SHALL GOVERN.

- Air Movement and Control Association, Inc. (AMCA)
- American Bearing Manufacturers Association (ABMA)
- American Gear Manufacturers Association (AGMA)
- American Institute of Steel Construction (AISC)
- American Iron and Steel Institute (AISI)
- American National Standard Institute (ANSI)
- American Petroleum Institute (API)
- American Society for Testing and Materials (ASTM)
- American Society of Civil Engineers (ASCE)
- American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
- American Society of Mechanical Engineers (ASME)
- American Water Works Association (AWWA)
- American Welding Society (AWS)
- ASME B31.1 Power Piping Code
- ASME Boiler and Pressure Vessels Codes

- ASME Power Test Codes
- Chlorine Institute (CI)
- Compressed Air and Gas Institute (CAGI)
- Hydraulic Institute Standards (HIS)
- Industrial Risk Insurers and applicable insurance agencies
- Institute of Electrical and Electronics Engineers (IEEE)
- Instrument Society of America (ISA)
- Insulated Power Cable Engineers Association (IPCEA)
- Los Angeles County Building Code
- Los Angeles County Electrical Code
- Los Angeles County Mechanical Code
- Los Angeles County Plumbing Code
- National Association of Corrosion Engineers (NACE)
- National Electric Code (NEC)
- National Electric Manufacturers Association (NEMA)
- National Fire Protection Association (NFPA)
- European Committee of Manufacturers of Compressors, Vacuum Technology, Pneumatic Tools, Air Treatment Equipment and Condensate Treatment Equipment (PNEUROP)
- Scientific Apparatus Makers Association (SAMA)
- Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
- South Coast Air Quality Management District - Rules and Regulations and Source Testing Manual (SCAQMD)
- State of California - California Code of Regulations (CCR)
- State of California - Construction Safety Orders (CAL/OSHA)
- Steel Structures Painting Council (SSPC)
- Tubular Exchanger Manufacturers Association (TEMA)
- U.S. Department of Labor - Occupational Safety and Health Administration (OSHA)

Equipment shall comply with all applicable requirements of Federal, State, and local codes and regulations. The Contractor shall adhere to the following code sections:

- Title 24, Title 8, Division 1, Chapter 4, Subchapter 4 (Construction Safety Orders)
- Subchapter 5 (Electrical Safety Orders)
- Subchapter 7 (General Industrial Safety Orders) of the California Code of Regulations (CCR)

The Division of Industrial Safety regulations are comprehensive and govern some of the equipment required to be furnished and installed under this Contract.

#### 5. WORKMANSHIP AND MATERIALS

The Contractor shall guarantee that the equipment furnished and work performed are in accordance with **Section 1A** of these Special Provisions.

Workmanship and materials shall conform to **Section 4-1** of the Standard Specifications in addition to the requirements specified in this Section.

5.1 Parts.

Equipment shall be new, designed, fabricated and assembled in accordance with the best modern engineering and shop practices. Individual parts shall be manufactured to standard sizes and gauges so that repair parts, furnished at any time, can be installed at the jobsite and not require that the equipment be returned to the manufacturer for factory installation. Like parts of duplicate units shall be interchangeable.

5.2 Materials.

Materials shall be suitable for service conditions. Iron castings shall be tough, close-grained gray iron free from blowholes, flaws, or excessive shrinkage and shall conform to ASTM A 48. Gray cast iron shall not be used for any parts in tension, parts normally subject to impact, parts with temperature above 400 degrees F, or pressure-containing parts handling hydrocarbons. Except where otherwise specified, structural and miscellaneous fabricated steel used in items of equipment shall conform to the Standards of the AISC and to **Part 8** of this Section.

5.3 Corrosion Due to Submergence.

All moving parts which will be submerged in water, and items in contact with these parts, shall be of corrosion-resistant materials. Parts shall be resistant to corrosion or abrasion by contacting chemicals and shall maintain their properties without deterioration due to the passage of time or exposure to light. Steel which will be submerged, all or in part, during normal operation of the equipment shall have a minimum nominal thickness of 1/4-inch.

5.4 Painted Surfaces. Painted surfaces shall be protected against impact, abrasion, discoloration, and other damage. All painted surfaces which are damaged prior to final acceptance of the Contract shall be repainted at Contractor's expense.

5.5 Warranty. The Contractor shall secure a warranty from the manufacturers of all equipment provided and installed in this Contract as defined in **Section 1A, Part 21** of these Special Provisions and **Section 3-13.3** of the Standard Specifications.

6. SAFETY GUARDS

Belt or chain drives, fan blades, couplings, exposed shafts, and other moving or rotating parts shall be covered on all sides by safety guards which conform to the General Industry Safety Orders of CCR Title 8 Division 1. Safety guards shall be fabricated from 16 US Standard (USS) gauge or heavier 316 stainless steel sheet metal, unless otherwise specified in these Special Provisions. Drawings and specifications of safety guards shall be submitted to the Engineer for acceptance prior to fabrication.

6.1 Guard Installation and Supports. Each guard shall be designed for easy installation and removal. In some cases, this may require a field check of the installation by the Contractor to avoid interferences and to assure easy

removal. Safety guards in outdoor locations shall be designed to prevent the entrance of rain and dripping water.

Necessary supports and accessories shall be provided for each guard to establish a stable, strong mounting of the guard as approved by the Engineer. Supports and accessories, including bolts, nuts, and washers, shall be 316 stainless steel.

Guards shall be secured to the driven machines or to foundations or floors by heavy structural angle supports and anchor bolts. Braces or supports secured to motors shall not be used. Braces and/or supports shall not bridge sound and vibration isolators.

6.2 Special Features. Guards shall be designed with adequate provision for movement of motors for adjustment of belt tension. Belt guards shall have a hole over both shaft centers to allow the shaft speed to be checked with a hand-held tachometer. The holes shall be 1-inch diameter with smooth edges and self-closing cover. Belt guards shall have a hinged front to allow easy access for changing belts and sheaves or chains and sprockets. Means shall be provided to permit lubrication, use of speed counters, and other maintenance and testing operations with the guard in the duty position.

## 7. EQUIPMENT BASES AND BEDPLATES

7.1 Materials and Appurtenances. A heavy, cast-iron or welded-steel base shall be provided for each item of equipment or package system that is to be installed on a concrete base.

Bases and bedplates shall be provided with the following:

- a. Machined support pads,
- b. Tapered dowels for alignment of mating or adjacent items,
- c. Adequate openings to facilitate grouting,
- d. Openings for electrical conduits,
- e. Threaded bedplate drain fittings,
- f. Seams and contact edges between steel plates and shapes shall be continuously welded and ground smooth.

Bedplate drains shall be piped with steel or PVC piping (or other material appropriate for contact with the fluid drained) to the nearest sump or designated drainage area, regardless of whether or not a detail is shown on the Contract Drawings.

7.2 Initial Leveling. Jacking screws shall be provided in the bases and bedplates of large equipment to aid in leveling prior to grouting. Jacking screws shall bear on a minimum 3-inch × 3-inch × 2-inch thick steel soleplate or larger and thicker as necessary not to exceed compressive strength of

concrete or as indicated on the Contract Drawings. Jacking or leveling screws shall not bear directly on concrete.

After assembly and installation on the concrete base, each unit shall be leveled and aligned in place using a precision level but not grouted until after the initial fitting and alignment of the connecting pipe(s). Pre-cut stainless steel shims shall be used for leveling. Leveling nuts shall not be allowed. Shims shall be installed so that tabs are easily accessible. A minimum of four(4) shims with a minimum total thickness of 0.015 inches shall be installed between the bedplate and the steel block at each anchor bolt. Each unit shall then be grouted to the concrete base.

7.3 Grouting. Each base and bedplate shall be completely filled with grout. Prior to grouting, all laitance, oil, dirt, etc., shall have been removed. Concrete surfaces for grouting under baseplates shall have a scratched surface roughened by raking before final set. The foundation area to be grouted shall be wetted thoroughly and standing water removed including any water in anchor bolt sleeves. Air holes shall be provided if required to avoid entrapping air and to allow full penetration of grout.

The grout shall extend to the edge of each base or bedplate and shall be beveled at 45 degrees all around the unit. Grout which is exposed at horizontal surfaces shall be rounded to provide drainage to appropriate points.

7.4 Leveling After Grouting. After grout has set, jacking screws shall be removed, and nuts on anchor bolts shall be tightened, followed by an overall check on leveling and alignment. Should equipment not meet tolerances of leveling and alignment, as recommended by the Manufacturer, corrective measures shall be taken to obtain the required tolerances.

7.5 Grouting for Special Cases. Reciprocating equipment, including instrument air compressors, shall always be grouted with epoxy grouts as manufactured by Carter-Waters, Master Builders, Inc., or equal.

7.6 Final Installation Check. No stresses shall be transmitted to equipment flanges. After final alignment and bolting, equipment connections shall be tested for applied pipe loads by loosening the flange bolts. If any movement of the joint occurs, the piping shall be adjusted to proper fit.

## 8. STRUCTURAL REQUIREMENTS

Structural steel shapes, built-up shapes, and steel plates shall conform to ASTM A 36 unless otherwise specified. Refer to **Division 5** of these Special Provisions for additional steel requirements. Required specific features of these structural elements include the following:

- a. All shop connections shall be welded. All field connections shall be bolted, unless otherwise specified.
- b. Fasteners on equipment that are subject to vibration and/or movement shall be self-locking type or shall be secured with cotter pins or safety wire.

- c. Thermal expansion and contraction for the temperature ranges indicated on the Contract Drawings, on the equipment data sheets, or as specified by the Engineer shall be considered in the design of the structural shapes.

Supports shall be designed, added, and/or modified as required to support the equipment at no additional cost to the District based on final certified manufacturer drawings or literature.

Drawings and calculations for equipment supports which may include, but are not necessarily limited to, foundations, footings, pads, and metallic superstructures shall be submitted to the District for acceptance in accordance with the requirements of **Division 1** of these Special Provisions.

#### 9. SEISMIC AND WIND RESTRAINT REQUIREMENTS

Equipment, components, and supporting structures furnished under this Section shall be provided with sufficient strength to prevent excessive motion or damage due to a wind or seismic event or vibrations. All equipment, components, appurtenances, and anchorage shall be designed to resist seismic forces in accordance with **Section 1K** of these Special Provisions, and wind forces in accordance with the County of Los Angeles Building Code and vibration isolation per **Part 11** of this Section.

#### 10. CONTROL REQUIREMENTS

Controls elements subject to damage shall be removed and packaged separately for shipment. Refer to **Division 17** of these Special Provisions for additional requirements.

#### 11. VIBRATION ISOLATION

All equipment, piping, and ductwork that vibrate during normal operation shall be provided with isolators.

11.1 Piping and Ductwork. For piping and ductwork isolation all penetration points shall be sleeved or otherwise formed to allow passage of piping or ductwork as well as maintain a minimum of 3/4-inch and maximum of 1-1/4-inch clearance around the outside surfaces. This clearance space shall be tightly packed with glass fiber followed by being caulked airtight.

11.2 Floor-Mounted Equipment. Isolator types for floor-mounted equipment shall conform to requirements of each equipment specification.

11.3 Air Handling Equipment. For air handling and HVAC equipment, in addition to vibration isolation, thrust restraints shall be provided.

11.4 Seismic Design. For earthquake protection, the spring mounts shall be furnished with rubber snubbers and all restraints shall be designed based on the acceleration levels of 0.5g in any horizontal direction and 0.35g in any

vertical direction as applied at the center of gravity. The most stringent of these design requirements or Los Angeles County Building Code design requirements shall be used.

11.5 Isolator Equipment Manufacturers. Isolation equipment shall be as manufactured by Mason Industries, Inc., Peabody Noise Control, Korfund, Amber Booth, Vibration Eliminator Company, Vibration Mountings, or equal. All vibration isolation materials shall be provided by a single manufacturer.

12. EQUIPMENT NOISE LEVEL LIMITATIONS, CONTROL, AND TESTING

12.1 Scope. This Section defines the noise level limitations and noise test requirements for the equipment in this project. The Contractor is responsible for enforcing vendor compliance with the noise level limitations defined in this Section.

12.2 References. The following publications are referred to in this Section:

- a. ANSI (American National Standards Institute) publications:
  - S1.1 - Acoustical Terminology
  - S1.2 - Method for Physical Measurements of Sound
  - S1.4 - Specifications for Sound Level Meters
  - S1.6 - Preferred Frequencies, Frequency Levels, and Band Numbers for Acoustical Measurements
  - S1.11 - Specification for Octave, Half-Octave and Third-Octave Band Filter Sets
  - S1.13 - Methods for Measurement of Sound Pressure Levels
  - S5.1 - Test Code for the Measurement of Sound from Pneumatic Equipment
- b. NEMA (National Electrical Manufacturer's Association) standard:
  - Standard Publication No. MG-1, Part 20, for Motors and Generators
- c. IEEE (Institute of Electrical and Electronics Engineers)
  - Standard 85 - Test Procedures for Airborne Sound Measurements on Rotating Electric Machinery
- d. Cal/OSHA (Occupational Safety and Health Administration Standards)
- e. AMCA (Air Movement and Control Association, Inc.)
  - 300 Standard - Reverberant Room Method for Sound Testing of Fans
  - 301 Standard - Methods for Calculating Fan Sound Ratings
  - 303 Standard - Application of Sound Power Level Ratings for Fans
- f. CAGI (Compressed Air and Gas Institute) and PNEUROP (European Committee of Manufacturers of Compressors, Vacuum Technology, Pneumatic Tools, Air Treatment Equipment and Condensate Treatment

Equipment) - Test Code for Measurement of Sound from Pneumatic Equipment

12.3 General. These noise limits are intended to provide a maximum combined equipment noise level of the facility that will satisfy in-plant, community, and governmental requirements.

- a. Process pipe lagging and/or insulation required to meet noise level criteria shall be installed by the Contractor as defined in the Contract Documents.
- b. Any equipment not meeting these noise requirement limits shall be equipped with removable sound enclosures and noise reduction insulation at the Contractor's expense. Any sound enclosure and/or insulation shall be easily removed and reassembled for regular maintenance.

12.4 Equipment Noise Level Limits.

- a. Sound pressure levels (SPL) specified in this Section are based on a reference pressure of 0.0002 microbar. The term dBA shall refer to the overall value of sound pressure level as measured by a sound level meter using the A-weighted network, slow response.
- b. Each item of equipment to be supplied for this project, unless otherwise noted, shall not exceed 85 dBA as measured at three(3) feet from the equipment and five(5) feet above the ground while the equipment is operating under all loads and/or speeds including full load and/or speed. Maximum sound pressure levels in the various octave bands are as indicated below and represent the maximum averaged upper limits. These maximum octave band sound pressure levels are not meant to occur concurrently. All equipment shall meet the maximum octave band sound levels specified while simultaneously complying with the overall sound pressure level of 85 dBA at three(3) feet and five(5) feet above the ground.

Equipment Group	Octave Band Center Frequencies, Hz							
	63	125	250	500	1000	2000	4000	8000
Group 1	80	80	80	80	77	77	73	73
Group 2	80	80	80	80	77	77	73	73
Group 3	—	See NEMA TR-1					—	—

- c. Equipment group descriptions are as follows:

Group 1

- Electric motors
- Compressors
- Blowers and fans
- Gear boxes

- Suction openings and silencers
- Pumps
- Control valves, restriction orifices, flow meters, piping systems
- Miscellaneous equipment including package units, etc.

Group 2

- Vents and silencers (intermittent operation)

Group 3

- Transformers
- Electrical switchgear
- Variable frequency controller (VFC)

12.5 Fan Noise Level Limits. Fan noise level limits and testing procedures shall comply with that of AMCA requirements as specified in this Section. All fans are subject to factory noise testing with the contract motor in accordance with the requirements specified in this Section. The factory sound power level rating calculations shall comply with AMCA Standard 301 and shall be the results of tests made in accordance with AMCA Standard 300 Test Code for Sound Rating. All fans shall be licensed to bear the AMCA Certified Sound Ratings Seal.

12.6 Submit Fan Test Procedure.

The Contractor shall submit the detailed factory noise testing procedure, configuration, and instruments to be used in the testing for District's acceptance. The Contractor shall clearly specify the configuration of the fan to be tested which shall be in compliance with Figures 1, 2, and 3 of AMCA Standard 300.

12.7 Fan Sound Pressure Calculation. The Contractor shall submit the total sound power level of the fan on an A-weighted network at each octave band in accordance with the above standards. The octave band sound power levels shall be combined logarithmically to obtain a single overall sound power level. The overall sound power level shall be converted to a sound pressure level, in dBA, assuming free field condition and using equation "B" of AMCA Standard 303. The term "4/R" in equation "B" of AMCA 303 shall be zero(0) for the free field calculation and the directivity factor "Q" shall be two(2) per AMCA 303. This calculated sound pressure level shall be submitted with all detailed calculations for District's acceptance. This free field condition shall be used for the sound pressure calculations of all fans in this project, unless one(1) of the installation types (A, B, C, or D) shown in AMCA 303 has been specified in the corresponding equipment specification section. If the installation is anything other than the AMCA 303 types, the Contractor shall conduct the sound pressure level calculations in accordance with equation "B" of AMCA 303 by submitting all formulas, values, and assumptions used for the environment where the fan is installed.

12.8 Compressor Noise Level Limits. All compressors furnished under this Contract shall be factory noise tested with their contract motor in accordance

with CAGI and PNEUROP Test Codes (whichever is applicable) and ANSI S 5.1 for the Measurement of Sound from Pneumatic Equipment. The Contractor shall submit the test procedure, setup, and instrumentation for District's acceptance. All the test results shall be submitted for District's acceptance.

12.9 Contractor and Vendor Responsibility.

12.9.1 Data Required:

- a. Each equipment vendor supplying motor-operated or noise-generating equipment shall complete the Equipment Sound Level Data Sheet (Attachment 1) attached at the end of this specification. This data sheet shall be completed by the vendor and submitted to the Contractor with a signed guarantee.
- b. When equipment is motor driven, data for both driven and driving equipment shall be submitted. The allowable SPL shall apply to the combined noise level of the driven and driving equipment, and the speed changer, if any. This also applies to package systems where the allowable SPL shall apply to the total combined noise level of the equipment package.
- c. The vendor's data sheet shall clearly indicate the conditions under which the noise tests were conducted, e.g., anechoic chamber, concrete block room, metal building, etc., and the measured ambient background noise level during testing. The data sheet shall also explain how the equipment will be modified to meet District criteria.
- d. The completed sound data sheet shall be submitted to the Engineer for review and acceptance.

12.9.2 Special Designs:

- a. When the specified noise levels cannot be met by the vendor's standard design, alternatives for a special design or for acoustic treatment of a standard design shall be provided and paid for by the Contractor.
- b. Acceptance of special acoustic treatment must be received from the Engineer prior to release to fabrication of the equipment.
- c. Abatement and/or lagging designs shall not limit equipment operation, maintenance, or accessibility and shall be easily removable. Abatement or lagging designs shall not create any safety or fire hazard. All lagging material must be accepted by the Engineer prior to installation.

12.9.3 Guarantee:

- a. The Contractor is ultimately responsible for guaranteeing sound levels and making all modifications at its expense to meet the sound level limitations.

- b. The Engineer reserves the right to reject any item which, when shop tested (using the specified test procedures), does not meet the required noise limits.

12.9.4 Guarantee Test:

- a. Noise guarantee acceptance tests shall be performed by the vendor for all equipment supplied. Mutual agreement between the Contractor and the Engineer as to the test date and time shall be reached in advance of the testing.
- b. Factory noise tests may be waived if specified in individual equipment sections of these Special Provisions. If the noise shop test has been waived and the equipment exceeds required noise limits on the field test, remedial action will be required at the Contractor's expense to meet the noise limits.

12.9.5 Installation Tests:

- a. The Contractor shall perform complete noise tests on all installed equipment and electrical items shown or listed in this project. The tests shall not be conducted without prior acceptance obtained from the Engineer. The tests shall determine whether the individual equipment item has met the guaranteed noise level quoted by the vendor or as defined in this Section. A noise test report shall be submitted to the Engineer for acceptance immediately following the test.
- b. Where said equipment does not meet the required noise levels, the Contractor shall modify the installation, including adding additional acoustical treatment, at no additional cost to the District, and retest the equipment until the noise limits can be reached. Failure to obtain successful noise limit certifications shall not constitute the basis of an extra work claim or time extension claim.

12.9.6 Test Procedure: Instrumentation to perform the noise shop tests and field tests shall meet ANSI Standards: S1.4, S1.6, and S1.11. Tests shall be performed in accordance with ANSI Standards S1.2 and S1.13.

13. EQUIPMENT WARRANTY

The Contractor shall warrant the equipment furnished and work performed in accordance with **Section 1A, Part 21** of these Special Provisions. Equipment shall be warranted against:

- a. Faulty or inadequate design,
- b. Improper assembly or erection,
- c. Defective workmanship or materials,

- d. Leakage, breakage, or other failures.

14. EQUIPMENT INSTALLATION

The Contractor shall obtain installation instruction booklets or other recommendations from the equipment manufacturers as to procedures for, sequences of, and tolerances allowed in equipment installation. One(1) copy of this information shall be given to the Engineer prior to installation of equipment. Whenever applicable, the Contractor shall obtain the services of a manufacturer's representative specifically trained in erection of its equipment to supervise the installation.

14.1 Grout. The manufacturer's recommendations as to grout spaces required, type of grout to be used, and tolerances for leveling and alignment, both vertical and horizontal, shall be obtained and followed.

14.2 Rivets. Rivets shall be set by hydraulic tools and shall be expanded to fill the holes completely. The surfaces of all riveted joints shall be in close contact throughout.

14.3 Access Openings. Where temporary openings are necessary through walls and partitions for the entry or installation of mechanical equipment, the permanent work at said openings shall be executed after equipment enters the building or after temporary facilities are removed. Permanent access panels shall be anchored into the building construction in accordance with the Contract Documents.

14.4 Connections. No rigid connections between equipment and the building structure shall be made that degrade the noise and vibration isolation system. Electrical conduit connections shall be looped to allow free motion of the isolation equipment.

14.5 Preparation for Installation. Skilled craftspeople (e.g., millwrights) experienced in installation of the equipment or similar equipment shall be used. Applicable specialized tools and equipment, such as precision machinist levels, dial indicators, and gauges, shall be utilized in the installations. Prior to installation of equipment, sacking and concrete preparation shall be completed, and the work area shall be maintained in a vacuum-clean condition during the equipment installation.

15. SPECIAL TOOLS AND ACCESSORIES FOR REGULAR MAINTENANCE

Equipment requiring periodic repair and adjustment shall be furnished complete with special tools, instruments, and accessories required for proper maintenance. Equipment requiring special devices for lifting or handling shall be furnished complete with those devices. Drawings and data on such devices shall be submitted to the Engineer for acceptance prior to delivery.

16. LUBRICATION

The following requirements apply to all mechanical equipment requiring

lubrication provided on this project.

16.1 Startup Lubrication. The Contractor shall provide, add, and drain flushing oil for each lubricant system where applicable for startup, preliminary operation, and testing. The Contractor shall supply and add lubricants required for the initial continuous operation of all equipment. Lubrication systems shall not require attention during startup or shutdown.

16.2 Future Lubrication Supply Need. The Contractor shall submit with the regular submittal equipment package, a list showing the proper lubricants for each item of mechanical equipment, approximate quantities needed per year of continuous operation, and recommended lubrication intervals. Wherever possible, the types of lubricants shall be consolidated with the manufacturer's approval to minimize the number of different lubricants required for plant maintenance. Lubrication systems shall not require attention more than once per week during continuous operation.

16.3 Lubrication Application Points. Where lubrication is provided by means of grease, a pressure-gun system with a separate nipple or zerk for each point shall be used where feasible. Equipment lubrication fittings shall be extended with piping beyond obstructions such as guards, covers, housings, and acoustic enclosures to provide ease of lubrication without disassembly or the stoppage of the operation of the unit.

## 17. DRIVE UNITS

17.1 General. Drive units shall be designed for twenty-four(24)-hour continuous-duty service and shall be constructed so that oil leakage around shafts is prevented.

17.2 V-Belt Drives. Each V-belt drive shall include a sliding base or other suitable tension adjustment that is accessible after grouting in accordance with **Part 7** of this Section. V-belt drives shall have a service factor of at least 2.0 at maximum speeds using the nameplate rating of the driving motor.

Positive tensioning devices shall have the following:

- a. Bearing lubrication points extended to accessible locations
- b. Adjustable motor bases with positioning screws
- c. Non-sparking guards to completely enclose all V-belts and sheaves.

17.3 Gears. Each gear reducer or increaser shall be oil lubricated and totally enclosed. Each gear shall have a nameplate service horsepower rating equal to the nameplate rating of the driving motor. Each gear box shall bear an AGMA nameplate which shows the service horsepower, actual service factor for the actual mechanical or thermal rating, as applicable, and the AGMA gear quality rating.

17.3.1 Thermal Capacity.

Each gear shall have a mechanical and thermal capacity equal to or greater than an equivalent horsepower, determined by multiplying the nameplate service horsepower rating by the specified service factor.

The thermal rating for the equivalent horsepower shall be obtained without auxiliary cooling equipment, such as heat exchangers. An exception to this would be a direct-connect fan mounted on each unit may be used to obtain the thermal rating. The units shall be designed to operate continuously for the conditions specified in a location where ambient temperatures vary from 40 degrees F to 100 degrees F.

17.3.2 Special Gears.

Helical, spiral-bevel, and combination gears shall have a service factor of at least 1.50. Worm gears shall have a service factor of at least 1.20.

18. ELECTRIC MOTORS

Electric motors furnished with equipment shall comply with the requirements of **Division 16** of these Special Provisions.

19. COUPLINGS

Motor couplings shall be either steel-tapered grid (steelflex) type, spacer type, gear type, or the flexible-metallic diaphragm type, unless otherwise specified.

Couplings shall be completely machined to a tolerance of not more than 0.001-inch on the radius and face-to-face. Both halves of the couplings shall be distinctly match-marked.

Couplings shall be keyed in place and cylindrical fittings shall be sufficiently light in weight to permit easy and rapid removal of the hub in the field without the need for heating.

Removable coupling guards shall be provided and shall be designed to prevent contact with the coupling or shaft. Guards shall be approved by Cal/OSHA and shall be as specified in this Section.

Coupling spacers of sufficient length shall be provided where required for maintenance of bearings, seals, and coupling hubs without disturbing the alignment and removal of equipment or driver.

20. BEARINGS

Ball bearings shall be oil-lubricated single-row, double-row, or shall be double-shielded. They shall be regreasable, single-row width, and made from vacuum degassed steel, unless otherwise specified in each equipment section of these Special Provisions (except for belted service frames where roller bearings

are furnished). Bearings, if specified as grease-lubricated, shall be equipped with readily accessible inlet and outlet plugs or fittings to allow for "in service" regreasing. Inner bearing protection shall consist of an internal shaft slinger or inner bearing cap.

21. SHAFTS

21.1 Critical Speed. The Contractor shall design the shafts for rotating equipment such that the critical speed of the shaft shall not be above 80 percent and below 130 percent of the normal operating speed of that shaft. In case of multi-speed operation of the equipment, the same limits apply to the lowest and highest operating speeds of the equipment.

21.2 Submittal. The Contractor shall submit detailed critical speed calculations for each individual shaft of all rotating equipment, for District's acceptance. The Contractor shall clearly specify the shaft diameter, length, material, weight, bearing, or other dynamic loads imposed on the shaft and their locations from the bearings. If the shaft is multi-diameter, the Contractor shall clearly show each individual shaft diameter with its corresponding length on the shaft sketch submitted. The Contractor shall clearly specify and submit all the formulas used in the calculations of the critical speed. Finished results without the calculations and formulas will not be acceptable. Computer-printed calculations with all the formulas will be acceptable.

22. GASKETS

Gaskets shall be provided in all flanged assemblies. Unless otherwise specified, gaskets shall be as specified in **Divisions 11** and **18** of these Special Provisions. Only non-asbestos type gaskets shall be installed.

23. CONNECTIONS

23.1 Dielectric Fittings. Dielectric fittings shall be provided for all dissimilar metal piping connections. Dielectric fittings shall be as manufactured by Capitol, Dresser Industries, or equal, as accepted by the Engineer. Fittings shall be flanged or union type and shall be capable of isolating currents at the 600 volt level.

23.2 Rivets. Rivets shall only be used where specified in the Contract Documents. Rivets on load bearing surfaces shall be flat headed, countersunk, and driven flush. Rivets used for general purposes shall be pan-headed. All rivets shall be 316 stainless steel.

23.3 Bolts. Bolts shall be flush or have the least practicable projection when in the fully tightened position. All bolts and nuts shall be 316 stainless steel.

23.4 Aluminum. Where aluminum metals are placed in contact with or fastened to ferrous metals, the contact surfaces shall be coated as specified in **Section 9A** of these Special Provisions.

24. SEALS

The Contractor shall procure seals and seal auxiliaries through the original equipment manufacturer. All sealing devices shall be installed by the original equipment manufacturer. Where packing is specified, only non-asbestos type packing shall be installed.

Where seals are not specified, the Contractor shall follow the recommendations of the equipment manufacturer suitable for the service specified.

The Contractor shall design, route, furnish, install, support, and anchor the seal or cooling water supply piping where specified as a barrier fluid or for cooling water for seals or bearings. Seal system guidelines outlined in the pump specifications or equipment manufacturer's installation information shall be followed by the Contractor.

The Contractor shall submit complete details of the seal water or bearing cooling water piping along with valves and instruments for District's acceptance. All items with their corresponding catalog cuts, materials of construction, complete pipe routing, and sizes shall be submitted for District's acceptance.

As a minimum, the water piping to each seal or bearing shall have the following:

- a. Inlet isolation ball valve,
- b. Needle valve for flow control,
- c. Flowmeter,
- d. Inlet pressure gage,
- e. Inlet thermometer,
- f. Outlet thermometer,
- g. Outlet isolation ball valve, and
- h. Outlet pressure gage.

Where mechanical seals are specified or used, the maximum shaft deflection to prevent damage to the seal and per ANSI/Hydraulic Institute Part 1.3 shall be identified and a shaft deflection calculation shall be submitted showing the maximum deflection at the seal does not exceed the maximum allowable for the mechanical seal.

25. EQUIPMENT ACCESS

All equipment, including valves, dampers, and trays, are required to be installed with adequate accessibility.

The facility has been designed to supply ample access for maintenance and operation, as indicated on the Contract Drawings. The Contractor shall conform to and maintain this access when redesign is required due to the Contractor submitting equipment that is not the same manufacturer and model as that shown on the Contract Documents. The Engineer may reject any proposed installation of alternate equipment should necessary access not be provided in the proposed alternate design.

The Contractor shall route electrical conduit in such a fashion that the motor/device can be removed without having to first move conduit or electrical fittings.

26. PAINTING

All shop painting of equipment shall be per **Section 9A** of these Special Provisions. All field painting shall be per **Section 9A** of these Special Provisions, if required.

27. PREVENTION OF CORROSION

Metallic materials shall be protected against corrosion. Equipment enclosures shall be given rust-inhibiting treatment and standard finish by the manufacturer. Aluminum shall not be used in contact with soil, and, where connected to dissimilar metal, shall be protected by accepted fittings and with treatment as specified in **Section 9A** of these Special Provisions. Parts such as anchors, bolts, braces, boxes, bodies, clamps, fittings, guards, nuts, pins, rods, shims, thimbles, washers, and miscellaneous parts shall be made of 316 stainless steel, unless shown otherwise.

28. STORAGE AND PRESERVATION OF MATERIALS AND EQUIPMENT

28.1 General. Equipment provided for this project shall be boxed, crated, or otherwise completely enclosed and protected during shipment, handling, and storage. Each container or piece of equipment shall be clearly marked with the Contractor's name, project name, and location. Equipment shall be stored on raised supports protected from exposure to the elements and shall be kept thoroughly dry at all times. Pumps, motors, drives, electrical equipment, and other equipment having anti-friction or sleeve bearings shall be stored in weathertight storage facilities such as warehouses. Covering with visqueen or similar material will not be considered a weather-tight enclosure.

Painted surfaces shall be protected against impact, abrasion, discoloration, and other damage. Painted equipment surfaces which are damaged prior to acceptance shall be repainted in entirety to the satisfaction of the Engineer.

28.2 Electrical Equipment. Electrical equipment, controls, and insulation shall be protected against moisture or water damage. Desiccants shall be provided for electric equipment that are not provided with space heaters. Space heaters provided in the equipment shall be connected and operating at all times until equipment is placed in operation.

28.3 Storage and Preservation at Construction Site. The Contractor shall erect and maintain on the site temporary storage facilities accepted by the Engineer. At its option and with the Engineer's acceptance, the Contractor may provide a suitable offsite storage space. The Engineer shall have access to the offsite storage facilities at any time to inspect the equipment stored therein.

28.3.1 Protective Procedures. The following procedure is to be used for the protection of equipment from the time of arrival at the construction site until it is placed in operation.

Any additional protective measures specified by the equipment manufacturer shall be performed by the Contractor. In the event of conflict between the manufacturer's recommendations and the requirements of this specification, the Engineer's decision will be the final determination. The Contractor's bid shall be based on the higher cost of the two options should there be in a conflict between manufacturer's recommendations and the requirements of this specification. The Engineer selecting the costlier of the two options shall not be the basis of an extra work claim by the Contractor.

The Contractor shall keep records to document the protection given the equipment while the manufacturer's guarantee is in effect.

28.3.1.1 Rust Prevention. The rust preventives referred to in this Section are Mobilarma compounds. Equal products may be accepted by the Engineer.

All interior and exterior surfaces shall be clean and dry before any rust prevention materials are applied. Mineral spirits such as VARSOL or Mobilarma 247, any Stoddard solvent, or equal, shall be used for cleaning of surfaces prior to application of any preservative compound. Kerosene or gasoline shall not be used as cleaning agents.

- a. Mobilarma 524 shall be used for all bearings and internal surfaces.
  1. Prime grade turbine oils, such as Terresso/Teresstic Turbine Oil, are not equivalent to Mobilarma 524.
  2. All rotating equipment protected by this compound shall be turned over weekly to keep bearings and other critical surfaces coated. Tools that will mar the shafts on equipment shall not be used for this operation.
  3. At two-week intervals, water shall be drained from all reservoirs protected with Mobilarma 524, and the required rust preventive shall be added to the proper level. If the fluid becomes dirty or contaminated with water, the reservoir shall be drained, flushed with solvent, and refilled with Mobilarma 524.

- b. Mobilarma 798 shall be used for all exterior surfaces.
  1. Mobilarma 798 does not have lubricating properties. Before placing the protected equipment part in service, the film shall be removed from the bearing surfaces, threads, or areas that come in contact with the lubricants.
  2. Coatings shall be inspected at two-month intervals and shall be renewed if there are any large breaks in the film.

28.3.1.2 Vapor Phase Inhibitors. If vapor phase inhibitors are used to protect the interiors of mechanical equipment the seals shall be examined when the equipment is received at the site. Any damaged vapor seals shall be repaired or replaced, and the inhibitor renewed if necessary.

Vapor seals shall be protected until the equipment is serviced for start-up. Any damage to seals prior to such time shall be immediately repaired.

Vapor phase inhibitors shall be renewed at the time intervals specified by the manufacturer.

28.3.1.3 Blanking Plates. All pumps, compressors, turbines, and blowers, after installation at their final service location and being thoroughly cleaned, shall be isolated from all piping by installing blanking plates between the pipe flanges. Gaskets shall be used on both sides of the blanking plates. The blanking plates shall not be permanently removed until after the pipes have been cleaned and tested.

28.3.1.4 Miscellaneous Mechanical Equipment. Other mechanical equipment, such as hoists, conveyors, monorails, cranes, elevators, flight scrapers, and other miscellaneous mechanical equipment, shall be protected as follows:

- a. Oil-lubricated bearing brackets and gear cases shall be flushed with solvent until clean. The units shall be filled with Mobilarma 524 to the level of the bottom of the shaft as a minimum. The shaft shall be turned several revolutions to apply a protective film coating, uniformly, to the entire shaft and bearings.
- b. A coating of Mobilarma 798 shall be applied to all shafts, couplings, and exposed machined surfaces.
- c. All exposed chains shall be removed. The chains shall be cleaned with a solvent, coated with Mobilarma 778, and wrapped in kraft paper. Each wrapped chain shall be labelled to provide the proper identification and stored with any accessories.

## 29. GALVANIZING

29.1 General. Galvanizing shall be by the hot-dip process and shall conform to the applicable requirements of **Section 210-3 "Galvanizing"** of the Standard Specifications, ASTM A 123/A 123M for structural steel members and

fabrications, and ASTM A 153/A 153M for bolt, nuts, washers, and hardware. Fabrication and galvanizing procedures for all steel products that are to be galvanized shall be in accordance with ASTM A 385. Fabrication techniques that would cause steel distortion or embrittlement shall not be used. If there are any conflicts between the specifications, the more stringent requirements shall apply.

29.2 Surface Preparation. Surface preparation prior to galvanizing shall be in accordance with standard industry practice (degreasing, pickling, and fluxing) to provide an acceptable surface for quality hot-dip galvanizing.

29.3 Repair of Coatings. Repair of damaged coatings shall only be allowable per Section 6.2 of ASTM A 123/A 123M. Any coatings with areas that require repair that do not meet the criteria specified in Section 6.2.1 or Section 6.2.2 of ASTM A 123/A 123M shall be rejected. Any repairs shall be in accordance with ASTM A 780.

29.4 Submittal. Prior to delivery, the Contractor shall submit for District's acceptance, a minimum of five(5) original copies, of the coating applicator's notarized Certificate of Compliance. This Certificate shall document that the hot-dip galvanized coatings meet or exceed the specified requirements of ASTM A 123/A 123M and/or ASTM A 153/A 153M as applicable in accordance with the requirements of **Section 1A, Part 9** of these Special Provisions.

In addition, the Contractor shall submit for District's acceptance certified coating thickness data in accordance with the sampling and testing methods outlined in ASTM A 123/A 123M and/or ASTM A 153/A 153M prior to delivery. For the purposes of the sampling and testing procedures in Sections 7 and 8 of ASTM A 123/A 123M, a "lot" shall be defined as all articles of the same size that are galvanized during a single batch in the galvanizer's kettle. The number of test specimens per lot shall be as specified in Section 7 of ASTM A 123/A 123M, and the number of measurements per specimen shall be as specified in Section 8 of ASTM A 123/A 123M.

The Contractor shall obtain the acceptance of the District on the Certificates of Compliance and the galvanized sample coating thickness data submittals prior to shipment authorization for the first batch of galvanized material to the job site. The galvanized coating thickness test data submittal shall clearly identify the lots used for the measurement, the quantity of the test specimens in each lot, the number of the measurements per specimen and the actual measurements taken. All of the required information shall be submitted in a single submittal for District's acceptance.

29.5 Verification. The District reserves the right to verify the coating thickness data of at least one(1) article of the same size per delivery, up to 10 percent of all articles of the same size per delivery, prior to installation at the jobsite using a magnetic thickness gage in accordance with ASTM E 376. This gage shall be submitted for District's acceptance in accordance with **Section 9A, Part 20** of these Special Provisions. The device shall be delivered to the District at least sixty(60) days prior to the arrival of the first batch of any galvanized steel at the job site. If any articles from a delivery load do not meet the required coating thickness, the District reserves the right to

test any additional articles of the same size in the delivery load in question or reject all of the articles of the same size in the delivery load in question. Any material that does not meet the required minimum coating thickness will be rejected. All costs for testing of galvanizing shall be paid by the Contractor.

30. WELDING

For welding of miscellaneous metals, refer to **Section 5B** of these Special Provisions. For welding of structural aluminum, refer to **Section 13C** of these Special Provisions.

30.1 Acceptable Welding Procedures. All pressure welds shall be made in accordance with Section IX of the ASME Boiler and Pressure Vessel Code, Welding and Brazing Qualifications. Only the following welding procedures are acceptable to the District:

- a. Shielded Metal Arc Welding (SMAW)
- b. Submerged Arc Welding (SAW)
- c. Gas Metal Arc Welding (GMAW/MIG)
- d. Gas Tungsten Arc Welding (GTAW/TIG)
- e. Gas-Shielded Flux Cored Arc Welding (FCAW-g)

Other welding processes shall not be used without prior acceptance from the District. All surfaces to be welded shall be free from loose scale, slag, rust, grease, paint, and any other foreign material.

30.2 Electrodes. Welding electrodes, automatic or manual, shall deposit a composition with chemical and mechanical properties corresponding to the material being welded. Where applicable, electrodes shall meet ASME specifications and AWS specifications. For welding between stainless steel parts, ER316 electrode type shall be used. For welding between dissimilar metals, E309L electrode shall be used. Electrodes classified in Group Nos. F1 and F2 in Table QW-432 of Section IX of the ASME Code shall not be used for pressure-retaining welds.

30.3 Welding Quality. Each weld shall be uniform in width and size throughout its full length. Each layer of welding shall be smooth, free of slag, cracks, pinholes, and undercut. Each layer of welding shall be completely fused to the adjacent weld beads and base metal. All welding seams and joints shall be airtight with a smooth interior surface.

30.4 Weld Repairs. Repair, chipping, and grinding of welds shall not gouge, groove, or reduce the base metal thickness.

Repairs to castings, by welding or other means, shall be performed only after obtaining written acceptance from the Engineer. No repairs shall be permitted on cast iron and/or ductile iron castings.

30.5 Not Used.

30.6 Not Used.

30.7 Not Used.

31. SYSTEM INTEGRITY TESTS

31.1 Scope. System integrity tests for the equipment furnished under this Contract shall be as follows:

- a. Static pressure test for non-pressure piping and equipment in accordance with **Section 18D** of these Special Provisions.
- b. Hydrostatic pressure test for pressure piping in accordance with **Section 18D** of these Special Provisions.

31.2 Damage During Tests. The Contractor shall be fully responsible for the proper operation of equipment during tests and shall not make any claim for damage which may occur to equipment prior to the time when the District formally accepts the Contract.

31.3 Rejection of Equipment. Should inspection, test, or analysis of equipment reveal faulty design, inferior or defective materials, excessive noise or vibration levels as defined by measurable levels defined in this Section, poor workmanship, improper installation, excessive wear or nonconformity with the requirements of the Contract Documents, such equipment will be rejected and shall be replaced with satisfactory work at the Contractor's expense.

Electrical equipment which has been subjected to damage by moisture, water, or other deleterious substances shall be thoroughly dried and have a dielectric test performed upon it as directed by the Engineer. Alternatively, the electrical equipment may be replaced by the Contractor at its expense.

32. COORDINATION

The work shall be coordinated with the work of all other trades. Coordination shall include adequate clearances for the installation and maintenance of equipment, physical and electrical requirements of equipment, and/or equipment requiring connections.

The Contractor shall perform all necessary work to join with and receive work of other trades, provide electric service, extend conduits, and make all necessary connections to minimize interruption of service in all areas.

33. FIELD ROUTING OF SMALL DIAMETER PIPING.

Design drawings are diagrammatic and do not show all offsets, bends, elbows, or other details which may be required for proper installation of the work. Field routing and support of piping smaller than four(4) inches in diameter is generally not shown and shall be proposed by the Contractor.

34. NOT USED

35. EQUIPMENT INSTALLATION SPECIFICS.

Equipment such as pumps, blowers, etc., shown on the Contract Drawings is representative only. Actual dimensions and electrical requirements will depend on equipment actually supplied by the Contractor.

The Contractor shall take measurements for its work at the installation sites, verify subcontractor's drawings, and be responsible for the proper installation within the available space of the equipment specified and shown on the Contract Drawings. The best possible headroom and space conditions for the installation shall be provided. The most orderly arrangement of conduit, piping, valves, fixtures, hangers, etc., shall be provided.

The Contractor shall secure the acceptance of the Engineer for any variations before making any changes to the design.

36. INSTALLATION CHECK AND START-UP

The Contractor shall perform all work required to install and place into operation the equipment in accordance with the manufacturer's recommendations. An experienced, competent, and authorized representative of the manufacturer or supplier of each item of equipment shall visit the site of the work and inspect, check, and approve the equipment installation. The equipment supplier's representative shall be present when the equipment is placed in operation. The equipment supplier's representative shall revisit the job site as often as necessary until the equipment installation and operation is satisfactory to the Engineer.

Each equipment supplier's representative shall submit to the District a written report certifying that the equipment:

- a. has been properly stored and maintained since delivery to the jobsite
- b. has been properly installed and lubricated
- c. is in accurate alignment
- d. is free from any undue stress imposed by connecting piping or anchor bolts, and
- e. has been operated under full load conditions and operated satisfactorily.

37. STANDARD PRODUCTS

Except as modified in this Section, materials and equipment shall be standard catalog products of manufacturers regularly engaged in the manufacture of the products. The material and equipment provided shall have been in satisfactory use at least two(2) years in other installations.

If in the Contract Documents a particular brand or make of material is shown or specified, such brand or make of material is to be regarded as a standard. The Contractor shall make every effort to procure the standard material.

37.1 Alternates to Standard Products. If the Contractor desires to submit a brand or make of material other than the standard for acceptance, it shall make such request in writing. The request shall refer to the section number of the Special Provisions and shall compare the Contractor's proposed substitution with the specified standard with respect to the composition, characteristics, workmanship, operational economy, maintenance, and coordination with other materials. Any other brand or make of the material may be accepted if it is, in the opinion of the Engineer, the recognized equal of that specified with respect to composition, characteristics, performance, workmanship, operational economy, maintenance, coordination with other materials, and if it is suitable for the purpose intended. The Engineer's decision as to whether or not a substitution will be permitted shall be final and conclusive. Any requested substitution is subject to the requirements of **Section 4-6** of the Standard Specifications.

37.2 Preference for Materials Made in the USA. It is preferred that all materials incorporated in the work be, wherever available, manufactured in and made from products of the United States. Any foreign manufactured equipment or components shall be clearly stated in the Contractor's proposal. The Contractor shall insure the availability of spare parts for any foreign made items as well as compatibility of necessary maintenance tools in English measurement units.

38. SUBMITTAL DATA

All submittals shall be submitted complete and in accordance with the requirements of **Section 1A** of these Special Provisions.

Each submittal shall have a statement to the effect that the equipment is in accordance with all requirements as set forth in the specification and related documents. Deviations or exceptions taken by the Contractor to any part of the specifications or related documents shall be grounds for the District to reject the equipment. The Contractor shall include a listing of all deviations or exceptions to the specifications or related documents in the submittal package.

Unless otherwise specified, the following information shall be submitted with each complete submittal. Additional submittal data is required by individual equipment Sections of these Special Provisions.

38.1 Mechanical Equipment Submittals Prior to Fabrication. The equipment submittal shall be submitted to and accepted by the Engineer prior to

fabrication of equipment. The equipment submittal shall as a minimum contain the following data:

- a. Name of equipment manufacturer.
- b. Equipment type and model.
- c. Equipment full load speed or capacity.
- d. Design temperature and pressure.
- e. Service factor for motors and gear reducers.
- f. Minimum AMBA (L<sub>10</sub>) bearing life and shaft critical speed calculations.
- g. Shaft deflection calculations when required.
- h. Shop drawings detailing individual equipment items and erection drawings showing as-built equipment locations and connections.
- i. All principal dimensions, including those required for the foundation, maintenance, and piping.
- j. Direction of rotation and maximum rotative speed (where applicable).
- k. All horizontal and vertical clearances necessary for dismantling.
- l. Size, type, location, and identification of all major and minor pipe connections for vents, drains, lube oil, instruments, controls, etc. including those to be plugged.
- m. Auxiliary piping, fittings, and equipment furnished.
- n. List of reference drawings.
- o. Certified performance curves (where applicable).
- p. Electric motor submittal information shall conform to the requirements of **Division 16** of these Special Provisions.
- q. Drawings and complete design data showing the construction of vibration isolation devices to be used including isolators.
- r. Equipment Manufacturers Quality Control and Welding Procedures. This submittal shall include a description of all procedures for welding, weld repairs, weld equipment, and qualification weld tests.
- s. Equipment guarantee from defects in design, materials, and workmanship.

- t. Nameplate drawings.
- u. Drawings of safety guards for belt or chain drives, fan blades, couplings exposed shafts, and other moving or rotating parts.
- v. Equipment manufacturer's recommendations and instructions for equipment storage, handling, and installation.
- w. Weights of electric motor and the heaviest piece of equipment that must be handled for normal maintenance.
- x. Any required special tools, instruments and accessories for proper maintenance.
- y. Detailed drawings with substantiating seismic and wind load calculations for equipment support and anchorage details. These calculations shall be performed by a Civil or Structural Engineer currently registered in the State of California.
- z. Allowable forces and moments data on pump and vessel nozzles and other types of connections on all equipment supplied.
- aa. Completed Equipment Sound Level Data Sheets (Attachment 1) as attached at the end of this Section for motor operated or noise generating equipment. Where applicable the Contractor shall submit alternatives for special design of acoustical treatments for equipment unable to meet specified noise levels. Noise test reports shall be submitted on all installed equipment and electrical items listed in the Special Provisions within thirty(30) days following the test.
- bb. Any special protection (for rain, dust, cold, etc.) required for startup, operation, and periods of idleness under environmental conditions specified for this jobsite.
- cc. Lubrication schedules for equipment, including lubricant types, quantities needed, and lubrication intervals required per year of continuous operation. This shall include the names and addresses of lubrication material suppliers.

38.2 Operation-Maintenance Training.

Course outlines for operation training shall be submitted thirty(30) days prior to training session for acceptance.

Resumes and proof of experience of each instructor for operation training shall be submitted thirty(30) days prior to the training session for acceptance. The Engineer shall be the sole judge as to the sufficiency of experience of the proposed instructor.

38.3 Shop and Field Testing.

Test procedures for shop tests shall be submitted with the first submittal for review and acceptance.

Pressure testing procedures shall be submitted with the first submittal for review and acceptance.

Results of shop and field tests including samples, test procedures, list of equipment used for testing, and test data including tables and curves shall be submitted for acceptance. The results of shop testing may be required prior to the District authorizing shipment of equipment to the jobsite.

38.4 Spare Parts Lists. Spare parts lists shall be submitted for equipment provided under this Contract. The lists shall include manufacturer's designation or identification of any spare parts recommended by each equipment manufacturer for operation of the equipment for a period of three(3) years following expiration of the equipment guarantee unless otherwise specified. The recommended spare parts shall be in a table format and shall include the address nearest to the jobsite where the spare part can be obtained, the ordering nomenclature, and current price of each recommended spare part.

<b>Local Parts and Service Contact:</b>	Name: _____			
	Address: _____			
	Phone: _____			
<b>Equipment Identification/Designation</b>	<b>Quantity</b>	<b>Name of Part/Description</b>	<b>Part Number</b>	<b>Price/Date</b>

38.5 Operation, Maintenance and Service Manuals. One(1) electronic copy of operation, maintenance, and service manuals shall be submitted through Unifier™ for all mechanical equipment provided under this Contract and as specified in the Equipment Schedule in this Section. The electronic manuals shall be in text-searchable PDF format (Adobe Acrobat latest version) with a "Table of Contents" for each document and "Thumbnail" images for each page or image in the document.

All material shall be scanned at a minimum resolution of 300 dpi. For color text, charts, drawings, graphs and/or photographs, the images shall be scanned using a color scanner. Black and white charts, drawings, graphs, and/or photographs shall be scanned in black and white unless grayscale is necessary to achieve a superior quality image. Grayscale shall NOT be used for the entire document.

All scanning shall conform with the following ANSI/AIIM standards: ANSI/AIIM MS44-1988 (R1993), Recommended Practice for Quality Control of Image Scanners, and AIIM TR38-1996, Compilation of Test Targets for Document Imaging Systems.

The manuals shall include the following information:

- a. Complete operating instructions including start-up, normal operation, and emergency shut-down for all equipment installed.
- b. Legible copies of all accepted shop drawings.
- c. All equipment maintenance and service instructions including a list of preventive maintenance items and their frequency of occurrence.
- d. Complete parts list of each piece of equipment.
- e. Recommended parts list for preventive maintenance.
- f. All available equipment descriptive literature.
- g. Operating characteristics, performance data, and ratings for each piece of equipment.
- h. All documentation, in accordance with **Division 16** and **Division 17** of these Special Provisions for electrical devices, instruments, and apparatus furnished as part of mechanical equipment.
- i. Final factory test reports and curves where applicable.
- j. All other information pertinent to the proper maintenance and servicing of equipment and systems provided in the project.
- k. Name, address, and telephone number to obtain service for each manufacturer's equipment.

These manuals shall be in addition to any instructions packed with the equipment and shall be submitted to the Engineer for acceptance within sixty(60) days after shipment of the equipment and at least four(4) weeks before equipment startup.

In addition to the electronic copy of the manuals, three(3) paper copies of all operation and maintenance manuals which have incorporated all District comments and have received the final acceptance of the District shall be submitted to the Districts in accordance with **Section 1A, Part 54** of these Special Provisions.

#### 39. MANUFACTURER'S NAMES

The use of manufacturers' names and catalog numbers in the Contract Documents shall not supersede the detailed specifications. The detailed specifications shall apply in the event of a conflict. If detailed specifications have not been given, the manufacturer's name and catalog number shall determine the design criteria and quality for comparison should an equal be submitted.

#### 40. OPERATION-MAINTENANCE TRAINING

The Contractor shall arrange, or have individual Equipment Manufacturers arrange, to have experienced representatives to train the District's operating personnel in both operation and maintenance of the various systems within the

facility. Scheduling and coordination of the training sessions shall be by the District.

As a minimum, two(2) eight(8)-hour sessions shall be provided to instruct the District personnel for each major equipment item as specified in the Special Provisions. Major equipment shall be considered to be at least those items that are listed in the Equipment Schedule of this Section. The training instruction time indicated above shall be separate and apart from any other vendor service time provided under this Contract, e.g., installation checks by vendor representatives, etc. The instructors shall be supplied by the Contractor, or the Equipment Manufacturer where specified, at a cost included in the Contractor's initial bid at no additional cost to the District.

The Contractor shall provide resumes and other proof of sufficient experience of each instructor to the District for review and acceptance prior to start of instruction. The Engineer will determine if the proposed instructor is sufficiently experienced to do the training. The Contractor shall replace any proposed instructor with a more experienced, knowledgeable instructor at no additional costs.

Outlines of the instructor's lectures and training exercises shall be submitted to the District in writing prior to start of the instruction period. The District may video/audio record each instructor's lecture and training period.

The training sessions may be scheduled during normal working hours, night shifts, weekends, etc. in order to meet District's personnel requirements. The sessions shall include both classroom instruction and field "hands-on" equipment training. The Contractor shall include in this initial bid the cost of multiple training sessions for the same equipment should it be required to meet the District's personnel working hours.

#### 41. NAMEPLATES

Nameplates shall be provided and mounted on or adjacent to each item of mechanical equipment. The nameplates shall be manufactured of 18 Cr-8 Ni stainless steel. They shall be a minimum of 1-1/2 inches by 4-inches, 1/16-inch thick, with engraved or embossed lettering not smaller than 3/16-inch and laminated in white. They shall be easily visible.

The following information shall be given on nameplates:

- a. Equipment tag number.
- b. Name, address, and service contact phone number of manufacturer.
- c. Manufacturer's serial number.
- d. Design temperature and pressure (where applicable).
- e. Equipment performance data (capacity, pressure, etc.).
- f. Lubricant required (if applicable).
- g. Maximum operating speed or other pertinent information.

h. Year built.

42. INSPECTIONS AND SHOP TESTING

The Contractor shall not use any material or equipment which has not been inspected, tested, and accepted. The Contractor shall keep the Engineer advised of the progress of the work away from the jobsite requiring inspection or witnessing of tests so that arrangements may be made for District's inspection.

Inspection, tests, or acceptance of any materials prior to shipment shall not be deemed as a final acceptance of the materials. The Engineer may inspect or require tests or analysis of any portion of the materials at any time after delivery to the site either before or after installation. Any material found to be defective or not otherwise conforming to the requirements of the Contract Documents will be rejected and shall be removed from the site. The District reserves the right to test each identical unit of a multiple unit installation or piece of equipment and is not obligated to test only one(1) component or accept a prototype factory test.

The performance of such inspections and acceptance of the work by the District representatives or the Engineer will in no way release the Contractor of his complete responsibility for construction means, methods, and techniques and for performing the work in accordance with the Contract Documents.

Work shall not be enclosed until it has been inspected, tested, and accepted. Any work that is enclosed before such inspection and test shall be uncovered for inspection and restored to enclosed condition at no additional cost to the District.

Unless otherwise specified in each individual equipment Section of these Special Provisions:

- a. The District reserves the right to witness each and every shop test of the equipment specified in this Contract. The Contractor shall notify the District, in writing, at least three(3) weeks in advance of the scheduled shop test for major equipment.
- b. Test procedures shall be submitted sixty(60) days prior to the tests to the District and accepted in writing by the District prior to notification of the scheduled shop test date.
- c. Results of all shop tests shall be submitted to the District for acceptance. Equipment shall not be shipped until the District has reviewed and accepted in writing the test result report submittal. The District will complete review of shop test results within ten(10) working days after receiving the submittal. The Contractor shall make all modifications to equipment and repeat all required tests at no additional cost to the District to produce an acceptable test submittal in accordance with the specified criteria.

- d. The District will witness the shop testing of equipment in accordance with the Major Equipment Schedule. The shop tests shall be witnessed by two(2) District representatives. All costs for the District representatives to witness the shop tests such as transportation, meals, hotel, etc., shall be arranged and borne by the Contractor. If the shop tests are not conducted as scheduled or do not successfully demonstrate compliance with the specifications, another shop test shall be required, and the Contractor shall pay all costs for the District representatives to witness subsequent shop tests.

43. DELIVERY OF SPARE PARTS AND SPECIAL TOOLS

The Contractor shall be responsible for proper storage and protection of all spare parts and special tools required by these Special Provisions. The Contractor shall deliver all required spare parts and special tools to the District at the same, single time at the end of the Contract. The District will inspect the spare parts and special tools prior to acceptance. Any deficiencies noted by the District shall be corrected by the Contractor at no cost to the District prior to final acceptance of the Contract.

44. FORCES AND MOMENTS DATA

Allowable force and moment data on pumps, fans, compressors, vessel nozzles, and other types of connections shall be submitted for District's acceptance for all equipment submitted. The Contractor shall clearly mark "X", "Y", and "Z" directions with arrows in positive directions for each equipment appurtenance. This information shall be provided for all equipment regardless of it being specified in other Sections of these Special Provisions.

\* \* \* \* \*



### EQUIPMENT SOUND LEVEL DATA SHEET

Sound pressure levels (SPL) in decibels (re 0.0002 microbars) shall be measured at three(3) feet from major bounding surfaces, excluding minor projections such as conduit boxes and bearing housings, at one-half the vertical height for equipment up to ten(10) feet high and at three(3) feet above the top following the standards of ANSI S1.2 1962 (R1976) "Physical Measurement of Sound" or equivalent.

Exceptions: \_\_\_\_\_  
 \_\_\_\_\_

SPL shall be measured at specified design point.

Exceptions: \_\_\_\_\_

Instructions to Suppliers, Manufacturers, or Vendors:

Complete all items below.

Octave Band Center Frequency (Hz)	Sound Levels in Decibels					
	Supplier's Guaranteed Maximum Level at 3'					
	Stock Item		Special Design		Acoustic Treatment	
	SPL	PWL	SPL	PWL	SPL	PWL
63						
125						
250						
500						
1000						
2000						
4000						
8000						

Describe special design (if any): \_\_\_\_\_

Describe acoustic treatment (if any): \_\_\_\_\_

We guarantee  our equipment will not exceed District's maximum acceptable sound pressure levels.

SPL are continuous broad band in nature and non-directional.

Exceptions: \_\_\_\_\_

Supplier, manufacturer, or vendor \_\_\_\_\_

Represented by \_\_\_\_\_ Title \_\_\_\_\_

Signature \_\_\_\_\_ Date \_\_\_\_\_

Equipment Description \_\_\_\_\_

Equipment Tag No. \_\_\_\_\_

SECTION 13B

PREFABRICATED MASONRY RESTROOM BUILDING

1. SCOPE

This Section sets forth the requirements for the installation of the Prefabricated Masonry Restroom Building (PMRB) as shown on the Contract Drawings and as specified in this Section.

1.1 Section Includes:

Requirements for furnishing and installing a Prefabricated Masonry Restroom Building (PMRB) that is factory designed, completely prefabricated, comprising all appurtenances necessary for complete installation. It is the intent of these Specifications to provide complete operable systems, subsystems and other items of Work. Any part or item of Work which is reasonably implied or normally required to make each installation satisfactorily and completely operable is deemed to be included in the Work and the Contract Amount. All miscellaneous appurtenances and other items of Work incidental to meeting the intent of these Specifications are included in the Work and the Contract Amount even though these appurtenances may not be specifically called for in these Specifications.

1.2 Related Sections:

Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

- 1.2.1 3A - Concrete
- 1.2.2 4A - Masonry
- 1.2.3 7C - Caulking and Sealant
- 1.2.4 7D - Sheet Metal
- 1.2.5 9B - Paint for Buildings
- 1.2.6 13C - Prefabricated Metal Covered Walkways
- 1.2.7 17I - Access Control an Alarm Monitoring System

1.3 Definitions:

1.3.1 Manufacturer:

The PMRB Manufacturer, hereafter referred to as MANUFACTURER, is to design, manufacture, and deliver the factory built PMRB, with all the necessary piping, and appurtenances as shown and specified herein. Provide the PMRB complete with all equipment factory installed on steel supports, and enclosed by a modular

building. The equipment shall include the Fixtures, Piping, HVAC system, control panels, breakers, and all internal electrical wiring. The completed PMRB shall be two to four pieces when delivered and require only off loading, installation on the foundation, hook up, and utility service hook up. Any additional finishes identified on the drawings shall be applied by the CONTRACTOR in the field. Provide the complete PMRB when delivered requiring no architectural, electrical, plumbing, and HVAC construction work in the field.

1.3.2 Contractor:

The CONTRACTOR is to oversee the MANUFACTURER to assure a complete PMRB, and supply, replace, and install in field any specified finishes, fixtures, or equipment that are not standard or available on the PMRB of the MANUFACTURER selected. The CONTRACTOR shall coordinate the connection to new and existing utilities and provide integration of systems including Fire Alarm, Electrical, Security. The CONTRACTOR shall provide integrated structural support of the Covered Walkway from the PMRB and shall provide finished surfaces for all structural connections exposed to view.

1.4 System Responsibility:

1.4.1 The MANUFACTURER is to take responsibility of the complete design, manufacturing, and delivery for the aforementioned equipment. The MANUFACTURER is responsible for all sections of this specification. Coordinate work with that of other trades and the CONTRACTOR. Coordinate the location of connecting water, sewer, electrical, and communication utilities with the CONTRACTOR.

1.4.2 The MANUFACTURER is responsible for reconnoitering the site so as to be aware of, and plan for, unusual conditions that could influence the design and manufacture of the PMRB. Failure to understand conditions of the site limitations, and site access will not alleviate the MANUFACTURER from the responsibility to design, manufacture, and deliver the equipment as shown and specified.

1.4.3 The CONTRACTOR is responsible for supplying, replacing, and installing all finishes, fixtures, or equipment in the field to supplement missing or MANUFACTURER installed PMRB elements that do not comply with this specification. It is the responsibility of the CONTRACTOR to provide a complete installation inclusive of all specified elements of the contract drawings and specifications.

1.5 INSURANCE

1.5.1 MANUFACTURER's General/Product Liability Insurance: In addition to the CONTRACTOR's construction insurance requirements in the General Conditions, the MANUFACTURER shall provide premises/operations and products/completed operations general liability insurance from an insurance company with a rating of not less than A-III according to the most recent Best's Key Rating Guide, in an amount equal to \$5,000,000 per occurrence. The coverage must be provided by an insurance carrier licensed and admitted in the state of manufacture.

2. GENERAL

2.1 Regulatory Requirements.

2.1.1 County of Los Angeles Building Code – Title 24, 2023 Edition

2.1.2 County of Los Angeles Electrical Code – Title 27

2.1.3 County of Los Angeles Plumbing Code – Title 28

2.1.4 County of Los Angeles Mechanical Code – Title 29

2.1.5 County of Los Angeles Green Building Standards Code – Title 31

2.1.6 Standard Specifications for Public Works Construction (Greenbook), 2024 Edition

2.1.7 Los Angeles County Sanitation Districts Amendments to the Standard Specifications for Public Works Construction, and Standard Drawings for Construction, 2024 Edition

2.1.8 Americans with Disabilities Act requirements

2.1.9 Additional Codes sections as referenced on Contract Drawings.

2.2 Quality Control.

2.2.1 Design, fabricate and assemble the PMRB equipment, electrical, control and ancillary equipment in accordance with the latest engineering and shop practices. Manufacture individual parts to standard sizes and gauges so repair parts can be obtained and installed in the field. Have the PMRB equipment be the product of a supplier regularly engaged in the design and manufacture of PMRB equipment to insure compatibility of all components.

2.2.1.1 The Specifications include requirements for materials of construction, coatings, and various structural, mechanical, plumbing, and electrical components. Manufacture the PMRB equipment to these requirements and permit no substitute construction, coating, or components.

2.2.2 Manufacturer’s Quality Assurance.

2.2.2.1 MANUFACTURER must be an organization regularly engaged in the production of PMRB equipment, have a minimum of ten years’ experience and have five similar prefabricated washroom installations in operation in the USA.

2.2.2.2 Conformance to Basic Electrical Standards: Comply with the latest edition of applicable standards as required by the Special Provisions. No exceptions to the requirements of these codes and standards will be allowed.

2.2.2.3 Labeling: Provide electrical equipment and materials that are listed and approved by Underwriters Laboratories or other OSHA approved nationally recognized Testing Laboratories.

2.2.3 Certificate of Compliance: Provide a certificate of compliance that the PMRB provided meets the requirements of the Drawings and Specifications.

2.3 Warranty.

2.3.1 Warrant the PMRB and equipment to be free from defects in materials and workmanship for a period of two years commencing upon substantial completion of construction. The warranty is to cover all repairs for all systems furnished by the MANUFACTURER.

2.3.2 Warrant the PMRB for a period of ten years from the date of delivery to the job site.

2.4 Product Delivery, Storage, and Handling.

2.5 Project Conditions.

2.6 Detail Work.

3. PRODUCTS

3.1 Manufacturers.

3.1.1 A single manufacturer to furnish a complete and functional PMRB.

3.1.2 Acceptable manufacturers are listed below but are not limited to the following:

3.1.2.1 Whitley Manufacturing Co, Inc

3.1.2.2 Structure Cast

3.1.2.3 Public Restroom Company

3.1.2.4 LB Foster, CXT

3.1.2.5 Romtec

3.2 Building.

3.2.1 Design Criteria:

3.2.1.1 Provide a packaged PMRB that is a factory assembled modular building enclosure attached to a base structure and requiring no additional assembly of building enclosures at the job site.

3.2.1.2 The building design criteria are as follows:

- a. To withstand snow load based on ASCE 7-16 Ground Snow Loads for the state and county of installation.

- b. To withstand wind loads based on ASCE 7-16 for wind speeds.

3.2.2 Be designed for site specific seismic requirements based on local conditions as dictated by the Available Ground Motion Parameters according to ASCE 7 and County of Los Angeles Building Code – Title 24, 2023 Edition.

- a. A live floor load of 125 PSF.

3.2.2.2 Size the modular building enclosure to maintain the required code clearances as follows:

- a. For spaces accessible to personnel and the public, provide the necessary clearances to and from each fixture, door, seating area and locker.
- b. For equipment and building systems, provide clearance above, below and around equipment for proper and safe servicing, removal and reinstallation of the equipment.

3.2.3 Building Construction:

3.2.4 Insulation values for the walls and roof structure shall be a minimum R-value in the walls and the roof to meet or exceed the requirements identified in the Standard Specifications for Public Works Construction (Greenbook), 2024 Edition.

3.2.4.1 Provide a structure meeting or exceeding the building design criteria specified herein.

3.2.4.2 Openings in the sidewalls and roof shall be as shown and be fully framed out and supported using single or multiple framing members sufficient to support and fasten those devices or equipment items requiring a framed opening, access hatches, HVAC equipment, pipe passages, conduit passages, door, window, and louver openings and other special purpose openings as shown or required.

3.2.4.3 The attaching of devices or equipment to the building at a framed opening shall be done fully according to the device manufacturer's mounting instructions.

3.2.5 Building Substructure:

3.2.5.1 The substructure shall be designed to support the structure live and dead loads plus the burden imposed by loading, transporting and unloading of this equipment.

3.2.5.2 Structural Calculations:

Perform the structural calculations for the base slab and PMRB base anchorage to the building pad / foundation slab including type, size, location, and embedment depth of the anchors. Engage the services of a professional engineer

licensed in the State of California to prepare the structural design calculations.

3.2.6 Registered Professional Engineer Review

3.2.6.1 The PMRB and the means of attaching the PMRB to the foundation shall be reviewed as well as sealed and signed by licensed professional engineer experienced in Structural Engineering and registered in the State of California. Submit a certificate, signed and sealed by a Professional Engineer licensed in the State of California that certifies that the Licensed Professional Engineer has evaluated and approved the complete design calculations.

3.2.7 Construction Materials:

3.2.7.1 Insulation

a. Wall Insulation

1. Polyisocyanurate: R-10 min.

b. Roof Insulation

1. Polyisocyanurate: R-23 min.

3.2.7.2 Concrete Base Slab

3.2.7.3 Load Bearing Masonry

a. All loadbearing masonry shall be constructed as specified in **Section 4A.**

3.2.7.4 Non-Load Bearing Masonry

a. All non-loadbearing masonry shall be constructed as specified in **Section 4A.**

3.2.7.5 Framed Walls

a. Framing of walls shall be reviewed as well as sealed by licensed professional engineer experiences in Structural Engineering and registered in the State of California as required in section **3.2.6.1.**

3.2.7.6 Roof

The finished roof surface shall provide a waterproof covering in conjunction with the selected field applied roof system or facade. The roofing system shall be capable of withstanding 80 MPH wind velocity. Provide load bearing members as needed to support all other loads and the size and location of members in the roof system.

3.2.7.7 Framed Openings and Penetrations

- a. Floor Openings
  - b. Wall Openings
    - 1. Exterior
    - 2. Interior
  - c. Roof Openings
- 3.2.7.8 Doors
- a. High Security Hollow Metal Doors and Frames
    - 1. B Label - 90 Minute rated.
  - b. Hardware
    - 1. Keying:
      - a) The interchangeable core (IC) cylinders with a construction core shall be provided by the Contractor for installation.
      - b) The cylinders with temporary construction cores are for use during construction only. The Contractor shall supply the District with two(2) construction keys which will be returned when the Contractor's temporary core is replaced with the District's permanent core.
      - c) The permanent cores will be supplied and installed by the District.
    - 2. Locksets:
      - a) All locksets shall be mortise type with anti-friction two(2)-piece latchbolts, with a minimum 5/8-inch throw. Function shall be appropriate for door use.
      - b) All locksets shall be able to accommodate Corbin Russwin IC mortise cylinder (Part No. 1080x114xA02).
      - c) Strikes: All strikes shall be sufficient length and have curved lip and wrought boxes.
    - 3. Strikes: All strikes shall be sufficient length and have curved lip and wrought boxes.
    - 4. Finish: Finish of all hardware shall be as shown in **Part 4.3 of this Section**.
    - 5. Hardware Set Schedule

**HW-Set 1****Single Leaf Exterior Door**

<u>Door No.</u>	<u>From</u>	<u>To</u>	<u>Swing</u>
100-1	Exterior	Women's Restroom	RHR
101-1	Exterior	Unisex Restroom	RHR
3 EA	S	HINGES	FBB191 4.5 x 4.5 NRP 626
1 EA	HES	ELECTRIC STRIKE	1006 626
1 EA	SC	LOCKSET	LV9080 06L 626
1 EA		LATCHPLATE COVER	
1 EA	COR	IC MORTISE CYLINDER w/CONSTRUCTION CORE	1080 x 114 X A02 626
1 EA	HES	ELECTRIC STRIKE	1006 626
1 EA	LCN	CLOSER	4041 □ DA 689
1 EA	PEM	THRESHOLD	172A
1 EA	PEM	DOOR SHOE	216APK
1 SET	PEM	JAMB WEATHER STRIP	332CR

\* Include Push Button and Operator

**HW-Set 2****Single Leaf Exterior Door**

<u>Door No.</u>	<u>From</u>	<u>To</u>	<u>Swing</u>
102-1	Exterior	Utility Chase	RHR
3 EA	S	HINGES	FBB191 4.5 x 4.5 NRP 626
1 EA	HES	ELECTRIC STRIKE	1006 626
1 EA	SC	LOCKSET	LV9080 06L 626
1 EA		LATCHPLATE COVER	
1 EA	COR	IC MORTISE CYLINDER w/CONSTRUCTION CORE	1080 x 114 X A02 626

1 EA	HES	ELECTRIC STRIKE	1006 626
1 EA	LCN	CLOSER	4041 □ DA 689
1 EA	PEM	THRESHOLD	172A
1 EA	PEM	DOOR SHOE	216APK
1 SET	PEM	JAMB WEATHER STRIP	332CR

c. Building Access Controls per Specification 17I.

3.2.7.9 Connection to adjacent structures:

3.3 Exterior Treatments.

3.3.1 Stucco Wall Finish

3.3.1.1 MANUFACTURER shall provide Stucco wall finish to match pattern, texture and color of stucco finishes located at adjacent existing Administration Building.

3.3.2 Metal Flashing and Trim

3.3.2.1 Metal Flashing and Trim finishes shall match Districts' standard color palette per special provisions 9B - Paint for Buildings.

3.3.3 Gutters and Downspouts

3.3.3.1 Metal Flashing and Trim finishes shall match Districts' standard color palette per special provisions 9B - Paint for Buildings.

3.3.3.2 The gutters and downspouts shown on the drawings are provided and installed by CONTRACTOR in the field. Apply a vapor barrier to the exterior of the building to reduce air infiltration and moisture damage.

3.4 Interior Finish Materials.

3.4.1 Flooring: Daltile Fabrique 12 x 24 Gris Linen (P690)

3.4.2 Ceramic Tile:

3.4.2.1 Standard: Daltile Fabrique 24 x 24 Blanc Linen (P685)

3.4.2.2 Accent: Daltile Fabrique 24 x 24 Noir Linen (P689)

3.4.3 Ceiling Treatments:

3.4.3.1 Water Resistant Gypsum Ceiling Panels.

3.4.3.2 Paint, Dunn Edwards Warm White (DEW380) Eggshell Suprema Interior

3.5 Architectural Furnishings, Fixtures, and Equipment (FF&E).

3.5.1 Toilet Accessories

3.5.1.1 Manufacturers.

a. Bobrick Washroom Equipment, Inc.

b. American Specialties, Inc.

c. Bradley Corporation

3.5.1.2 Surface-Mounted Soap Dispenser: Bobrick No. B-4112, Bradley No. 6542, or equal.

3.5.1.3 Surfaced-Mounted Paper Towel Dispenser and Waste Receptacle. Bobrick No. B-43949, Bradley No. 234-11, or equal.

3.5.1.4 Partition-Mounted 2-Stall Seat-Cover and Toilet Tissue Dispenser. Bobrick No. B-347, Bradley No. 592, or equal.

3.5.1.5 ADA Compliant Recessed-Mounted Seat-Cover and Toilet Tissue Dispenser. Bobrick No. B-3474, Bradley No. 5922, or equal.

3.5.1.6 Surfaced Mounted Sanitary Napkin Disposal. Bobrick No. B-254, Bradley No. 4737-11, or equal.

3.5.1.7 ADA Compliant Recessed-Mounted Seat-Cover Dispenser, Sanitary Napkin Disposal and Toilet Tissue Dispenser. Bobrick No. B-3574, Bradley No. 5912, or equal.

3.5.1.8 Surfaced Mounted Toilet Tissue Dispenser. Bobrick No. B-2888, Bradley No. 5402, or equal.

3.5.1.9 Framed Mirrors: Standard and ADA

3.5.1.10 Trach Receptacle: Provide hole in countertop with can in cabinet below.

3.5.1.11 Horizontal Grab Bar.

a. At Water Closets: Bobrick No. B-68137, 1-1/2-inch diameter stainless steel, approximately 36-inch × 54-inch, Bradley No. 812, or equal.

b. At Barrier-Free Shower Stall: Bobrick No. B-6806, approximately 30-inch × 42-inch, Bradley No. 812, or equal.

3.5.1.12 Utility Shelf with Mop Hooks. Borbrick No. B-239 x 34, Bradeley No. 9933, or equal.

3.5.1.13 Partitions and Doors: Shall be floor mounted, overhead braced, flush type, with pilaster fronts.

- a. Partition Panels: Partition panels shall be 1-inch thick of two(2) sheets of stretcher-leveled furniture steel, assembled over and cemented under pressure to a sound deadening moisture resistant insulating core, as standard with the manufacturer. Form edges of sheets to interlock together to provide a tight fit on all four(4) sides with corners mitered, welded, and ground smooth.
- b. Doors: Doors shall be constructed the same as partition panels, except edges of sheets shall be welded at frequent intervals to insure rigidity. Doors for handicapped partitions shall be 34-inches wide, except as noted on the Contract Drawings, and shall swing out of the compartment.
- c. Pilasters: Pilasters shall be constructed the same as for doors, except the thickness shall be 1-1/4-inch, reinforced to receive the door connections.
- d. Partitions, Doors and Urinal Screens - 22-gauge minimum; pilasters - 20-gauge minimum; door reinforcement - 16-gauge minimum; pilaster reinforcement - 18-gauge minimum.
- e. Finishes: Base metal shall be galvanized steel. Topcoats shall be two(2) coats of synthetic enamel baked on to a smooth lustrous finish in accordance with the manufacturer's standard practice. Manufacturer shall furnish documentation stating that the galvanizing treatment has been applied. Color shall be selected by the Engineer from the Manufacturer's standard color chart.

1. Partition Door Hardware and Fittings:

- a) General: Hardware and fittings shall be fabricated of non-corrosive metal alloy with nickel- chrome plated finish, or of stainless steel, except as otherwise specified.
- b) Hinges: Hinges shall be adjustable roller bearing gravity type to hold doors ajar approximately 30 degrees. Ball bearings and cams shall be hardened steel with all moving parts self-lubricating.
- c) Coat Racks: Latches and Bumpers: Provide combination coat-hook and bumper, stop and keeper, and throw-type latch.
- d) Brackets and Trim: Wall and pilaster stirrup brackets shall be nickel - chrome plated. Pilaster shoes shall be approximately three(3) inches high and shall be stainless steel.

- e) Headrail: Headrails shall be etched and anodized extruded aluminum clamping over the pilasters and secured to the walls with stainless steel brackets.
  - f) Fastenings: Provide fastenings as required of stainless steel. Fastenings shall be of one-way, head type for attaching metal to metal.
- 3.5.1.14 Bobrick Duraline 2080 Series Gap Free or approved equal.
- 3.5.1.15 Grab bars:
- 3.5.2 Shower FF&E
- 3.5.2.1 Curtain Rod and Curtain:
- 3.5.2.2 Foldable Shower Seat:
- a. Shower seats shall be Bobrick folding seats, Model B-5181, Bradley No. 9569, or equal.
  - b. Frame and mounting brackets shall be stainless steel, featuring self-locking mechanism.
  - c. Seat is constructed of water-resistant, ivory-colored 1/2-inch (13mm) thick solid phenolic. Reversible for left- or right-hand field installation.
- 3.5.2.3 Grab bars:
- 3.5.2.4 Shower Pan:
- a. Barrier-Free Shower Pan: Accessibility Professionals Model APA6636BFPAN 66-inch × 36-inch × 6-inch, or equal. Color shall be white.
- 3.5.2.5 Shower Curtain Rods:
- a. Concealed mounted shower curtain rod shall be 1-inch O.D., 18-gauge stainless steel tube.
  - b. Shower Curtain: Bobrick No. 204, Bradley No. 9533, or equal. Include stainless steel shower curtain hooks.
- 3.5.3 Lockers FF&E
- 3.5.3.1 Lockers:
- a. General: The lockers shall be 12-inches wide, 18-inches deep, 72-inches high, one-tiered, set on a concrete raised base as shown on the Contract Drawings. Lockers shall have metal doors.

- b. Accessories: Each locker shall have coat rod, hat shelf and side hooks.
- c. Locking Devices: Pad locking device shall be provided for the lockers.
- d. Manufacturer: Lockers shall be as manufactured by Lyon Metal Products; Republic Storage Systems Company, or equal. Colors to be selected by the Engineer from the Manufacturer's standard color chart.

3.5.3.2 Locker Room Benches:

- a. Type: Locker room benches shall be of the size shown on the Contract Drawings and shall be constructed of hardwood seats with clear sealer and enameled steel bases fastened to the floor as recommended by the manufacturer.
- b. Manufacturer: Locker room benches shall be as manufactured by Lyon Metal Products, Inc.; Republic Steel Industrial Products Division, or equal.
- c. Color for Steel Base: To match selected locker color.

3.6 Coating Systems

3.6.1 All interior and exterior surfaces of exposed masonry, steel, wood, plastics, composites, piping, and ductwork are to receive surface preparation appropriate to receive subsequent base and top / finish coats as per special provisions 9B.

3.7 Heating, Ventilation and Air Conditioning Systems:

3.7.1 Provide the HVAC system to achieve suitable conditions as required for ventilation, humidity, and temperature control. Provide the HVAC system in accordance with local codes. The HVAC system shall maintain an indoor temperature of not less than 68F in the winter and not more than 78 degree F in the summer. Utilize ASHRAE standard temperatures for Long Beach, CA - Summer cooling design temperatures 91.8F/66.0F DB/WB and Winter heating design temperatures 41.7F. Provide duct and equipment supports meeting local seismic requirements. Perform the heating and cooling calculations and submit for approval.

3.7.2 AC Unit:

Provide wall- or split-air conditioning unit rated at 2 Tons cooling capacity, Underwriter Listed with wall mounted thermostat. Provide system capable of maintaining 72F in the summer. Route condensate drains to exterior and terminate 12 inches above grade.

3.7.3 Exhaust Fans:

Provide ceiling exhaust fans ducted to exterior vent, meeting local mechanical code ventilation requirements for restrooms, UL Listed rated at 120/1/60 power supply. Provide wall switch control for the fans. Provide louvers of aluminum construction for makeup air as required.

3.7.4 Baseboard Heaters:

Provide floor mounted UL listed electric baseboard heaters for the restrooms. Provide the heaters with built in thermostats. Provide system to maintain 75 degrees F in the winter.

3.7.5 Unit Heaters:

Provide wall mounted UL listed electric unit heaters in the Utility Chase area controlled by wall mounted thermostats. Provide system to maintain 75 degrees F in the winter.

3.7.6 Ductwork:

Provide aluminum ductwork meeting SMACNA construction.

3.7.7 Controls:

Provide the AC unit controlled from the wall mounted thermostat. Provide the exhaust fans with local on-off switches.

3.8 Plumbing

3.8.1 Provide plumbing systems in compliance with local codes. Provide pipe and equipment supports meeting local seismic requirements.

3.8.2 Toilets:

Provide ADA compliant wall mounted elongated bowl vitreous china toilets with open seat cover. Provide low consumption flushing system to allow 1.28 GPF when paired with a 1.28 GPF flushometer valve.

3.8.3 Lavatories:

Provide lavatories made of vitreous china hung at ADA compliant heights and protections. Lavatories to have single hole for faucet and overflow.

3.8.4 Faucets:

Provide battery operated faucets with single inlet and in-line strainer. Faucets to use battery operated proximity sensors. Provide 0.5 gpm pressure compensating aerators. Provide automatic lavatory mounted soap dispensers.

3.8.5 Shower:

Provide a pressure compensating concealed shower fitting with stops, 2.75 gpm ball joint shower head, bent arm, and escutcheon. Shower basin to be provided as outlined under architectural section.

3.8.6 Mop Basin:

Provide floor mounted basin 36 by 24 by 10 inches, made of molded stone. Provide faucet on 8 inch centers with rigid spout with pail hook, wall brace, ¼ inch hose outlet cross handle, and ¾ inch hose tread outlet vacuum breaker. Provide hose and hose bracket and mop hanger plate.

3.8.7 Water Heater:

Provide tank type electric water heater with minimum of 30 gallons capacity. Provide the heater suitable for potable water application and designed to meet NSF-61 requirements. Provide T&P relief valve and drain valve, NEMA 4 control panel enclosure.

3.8.8 Sanitary, Vent, and Potable Water Piping:

Provide sanitary piping of solid core, schedule-40 PVC piping with drain, waste, vent fittings, complying with local plumbing codes. Provide potable cold and hot water piping of Type L copper with insulated exterior. Provide solder joints or threaded fittings. Clean and disinfect potable water piping and valves.

3.8.9 Floor Drains and Cleanouts:

Provide floor drains of cast iron and brass strainers equipped with funnel at the water heater. Provide cleanouts of cast iron, internal countersunk bronze plug, inside caulk connection and scoriated round cast iron top.

3.8.10 Pipe Insulation:

Provide cellular glass vapor retarded insulation on the potable cold and hot water piping. Provide insulation thickness to meet energy code.

3.8.11 Potable Water Valves:

Provide all bronze ball or gate valves. Install shutoff valves close to water main on each branch serving plumbing fixtures or equipment and on each water supply to equipment. All valves shall comply with NSF-61.

3.9 Electrical Requirements

3.10 Panels and Enclosures

4. EXECUTION

4.1 Manufacturer's Instruction.

Shop assemble and test the PMRB prior to shipment, except as otherwise noted, to assure proper operation. Assemble equipment where shown and in accordance with equipment MANUFACTURER's recommendations.

4.2 Site Preparation.

The CONTRACTOR shall provide clear access as required by the MANUFATURER to the project site prior to delivery of the PMRB.

4.3 Field Inspection.

Prior to shipping the PMRB to the site, field verify that the PMRB, Building Pad, yard piping, and electrical connections are compatible.

4.4 Contractor's Installation Requirements.

The CONTRACTOR will be required to provide a crane to off-load the PMRB from the delivery truck and place the PMRB directly on to the foundation as shown without placing the PMRB on any unprepared areas of the site. Following setting of the PMRB, the CONTRACTOR will anchor the PMRB to the foundation using 316 stainless steel anchor bolts furnished by the CONTRACTOR. Yard piping terminations will be cleaned prior to PMRB installation. The CONTRACTOR will make all piping connections and external electrical connections in accordance with the MANUFACTURER's approved installation submittals.

4.5 Manufacturer's Field Services.

Furnish the services of a qualified representative of the MANUFACTURER to provide instruction on proper installation of the PMRB, inspect the completed installation, and make any necessary adjustments.

5. SUBMITTALS

5.1 Product Data.

5.2 Shop Drawings.

Submit shop drawings, including arrangement and erection drawings of the complete PMRB.

5.2.1 Provide complete assembly and installation drawings together with detailed specifications covering materials used, construction, fixtures, furnishings, and other accessories forming a complete PMRB.

5.2.2 Provide a full set of architectural drawings, all to scale, including , but not limited to wall and roof construction, openings, finishes, fixtures, and accessories required for a complete construction.

5.2.3 Provide a full set of structural drawings, all to scale, including fully dimensioned plans and sections The structural drawings to include structural reinforcing members including exact size, location, and method of attaching, and the anchoring system. The structural drawing is to include the

structural support sizes or shapes to be utilized with weights and the total weight of all structural members and components comprising the total weight of the PMRB.

5.2.4 Provide a full set of electrical drawings, all to scale, including power plans, lighting plans, and grounding plans.

5.2.5 Provide properly marked cut sheets for each major component of the PMRB, both mechanical, plumbing, and electrical.

5.2.5.1 Provide a full set of HVAC drawings, including equipment layout, dimensioning, typical installation, and ductwork layout, all to scale. Provide calculations based on the heat load of the final, approved equipment to be located inside the PMRB, confirming that the HVAC units, as specified within, are adequately sized for the application.

5.2.5.2 Provide a full set of plumbing drawings, including equipment and piping layout, all to scale. Provide plumbing calculations based on the fixture unit usage per the plumbing code.

5.2.6 Provide a copy of the entire specification section for the PMRB with addenda and all referenced specification sections with addenda.

5.2.7 Provide complete description of the PMRB including:

- 5.2.7.1 Submittal schedule
- 5.2.7.2 Shipment schedule after receipt of approved submittals
- 5.2.7.3 Specification section number relevant to the submittal
- 5.2.7.4 Technical information
- 5.2.7.5 PMRB
- 5.2.7.6 PMRB footprint
- 5.2.7.7 Mechanical major component properly marked cut sheets
- 5.2.7.8 Electrical major component properly marked cut sheets
- 5.2.7.9 MANUFACTURER recommended spare parts list
- 5.2.7.10 Post production features
- 5.2.7.11 Owner's manual description
- 5.2.7.12 Shipment method and carrier type
- 5.2.7.13 Clarification and variations from Contract Document
- 5.2.7.14 Receiving instructions

5.2.7.15 Storage instructions

5.2.8 Provide information as requested for building permits.

5.3 Quality Control Submittal. Provide the following documentation:

5.3.1 List of five similar installations along with the following information:

5.3.1.1 A brief description of each installation.

5.3.1.2 Name of owner of installation, telephone number, and contact person.

5.3.1.3 Date of installation.

5.3.2 Equipment MANUFACTURER's certified performance and materials records as required.

5.3.3 MANUFACTURER's certified field report.

5.3.4 Certifications of a qualified representative of the MANUFACTURER's field services.

5.3.5 A certificate of compliance from the MANUFACTURER that the PMRB provided meets the requirements of the Drawings and Specifications.

5.4 Operation and Maintenance: Submit Operation and Maintenance Manuals for the PMRB fixtures and equipment.

5.5 Provide the copy of MANUFACTURERs General/Product Liability insurance certificate.

5.6 Manufacturer's Qualification.

5.7 Applicator's Qualification.

5.8 Manufacturer's Installation Instructions.

5.9 Material Compatibility Certification.

5.10 Special Details.

5.11 Delivery, Storage, and Handling.

5.11.1 The MANUFACTURER is to deliver the PMRB completed and undamaged by the MANUFACTURER's carrier to the site fully assembled and ready for the power, fiber optic, and applicable utility connections to be completed on site.

5.11.2 Once the PMRB is delivered to the site the MANUFACTURER is to provide supervisory assistance in unloading and anchoring of the PMRB onto the concrete foundation and completion of the field work as specified.

5.12 Sample Warranty.

5.13 Definition of Acceptance:

5.13.1 PMRB system acceptance is defined as the point in time when the following requirements have been fulfilled as specified:

5.13.1.1 All operation and maintenance documentation has been submitted, reviewed, and approved.

5.13.1.2 All training has been completed.

5.13.1.3 A warranty statement with the warranty commencement date indicated has been provided. The warranty statement is to clearly identify the MANUFACTURER as responsible for warranty service.

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SECTION 13C

MANUFACTURED COVERED WALKWAY

1. SCOPE

This Section sets forth the requirements for manufactured covered walkways as shown on the Contract Drawings and as specified in this Section.

1.1. Section Includes:

1.1 Aluminum Posts, Internal Gutter System, Roof Decking, Anchors Fasteners, and drainage plates.

1.2. Related Sections:

1.2 Related Work Specified in Other Sections Includes, but is not limited to, the Following:

1.3 03A - Concrete

1.4 05C - Structural Anchorage

1.5 07C - Caulking and Sealant

1.6 07D - Sheet Metal

1.7 09B - Paint for Buildings

1.8 13B - Prefabricated Masonry Restroom Building

1.9 16A - Electrical Work

2. GENERAL

The Contractor shall provide material, equipment and labor necessary to complete the installation as shown on the Contract Drawings and specified in this Section.

Contractor shall examine the Contract Drawings and Special Provisions and include items, which are not specifically mentioned in other Sections of these Special Provisions.

2.1 REGULATORY REQUIREMENTS:

2.2 County of Los Angeles Building Code - Title 26, 2023 Edition for all snow and wind load requirements.

2.3 Welding:

2.3.1 Aluminum welding to be in accordance with ANSI / AWS D1.2/D1.2M: 2014. Welding must be performed solely with Pulsed Gas Metal Arc Welding (Pulse-MIG) processes or Gas Tungsten Arc Welding (TIG) processes by experienced operators.

2.3.2 All exposed surfaces must be free of sharp or jagged surfaces.

### 3. PRODUCTS

#### 3.1 Manufacturers:

3.1.1 A single manufacturer to furnish and deliver a complete Manufactured Covered Walkway system to be installed by the Contractor.

3.1.2 Acceptable manufacturers are listed below but are not limited to the following:

3.1.2.1 Upside Innovations LLC

3.1.2.2 Tennessee Valley Metals Inc.

#### 3.2 Materials.

##### 3.2.1 Roof Decking:

3.2.1.1 Aluminum Decking to be 6063-T6 Mill finish with Powder coating.

- a. Shape shall be Roll Formed Flat Pan type decking panels
  1. Measuring 2 ½" x 12" x .032".
- b. Decking shall be attached to inner flange of gutters with Tek Screws at both ends.
- c. Decking shall be cut to custom lengths to accommodate desired width of walkway.

##### 3.2.2 Canopy Posts:

3.2.2.1 All canopy posts to be constructed of 6061-T6 extruded aluminum.

- a. Constructed from 4" by 4" x 0.125" square tube and function as the downspouts of the gutter system.
- b. Posts shall be cut to meet the minimum required canopy height above walking surface.
- c. The maximum space between posts shall be 12' wide and 12' long in the direction of travel.
  1. The maximum spacing may decrease for areas with extreme wind and/or snow loads.
- d. Each post is to be surface mounted to concrete with a footplate at the base of the post.

1. Footplates are to be 8" by 8" by ½", secured to the ground using a minimum of 2x 5/8" x 5" galvanized steel wedge anchors per footplate, unless noted otherwise on the drawings. Typical installations will utilize 4 anchors per footplate.

e. Posts functioning as downspouts are to be located as shown on the drawings, are to be attached to gutters using a downspout bracket, and are to receive a 2 ½" x 5" opening with a deflector plate at the bottom of the post.

3.2.3 Internal Gutter System:

3.2.3.1 All internal gutters to be constructed of 6061-T6 extruded aluminum.

3.2.3.2 Water is to be directed from the canopy decking into the gutter system that lines both sides of the canopy and flows to designated support posts with drainage plates and outlets at grade.

3.2.3.3 Gutter fascia shall be 6" high by 4" wide by 0.10" thick.

3.2.3.4 Gutter sections shall be cut to specific length dependent on walkway design.

3.2.3.5 Gutter sections are connected using 12" long by 0.125" thick splice plates and fasteners per manufacturer's instructions.

3.2.3.6 Gutter corners to be to be 18" by 18" pre-welded aluminum corners and connected using splice plates per manufacturer's instructions.

3.2.3.7 Canopy gutters mounted to buildings are to use 3/8" stainless steel bolts every 18".

3.2.3.8 Gutters are to be cut in the field to include a 2 ½" drainage hole as required to provide drainage to downspout posts as indicated on the drawings.

3.3 Anchors: All anchors and lag bolts shall be galvanized steel.

3.4 Fasteners:

3.4.1.1 All Tek Screws shall be galvanized.

3.4.1.2 Roof Deck shall be fastened to gutters using #12 x 1" galvanized steel sleeve anchors.

3.5 Sealant: Silicone sealant shall be applied to all joints for a watertight seal.

3.6 Finish: Powder coating shall match Districts color standards per Specification 9B Paint for Buildings.

4. EXECUTION

4.1 General.

4.2 Manufactured Covered Walkway is to be rigid, partially free-standing structure supported on posts and anchored to framed or masonry walls in

accordance with the County of Los Angeles Building Code's snow and wind requirements. All footplates should be fastened securely to a 6" thick concrete slab or 16" minimum diameter footing in order to achieve full structural integrity. Footing depth must be 36" minimum.

4.3 Flashings. Furnish and install flashings as shown on the Contract Drawings and specified in this Section. Provide types to suit the indicated conditions. Flashings shall be lapped 3-inches on ends. Flashing shall be secured to wall 12-inches on center.

4.4 Painting. All surfaces of sheet metal, except those to be embedded in asphalt or concrete, shall be primed and allowed to dry before installation. All sheet metal shall be painted. Painting shall be as specified in **Section 9B** of these Special Provisions.

5. SUBMITTALS

5.1 SHOP DRAWINGS. Submit shop drawings for approval before starting fabrication. Drawings shall show construction details including but not limited to expansion joints and expansion-joint covers, profiles, shapes, seams, supporting, and securing at reasonably large scales, material thickness, joining methods, reinforcement and anchorage features. Show complete information regarding concealed joints. All dimensions shall be verified at the jobsite before fabrication.

5.1.1 Overall Layout dimensions

5.1.2 Footer Layout Drawings

5.2 Warranty: Submit sample Manufacturer's Warranty.

5.2.1 Manufacturer's Warranty to ensure products are to be free from defects in material and workmanship for a period of one year beginning from the date of delivery of the product.

5.3 Engineering Calculations and Drawings: Submit drawings and calculations signed and sealed by a Professional Structural Engineer licenses in the State of California.

5.4 Submit qualification data for fabricator.

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SECTION 16A

ELECTRICAL WORK

1. SCOPE

This Section sets forth the requirements for all electrical work to be performed under this Contract.

2. GENERAL

2.1 The Contractor shall provide all labor, tools, equipment, materials, services and documents required to install, connect, adjust, test and leave in sound operating condition the complete electrical installation as shown on the Contract Drawings and called for in these Special Provisions.

2.2 All electrical work shall be performed by a California-licensed class C-10 (Electrical) Contractor. Only certified electricians shall perform electrical work in accordance with California Labor Code requirements. Each certified electrician shall supervise a maximum of one(1) electrician trainee. Electrician trainees must be enrolled in a state approved school.

2.3 The Contractor shall provide and install all electric equipment, raceways and wiring as specified in the Contract Documents. Indication of required electrical work in any Contract Document, i.e., in any Section of these Special Provisions or on any Contract Drawing, shall require installation of the equipment and wiring by the Contractor at no additional cost to the District.

2.4 Unless otherwise specified in these Special Provisions or shown on the Contract Drawings, the enclosures containing electric equipment, devices and instruments shall be metallic, rated as follows:

2.4.1 Indoor locations - NEMA Type 1.

2.4.2 Outdoor locations or in galleries - NEMA Type 4.

2.4.3 Hazardous (classified) locations identified on the Contract Drawings - UL-or CSA-listed or FM-approved for use in these locations.

2.5 Unless otherwise specified in these Special Provisions or shown on the Contract Drawings, the areas of water reclamation plants and pump stations defined in the following table are considered corrosive. All exposed conduit and conduit bodies to be installed in these areas shall be PVC-coated type meeting the requirements of **Part 9.2** of this Section. All pull boxes, junction boxes and terminal boxes to be installed in these areas shall be NEMA Type 4X (stainless-steel). The boundary specified as "INSIDE CONTAINMENT AREA/BASIN" includes the areas from the bottom of the containment area/basin to all space vertically above.

NO	CORROSIVE AREA	BOUNDARY
1	CHLORINATION ROOM	INTERIOR
2	PRIMARY SEDIMENTATION TANK	TOP OF TANK
3	AIR FLOTATION UNIT	INTERIOR
4	CHLORINE TANK	10 FEET AROUND TANK
5	SULFUR DIOXIDE TANK	10 FEET AROUND TANK
6	AERATION TANK	10 FEET AROUND TANK
7	POLYMER STATION	INSIDE CONTAINMENT AREA/BASIN
8	CHEMICAL HANDLING AREA	INSIDE CONTAINMENT AREA/BASIN
9	FERROUS CHLORIDE TANK	INSIDE CONTAINMENT AREA/BASIN
10	ODOR CONTROL SYSTEM	INSIDE CONTAINMENT AREA/BASIN
11	SLUDGE DEWATERING BUILDING	INTERIOR
12	AMMONIA STATION	INSIDE CONTAINMENT AREA/BASIN PLUS 3-FOOT ENVELOPE BEYOND THE CONTAINMENT BASIN
13	SODIUM HYPOCHLORITE STATION	INSIDE CONTAINMENT AREA/BASIN
14	SODIUM BISULFITE STATION	INSIDE CONTAINMENT AREA/BASIN

2.6 The locations of equipment and conduit routing shown on the electrical Contract Drawings are approximate. The Contractor shall refer to the architectural, structural, civil and mechanical Contract Drawings for exact dimensions and limitations of structures and exact locations of the equipment requiring electrical connections.

In the event that obstructions or difficulties are encountered in locating equipment or conduit runs, the District reserves the right to direct the Contractor to relocate the equipment and/or change conduit routing to suit the field conditions. Such changes shall not be considered grounds for claims for extra work or time extension.

2.7 Electrical Contract Drawings are diagrammatic and do not show detail requirements. Additional conduit, fittings (such as elbows, hubs, bushings, couplings, plugs, reducers, unions, terminal blocks, etc.), conductor terminals, supports, pull boxes and any other elements – required for proper operation of equipment due to specificity of its location or due to any other special condition – shall be provided at no additional cost to the District.

2.8 The installation detail drawings, that may be included in the Contract Documents, do not necessarily cover the entire scope of the installation detail drawings that may be required by the Contractor to accomplish its work as defined in the Contract Documents. Any additional installation detail drawings, deemed by the Contractor necessary for accomplishing its work, shall be developed by the Contractor at no additional cost to the District. These drawings shall be submitted for the District's acceptance.

2.9 The Contractor shall include in their bid the following additional costs for:

- a. All required coordination work with Southern California Edison (SCE).
- b. All required coordination work with the vendors of the Contractor- or District-furnished equipment or packaged systems, including verification and revision of the Contract Documents to match final certified vendor drawings for each piece of the Contractor- or District-furnished equipment or packaged system.
- c. Installation of all electric equipment according to the modified Contract Documents.

No additional costs shall be borne by the District to complete an acceptable system as defined in this Section.

2.10 If any piece of the equipment proposed by the Contractor cannot fully meet the requirements of these Special Provisions, such exceptions shall be clearly stated. No exception will be allowed unless accepted in writing by the District.

2.11 If any piece of the equipment proposed by the Contractor and accepted by the District differs from that specified in the Contract Documents and, as a result, changes in switchboards, control panels, conduits, wiring, etc., are required, it shall be the Contractor's responsibility to modify the design, submit it for the District's acceptance, and provide all equipment and labor required to comply with the National Electrical Code and prevent excessive voltage drop. Such modifications shall not be considered grounds for claims for extra work or time extension.

2.12 General requirements for adaptation of Contractor-furnished equipment for installation and operation as specified in the Contract Documents shall conform to the requirements of these Special Provisions.

2.13 Unless otherwise specified or shown on the Contract Drawings, electrical materials and equipment provided and installed by equipment manufacturers for mechanical systems specified in **Divisions 11** through **15** of these Special Provisions shall comply with all provisions of this Section and meet the following requirements:

2.13.1 All conductors shall be enclosed in conduit. Refer to **Parts 9** and **11** of this Section for conduit material and installation requirements.

2.13.2 Conductor identification and termination for internal wiring shall be in accordance with **Part 1** of this Section.

2.14 Data regarding the modifications of the existing electric equipment or systems presented in the Contract Documents are based on the best information available to the District. The Contractor shall include in their

bid the costs associated with investigation of the existing electric equipment or systems in the field to obtain any additional required information.

2.15 In case of conflicting or incomplete technical information, the Contractor shall identify this discrepancy and coordinate its resolution with the District.

2.16 All work or connections requiring power interruptions to the existing facilities shall be done at a time and under conditions that will least interfere with the existing plant operation and as authorized by the District.

2.17 The Contractor shall repair or replace all existing improvements damaged or removed by the Contractor as a result of proposed work. Repairs and replacements shall match the existing improvements in finish and dimensions.

2.17.1 Unless otherwise specified, painting of electrical equipment shall be in accordance with the equipment manufacturer's standard paint process. Field painting of equipment at the jobsite is not acceptable. The finish color shall be SAE-AMS-STD-595, Color ANSI No. 61 Gray

### 3. PRINCIPAL ITEMS OF WORK

The principal items of work include, but are not necessarily limited to, the following:

3.1 Modify the existing electric equipment and systems and perform "hot switchover" of the control functions from the existing to proposed control systems according to **Part 17** of this Section.

3.2 Provide and install raceway systems, including all conduits, conduit fittings (such as couplings, elbows, tees, etc.), manholes, boxes (outlet, junction, pull and terminal) and all miscellaneous devices required to form complete electric, instrumentation and communication systems.

3.3 Provide and install the conductors for all electric and instrumentation circuits.

3.4 Provide and install raceways for telephone system.

3.5 Provide and install lighting system including raceways and the conductors, all lighting fixtures, lamps and convenience receptacles.

3.6 Ground all electric systems, equipment, and metal structures. This includes providing and installation of all required grounding electrodes and wells, cables and terminations, and the isolated instrumentation grounding system (control common).

3.7 Perform field-testing of all equipment as specified in **Part 21** of this Section.

3.8 Perform all other work not specifically called out but necessary for complete and successful operation of the electric systems.

3.9 Clean, test, adjust and leave the complete installation in operational condition acceptable to the District.

#### 4. CODES AND STANDARDS

4.1 The design, equipment, materials and installation thereof shall conform to requirements of the latest editions of the following codes and standards:

NO	CODE OR STANDARD
1	NATIONAL ELECTRICAL SAFETY CODE (ANSI-C2)
2	NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
3	ELECTRICAL SAFETY ORDERS (CAL-OSHA)
4	NATIONAL ELECTRICAL CODE (NFPA 70)
5	ELECTRICAL CODE OF COUNTY OF LOS ANGELES
6	AMERICAN NATIONAL STANDARD INSTITUTE (ANSI)
7	INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)
8	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
9	ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IES)
10	UNDERWRITERS LABORATORIES (UL)
11	INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

4.2 Nothing on the Contract Drawings or in these Special Provisions shall be construed to permit any work contravening these codes and standards. Any changes or alterations in the equipment needed to meet the code and standard requirements shall be made at the expense of the Contractor. In the event of conflicts among the referenced codes and standards and these Special Provisions, the more stringent requirements shall govern.

4.3 All electric equipment and materials shall be listed by and bear the label of Underwriters Laboratories (UL), Factory Mutual (FM), Canadian Standards Association (CSA) or one(1) of the nationally recognized electrical testing laboratories listed by OSHA. Installation of electric equipment and materials shipped to the job site without such labels will not be allowed.

4.4 The Contractor shall submit proof that the items provided under these Special Provisions conform to such standards. The label of or listing in the publications of one(1) of the above named organizations shall be acceptable as sufficient evidence that the items conform to these standards. If for a particular type of material or equipment such a standard has not been established by one(1) of the above named organizations, the Contractor shall submit for acceptance manufacturer's certificate of compliance identifying the manufacturer, the product and the standard(s) of the American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA),

Institute of Electrical and Electronics Engineers (IEEE) to which requirements this product conforms. In addition, the certificate of compliance shall state that the product conforms to all requirements of these Special Provisions.

5. MATERIALS AND EQUIPMENT REQUIREMENTS

5.1 General.

5.1.1 All electric materials and equipment shall be standard catalog products of manufacturers regularly engaged in the manufacture of such products. Any deviation from this requirement shall be accepted by the District in writing.

5.1.2 All electric materials and equipment provided and installed by the Contractor shall be new and free from all defects.

5.1.3 When two(2) or more electric devices or pieces of equipment of the same class are provided, the electric devices and equipment shall be products of a single manufacturer, and they shall be interchangeable.

5.2 Warranty.

5.2.1 The Contractor shall provide a warranty on all electric materials and equipment as specified in **Section 1A, Part 21** of these Special Provisions.

6. EXAMINATION OF CONTRACT DOCUMENTS AND SITE

The Contractor shall examine the civil, structural, mechanical and other relevant Contract Documents and shall visit the site of the work to become familiarized with all existing conditions and ascertain all the necessary work entailed in this Contract. By submitting a bid for the work, the Contractor shall be deemed to have made such examination and that the Contractor is familiar with and accepts all conditions of the work.

7. EXCAVATION AND BACKFILL

The Contractor shall do all excavation and backfill necessary to complete the installation of the conduits as shown on the plans. Trenches shall be held to the minimum width required for installation. The trenches excavated in existing concrete, asphalt or landscaped areas shall be restored in kind to match the existing surface.

8. GROUNDING

8.1 General

8.1.1 The Contractor shall provide and install all grounding conductors and connectors and make all connections as required to complete

the grounding system as specified in this Section, whether or not grounding conductors and their connections are shown on the Contract Drawings.

8.1.2 The Contract Drawings are diagrammatic and do not show all required grounding connections. The Contractor shall ground all electric equipment (such as electrical enclosures, transformer neutrals, metal conduits, lighting poles, lighting fixtures, motor frames, junction boxes, transformer guard posts, etc.) whether or not the required grounding connections are shown on the Contract Drawings. The sizes of the grounding conductors shall be selected according to the NEC requirements.

8.1.3 Each control panel, panelboard and lighting pole shall be grounded in one(1) place by a grounding conductor.

8.1.4 The grounding rods and grounding wells shall be installed in locations shown on the Contract Drawings. Grounding wells shall be installed as shown in **Section 16J** of these Special Provisions.

8.1.5 All metallic conduits terminated in each switchboard section, control panel, box (outlet, junction, pull and terminal) and at each cable tray, instrument or any other piece of equipment or enclosure shall be bonded to this piece of equipment or enclosure and bonded together by UL-approved grounding bushings, along with the equipment grounding conductors (if specified or provided in vendor-furnished cables) installed in the conduits. Each conduit stubup and each conduit terminating at a cable tray shall be grounded by an UL-approved grounding bushing.

## 8.2 Grounding Conductors.

8.2.1 Bare grounding conductors shall be annealed, concentric-lay, stranded-copper conductors with ASTM designation B8, Class B. Before stranding, the copper conductor shall meet ASTM designation B3. Unless shown otherwise on the Contract Drawings, the size of the bare grounding conductors shall be 4/0 or as required by the NEC.

8.2.2 Bare grounding conductors to be stubbed up beneath a floor-mounted equipment such as switchboard or flush with finished floor or grade shall have 6-inches of PVC Schedule 40 conduit below the concrete slab and 1/2-inch of PVC Schedule 40 conduit above the finished surface.

8.2.3 The underground grounding conductors shall be installed at a depth of not less than 18-inches below the established elevation of the finished grade.

8.2.4 Grounding conductors emerging from underground other than concrete slab shall be protected with PVC conduit sleeves and bushings.

## 8.3 Grounding Connections.

8.3.1 Underground Grounding Connections:

8.3.1.1 The grounding conductors at all underground intersections and all connections to grounding rods, taps, and risers shall be connected using the appropriate compression ground connectors for the intended application.

8.3.1.2 Underground compression-type grounding connectors shall be suitable for direct burial or embedding in concrete. Connectors shall meet all applicable requirements of IEEE 837 "Standard for Qualifying Permanent Connections Used in Substation Grounding" and shall be listed according to the requirements of UL 467 "Standard for Grounding and Bonding Equipment."

8.3.1.3 All ground connectors shall be provided with a corrosion-inhibiting compound pre-applied to the contact surfaces. The compound must be compatible with the conductors accommodated by the connector.

8.3.1.4 All connectors shall be clearly and permanently embossed with the following information:

- a. Manufacturer's inspection symbol
- b. Catalog number.
- c. Conductor accommodation(s).
- d. Installation die index or die catalog number.
- e. Underwriters Laboratories Listing Mark/CSA certification mark.
- f. The words "Suitable for Direct Burial," "Direct Burial," "Burial", or "DB" as specified in ANSI/UL 467.

8.3.1.5 Connectors shall be installed in strict accordance with the manufacturer's instructions.

8.3.1.6 Compression-type grounding connectors shall be Burndy Hyground, ABB Blackburn E-Z-Ground, or accepted equal.

#### 8.3.2 Exposed Grounding Connections:

8.3.2.1 Exposed grounding conductor fittings shall be properly sized copper alloy or other suitable nonmagnetic and corrosion-resisting material.

8.3.2.2 All exposed grounding connections shall be of the bolted type.

#### 8.4 Grounding Plates.

8.4.1 Flush grounding plates shall be of copper alloy suitable for compression connection to copper grounding conductors. Plastic plugs shall be provided to protect the tapped holes in the flush grounding plates from penetration of concrete and dirt until the holes are used.

8.4.2 Flush grounding plates shall be installed in the concrete equipment pad or foundation when shown on the Contract Drawings or when required to align with grounding plates provided with the equipment.

8.4.3 Grounding plates shall be Cadweld B162 or accepted equal.

## 9. CONDUIT AND FITTINGS

Types of conduits to be installed on this project are specified elsewhere in these Special Provisions or shown on the Contract Drawings. The conduits shall meet the following requirements.

### 9.1 Galvanized Rigid Steel Conduit.

9.1.1 The conduit shall be hot-dip galvanized inside and outside with hot-dip galvanized threads.

9.1.2 The conduit shall be manufactured in accordance with UL 6 and ANSI C80.1 Standards for Electric Rigid Steel Conduit.

9.1.3 The conduit shall have standard NPT threads with a 3/4-inch taper per foot. Running conduit threads are not acceptable.

9.1.4 The conduit shall be manufactured by Western Tube and Conduit, Allied Tube and Conduit, Wheatland Tube Co., or accepted equal.

### 9.2 PVC-Coated Galvanized Rigid Steel Conduit.

9.2.1 The conduit shall meet the following requirements:

9.2.1.1 Before the PVC coating is applied, the hot-dipped galvanized surfaces shall be coated with an epoxy-acrylic primer to ensure a bond between the zinc substrate and the PVC coating.

The PVC coating shall be bonded to the primed outer surface of the conduit. The bond between the conduit and PVC coating shall be equal to or greater than the tensile strength of the PVC coating. The PVC coating shall have minimum thickness of 0.04-inch.

9.2.1.2 Coated conduit shall conform to NEMA Standard RN-1, the galvanized coating may not be disturbed or reduced in thickness during the cleaning and preparatory process.

9.2.1.3 Urethane coating shall be applied to the interior of the conduit. The internal coating shall have minimum thickness of 0.002-inch. It shall afford sufficient flexibility to permit field bending without cracking or flaking.

9.2.1.4 Each conduit coupling and fitting shall have a PVC sleeve extending beyond its thread one(1) conduit diameter or 2-inches, whichever is less. The inside diameter of the sleeve shall be the same as the outside

diameter of the conduit before coating. The wall thickness of the sleeve shall be at minimum 0.04-inch.

9.2.2 PVC-coated conduit shall be as manufactured by OCAL, Robroy Industries, or accepted equal.

9.3 Rigid Aluminum Conduit.

9.3.1 Rigid aluminum conduit shall be threaded type, constructed from Alloy No. 6063 in temper designation T1.

9.3.2 The conduit shall be manufactured in accordance with UL 6A and ANSI C80.5 Standards for Electric Rigid Aluminum Conduit.

9.3.3 The conduit shall have standard NPT threads with a 3/4-inch taper per foot. Running conduit threads are not acceptable.

9.3.4 Rigid aluminum conduit shall be as manufactured by Republic Conduit, Allied Tube and Conduit, Wheatland Tube Co., Patriot Aluminum Products, or accepted equal.

9.4 Rigid Nonmetallic Conduit.

9.4.1 Rigid nonmetallic conduit shall be Schedule 40 polyvinyl chloride (PVC).

9.4.2 The conduit shall be rated for use with 90-degrees C rated conductors.

9.4.3 The conduit shall be manufactured in accordance with UL 651.

9.4.4 The conduit shall be as manufactured by Carlon, Southern Pipe, or accepted equal.

9.5 Conduit Fittings.

9.5.1 All conduit fittings, such as couplings, elbows, tees, etc., shall be threaded type (not employing set screws or bolts). The fittings shall be of the same material as the corresponding conduit. All fittings shall be capable of carrying short-circuit fault currents equal to or exceeding the requirements of U.L. Standard 514B (rating of the conduit). Conduit bushings shall be of the grounding type. Conduit fittings shall be Crouse-Hinds, Appleton, OZ/Gedney, or accepted equal.

9.6 Conduit Bodies.

9.6.1 All conduit bodies shall have wedge-nut or captive screw covers with sealing gaskets. Conduit bodies shall be Form 7 or mogul-type as manufactured by Crouse-Hinds, Appleton, OZ/Gedney, or accepted equal.

9.7 Liquidtight Flexible Metal Conduit.

9.7.1 Liquidtight flexible metal conduit shall be manufactured from single strip steel, hot-dip galvanized on all four(4) sides before conduit fabrication. Strip steel shall be spiral wound resulting in an interior that is smooth and clean for easy wire pulling.

9.7.2 Liquidtight flexible metal conduit shall be listed under UL 360 Standard for Liquidtight flexible steel conduit.

9.7.3 Liquidtight flexible metal conduit shall have gray PVC cover.

9.7.4 Liquidtight flexible metal conduit shall be terminated with insulated metal conduit connectors with external integral grounding lugs cast into the gland nut.

9.7.5 Liquidtight flexible metal conduit connectors shall be Appleton Series ST or STB, OZ/Gedney "Ground-Tite Type 4Q-L," or accepted equal.

9.7.6 Liquidtight flexible metal conduit shall be Southwire "Titan 2," AFC "Liquid-Tuff," Anaconda "Sealtite Type UA," Electri-Flex "Liquatite Type LA," or accepted equal.

## 10. PULL, JUNCTION AND TERMINAL BOXES

### 10.1 Metal Boxes.

#### 10.1.1 General:

10.1.1.1 Unless otherwise specified or shown on the Contract Drawings, all pull, junction and terminal boxes shall meet the following requirements.

10.1.1.2 All boxes shall be made of the same material as the conduits to be terminated in these boxes.

10.1.1.3 All boxes shall be sized as required, unless the inside dimensions (length x width x depth) are shown on the electrical plans.

10.1.1.4 All boxes shall be provided with gaskets. Box covers shall be secured by screws.

10.1.1.5 All boxes installed in locations identified on the Contract Drawings as Class I, Division 1 hazardous (classified) areas shall be UL- or CSA-listed or FM-approved as explosion proof.

10.1.1.6 All terminal boxes shall be provided with number of terminals, meeting the requirements of **Part 15.1.2** of this Section, as shown on the Contract Drawings.

### 10.2 Nonmetallic Boxes.

10.2.1 Where specified elsewhere in these Special Provisions or shown on the Contract Drawings, nonmetallic boxes shall meet the following requirements.

10.2.2 For outdoor installation, the boxes shall be rated NEMA Type 4X.

10.2.3 The boxes shall be constructed of molded glass-reinforced polyester resins that are chemically resistant to hydrogen-sulfide-laden corrosive atmospheres. The material shall include a flame retardant to obtain a flammability rating meeting the requirements of UL Standard 94V-0. Heat distortion temperature shall be 175-degrees C.

10.2.4 The boxes shall be of one-piece construction with smooth, rounded corners. There shall be no gasketed joints except for the covers. The covers shall be secured by stainless-steel screws.

## 11. INSTALLATION OF CONDUIT

### 11.1 General.

11.1.1 Unless otherwise specified or shown on the Contract Drawings, installation of conduit shall be according to the requirements specified below.

11.1.2 The location of conduit runs and conduit stub-ups are shown on the Contract Drawings diagrammatically. The Contractor shall change the routing of conduit and move the stub-ups to meet the requirements of the District-accepted manufacturer's submittals for all equipment and to meet the field conditions. Such changes shall be made with the District's acceptance, and they shall not be considered grounds for claims for extra work or time extension. Conduit stub-ups shall not be installed before equipment submittals are accepted by the District.

11.1.3 All conduits shall be installed in a neat and workmanlike manner. When completed, the conduit runs shall be mechanically and electrically continuous throughout and effectively grounded.

11.1.4 No conduit run shall have more than the equivalent of four(4) 90-degree bends between an outlet or fixture and the next outlet, fixture, pull box or enclosure.

11.1.5 The radius of conduit bend and the maximum distance between conduit supports shall be according to requirements of NEC.

11.1.6 When a conduit enters a motor terminal box, a suitable length of flexible, liquidtight metal conduit shall be provided.

11.1.7 External bonding jumpers shall be installed on all flexible liquidtight metal conduits. External bonding jumpers shall be installed parallel to the flexible liquidtight metal conduits and secured with non-

metallic ties. Spiral wrapping of the bonding jumpers around the flexible liquidtight metal conduits is not acceptable.

11.1.8 Conduit sealing fittings shall be installed in conduits located in areas identified on the Contract Drawings as hazardous (classified) per the requirements of the NEC.

11.1.9 Openings provided for conduit passage through any electrical enclosure or through the wall, floor or ceiling of any building shall be sealed with a two-component, non-sag, polyurethane-based elastomeric sealant. The sealant shall be Sikaflex-2c NS as manufactured by Sika Corporation or equal.

11.1.10 All conduit, conduit bodies and fittings to be installed in the hazardous (classified) locations identified on the Contract Drawings shall be UL-listed for use in these locations.

11.1.11 The center-to-center separation of each pair of adjacent conduits penetrating a gallery or building wall shall not be less than three(3) times the outside diameter of the larger conduit.

11.1.12 PVC-coated conduit shall be worked with tools recommended by the conduit manufacturer in a manner minimizing damage to the coating. Damaged coatings and field joints shall be treated with a PVC compound to provide protection equal to the original coating.

11.1.13 In architecturally finished areas of buildings, the Contractor shall use electrical metallic tubing and install it concealed in building walls and drop ceilings.

11.1.14 Utility company conduit shall be installed according to the requirements of the utility company. Those conduits that are to be buried in the ground shall be encased in concrete according to the requirements of **Part 11.1.17** of this Section.

11.1.15 All spare conduits shall be stubbed up according to **Part 11.2.4** of this Section and capped or plugged to prevent the ingress of dirt and water. A 1/4-inch diameter nylon rope shall be installed in each spare conduit.

11.1.16 Openings in conduits containing conductors that pass through or terminate in areas including, but not necessarily limited to the locations listed below shall be sealed using "NEER" by Emerson, or equal to prevent rodents from accessing the raceway system and equipment:

- a. Stub-ups beneath electrical and control equipment.
- b. Underground manholes and pull boxes.
- c. Aboveground pull and junction boxes.
- d. Cable trench walls and floors.

- e. Conduit openings terminating on cable trays.

11.1.17 Each conduit identified in the Contract Documents by a conduit number shall be provided with stainless-steel identification tags affixed by means of stainless-steel wire to the conduit or conduit's termination bushings. The minimum size of the identification tags shall be 5/8-inch x 2-1/2-inch by McMaster-Carr Part No. 1632T88, or equal. The identification tags shall be laser-etched and filled with CerMark No. LMM6000 black laser marking ink with the conduit number shown in the Contract Documents. The letters and numbers on the tags shall, as a minimum, be 1/4-inch high.

## 11.2 Underground Conduit.

11.2.1 When accepted by the District, direct buried PVC-coated rigid steel conduit meeting the requirements of **Part 9.2** of this Section may be used for underground installations in lieu of concrete-encased PVC-coated rigid steel conduit or steel-reinforced and concrete-encased rigid nonmetallic conduit. Minimum burial depths shall be in accordance with the NEC.

11.2.2 Unless otherwise shown on the Contract Drawings, the minimum burial depth of underground conduits, measured from the finished grade to the top of the conduits shall be 24-inches.

11.2.3 Minimum size of underground conduit shall be 3/4-inch.

11.2.4 Each conduit emerging from a concrete slab, wall or grade shall be PVC-coated rigid steel conduit. For vertical stub-ups under or into electrical equipment, a conduit coupling shall be installed flush with the surface of the concrete slab or grade, and a conduit nipple shall be installed to extend the conduit beyond the finished concrete surface. Vertical stub-ups not under or into electrical equipment shall be installed with the PVC-coated rigid steel conduit extending a minimum of 6-inches above the slab or grade. PVC-coated rigid steel conduit shall extend below the concrete slab or grade through the first conduit bend until the conduit is horizontal (parallel with the ground surface).

11.2.5 Each conduit stub-up, including a length of at least 6-inches below a concrete slab or grade, shall be PVC-coated rigid steel conduit. The PVC-coated rigid steel conduit shall meet the requirements of **Part 9.2** of this Section.

Each conduit to be stubbed up flush with finished floor or grade, if so, shown on the Contract Drawings, shall have 6-inches of PVC-coated rigid steel conduit below the concrete slab or grade. The PVC-coated rigid steel conduit shall meet the requirements of **Part 9.2** of this Section.

Each conduit to be stubbed up beneath a floor-mounted equipment such as switchboards, control panels and variable-frequency controllers, shall have 6-inches of PVC-coated rigid steel conduit below the concrete slab or grade and 1/2-inch of PVC-coated rigid steel conduit above the finished surface,

excluding the conduit threads. The PVC-coated rigid steel conduit shall meet the requirements of **Part 9.2** of this Section.

11.2.6 Underground conduits connecting the pieces of equipment located on the same concrete slab may be installed directly under the slab, if the concrete slab is at least 6-inches thick and the conduits are encased in concrete at least 3-inches all around.

11.2.7 Conduits located beneath building and equipment slabs shall be PVC-coated rigid steel conduit meeting the requirements of **Part 9.2** of this Section. Conduits shall be installed a minimum of 6-inches below structural footings and shall be encased with a minimum of 3-inches cover of 2-sack slurry.

11.3 Exposed Conduit.

11.3.1 Exposed conduit to be installed in the areas identified on the Contract Drawings as corrosive shall be rigid steel, galvanized, PVC-coated meeting the requirements of **Part 9.2** of this Section.

11.3.2 Exposed conduit to be installed in all areas other than those identified on the Contract Drawings or in **Part 2.5** of this Section as corrosive shall be rigid aluminum meeting the requirements of **Part 9.3** of this Section (**for water reclamation plants and pumping plants**).

11.3.3 Exposed conduit shall be run horizontally or perpendicularly to structures and equipment with symmetrical right-angle bends.

11.3.4 To avoid moisture traps, provide a junction box with a drain fitting at each low point of vertical or horizontal runs of conduit.

11.3.5 Exposed rigid steel galvanized conduits shall be supported either by one-hole galvanized-steel straps with galvanized-steel spacers or by galvanized-steel channels and matching galvanized-steel clamps.

11.3.6 Exposed rigid aluminum conduits shall be supported either by one-hole aluminum straps with aluminum spacers or by aluminum channels and matching aluminum clamps.

11.3.7 Exposed PVC-coated galvanized rigid steel conduits shall be supported either by one-hole PVC-coated electro-zinc plated steel straps with PVC-coated galvanized-steel spacers or by PVC-coated galvanized-steel channels and matching PVC-coated electro-zinc plated steel clamps.

11.3.8 Each wall- or ceiling-mounted conduit crossing an existing or proposed structural expansion/contraction joint shall be provided with a watertight expansion coupling as specified in this Section and whether shown on the Contract Drawings or not. Also, each exposed long run of conduit shall be provided with expansion coupling to allow equalized movement for both expansion in hot weather and contraction in cold weather per NEC requirements as specified in this Section and whether shown on the Contract Drawings or not.

The expansion couplings shall be provided with external copper bonding jumpers sized according to NEC requirements. The expansion couplings shall be as manufactured by Appleton, O-Z/Gedney, or accepted equal.

11.3.9 Each exposed conduit installed above buried fill in landfills shall be terminated in each pull box and each enclosure with a weatherproof expansion coupling. The couplings shall provide for 8-inches of conduit movement and have bonding jumpers. The couplings shall be as manufactured by O-Z/Gedney, Appleton, or accepted equal.

11.3.10 Exposed conduit used for making final connections to rotating or vibrating equipment or for equipment requiring flexible connections shall be liquidtight flexible metal conduit, meeting the requirements of **Part 9.7** of this Section.

11.4 Conduit Spacing.

11.4.1 Unless otherwise specified or shown on the Contract Drawings, conduit spacing shall be as specified below.

11.4.2 Both exposed and underground conduits containing circuits of different power classes (levels) shall be installed with proper spacing to avoid electromagnetic interference and thereby ensure proper operation of instrumentation and control systems.

The basic circuit levels are shown in the following table:

CIRCUIT LEVEL	CIRCUIT DESCRIPTION
1 - HIGH SUSCEPTIBILITY	THERMOCOUPLE
	RTD (RESISTANCE TEMPERATURE DETECTOR)
	CONTROL COMMON
	ANALOG SIGNAL <50 V (E.G., 4 TO 20 MA DC OR 1 TO 5 V DC)
	DIGITAL SIGNAL <15 V
	DATA HIGHWAY
	TELEPHONE
2 - MEDIUM SUSCEPTIBILITY	24 V DC CONTROL <250 MA
3 - LOW SUSCEPTIBILITY	24 V DC CONTROL >250 MA AND <3 A
	125 V DC CONTROL <3 A
	AC FEEDERS <20 A
4 - POWER	<1000 V, 20 A TO 800 A
4S - POWER, CLASS S	>1000 V OR >800 A

11.4.3 Minimum edge-to-edge separation, in inches, of conduits shall be as follows.

## 11.4.3.1 Underground Conduits:

STEEL CONDUIT					
LEVEL	1	2	3	4	4S
1	2	2	3	12	12
2	2	2	3	9	12
3	3	3	2	2	6
4	12	9	2	3	3
4S	12	12	6	3	3

## 11.4.3.2 Aboveground Conduits:

LEVEL	1	2	3	4	4S
1	0	1	3	12	12
2	1	0	3	9	12
3	3	3	0	0	6
4	12	9	0	0	0
4S	12	12	6	0	0

## 12. CABLE TRAYS

12.1 General.

12.1.1 Cable trays shall conform to the requirements of NEMA Standard VE 1. All cable trays shall be of a copper-free aluminum alloy.

12.1.2 Cable trays containing Level 1 or 2 circuits, as defined in **Part 11.4.2** of this Section, shall be solid-bottom type with continuous solid covers. The trays shall be of three-piece construction consisting of two(2) longitudinal members (side rails) with a flat bottom welded to the side rails. The cable trays shall be rated for a working load capacity of fifty(50) pounds/linear foot.

12.1.3 Cable trays containing Level 3, 4 or 4S circuits, as defined in **Part 11.4.2** of this Section, shall be ventilated-trough type with raised solid covers. The trays shall be of three(3) piece construction consisting of two(2) longitudinal members (side rails) with a flat bottom welded to the side rails. The cable trays shall be rated for a working load capacity of seventy-five(75) pounds/linear foot.

12.1.4 The cable tray system shall include straight sections, fittings, reducers, connectors, covers, accessories and supports as required to provide a properly assembled cable tray system. All components shall be of standard design of the same manufacturer and include elbows, tees, reducers with connectors, wraparound plates, blind ends, dropouts, dividers, covers, flange connections, bolts, and nuts as required.

12.1.5 Cable tray and fitting covers shall be solid, flanged covers of the same material as the cable trays. The tray covers shall be equipped with clamps for fastening.

12.1.6 Tray runs shall be continuous, with factory-formed fittings, except vibration-isolation gaps when required. Coupler joints shall be of the high-pressure bolted type. Adequate conductance across each joint shall be accomplished by use of suitable bonding jumpers.

12.1.7 Expansion couplers of the same manufacturer as the trays shall be provided for installation in tray systems at each proposed structural expansion/contraction joint or when the continuous straight length exceeds one hundred-fifty(150) feet.

12.1.8 Cable Tray Separators:

12.1.8.1 Cable tray separators, if specified elsewhere in the Contract Documents, shall be slotted at regular intervals for installation without field drilling. They shall be made of the same material as the cable tray. The separators shall be provided with necessary splice clips and required number of bolts, nuts and captive lock washers.

12.1.8.2 Each piece of separator for horizontal bends shall be slotted at regular intervals for easy field adjustment to any degree of radius curvature. Separators for vertical bends shall be factory formed for individual fittings in which they are to be placed.

12.1.9 The cable trays shall be as manufactured by P-W Industries, B-Line, or accepted equal.

12.2 Cable Tray Supports.

12.2.1 Unless otherwise shown on the Contract Drawings, supports for the tray system, including fittings, shall be provided according to the requirements of NEMA Standard VE 1 and the following requirements. The Contractor shall design, fabricate and install the required complete support system including miscellaneous supports. Cantilevered trays shall be installed such that torsional loadings applied to support steel will not be excessive. In all cases, supports shall be coordinated with structural elements of buildings, and supplementary support steel shall be provided for tray systems as required. Supports shall be installed adjacent to and on each side of all fittings, including bends, crosses, ells and ends of tray runs. Tray supports shall be spaced at eight(8)-foot intervals and two(2) feet from each end of the tray run or as shown on the Contract Drawings.

12.2.2 Supports shall be assembled with proper fittings and bolts. They shall be mounted plumb and level and rigidly anchored. Supports shall be designed to permit horizontal and vertical adjustment of the trays wherever possible. All hangers, brackets, fittings, bolts, washers, nuts and other connecting material shall be Type 316 stainless-steel. Exposed surfaces of field-cut material shall be painted with asphalt-based aluminum paint.

12.2.3 Unless otherwise shown on the Contract Drawings, support anchors shall be post installed anchors as specified in **Section 5C** of these Special Provisions. All anchors shall be Type 316 stainless-steel.

12.2.4 Cable tray supports shall be, for each support, one(1) of the following:

12.2.4.1 Single-hanger member with tray-support brackets cantilevered.

12.2.4.2 Double-hanger member with tray-support arms trapeze style between hanger members.

- a) Support hangers shall consist of threaded rods (1/2-inch diameter, at minimum) and channels (1-5/8-inch wide, at minimum) series of Unistrut, Power-Strut, or accepted equal. Channels lighter than Unistrut P1000 or Power-Strut PS200 shall not be used. All support members shall be Type 316 stainless-steel.

12.2.5 The design of the cable tray supports shall meet the earthquake restraint requirements of **Part 16** of this Section.

12.3 Installation of Cable Trays.

12.3.1 Cable trays shall be installed in a neat and workmanlike manner with all runs continuous, level, plumb and parallel to the building walls and floors.

12.3.2 End plates shall be installed at all open tray ends.

12.3.3 Cable trays shall be installed in a manner allowing shedding water readily on horizontal or inclined tray runs. No drilling of trays shall be permitted for installation of cover clamps.

12.3.4 Cable trays passing through wall openings shall be sealed with removable UL-listed fire barrier foam. Fire barrier foam shall be 3M FIP 1-step, Touch n' Seal 1.75 PCF, or equal.

13. CONDUCTORS FOR INSTALLATION IN CONDUIT OR CABLE TRAYS

13.1 Conductors for wiring lighting fixtures, lighting switches and receptacles shall be Type XHHW-2, stranded or solid copper rated 600 V, 90-degrees C for wet and dry locations.

13.2 Insulation color of single-conductor cables shall be according to the following table:

<b>AC AND DC POWER</b>	<b>BLACK</b>
<b>AC AND DC CONTROL</b>	<b>RED</b>
<b>AC NEUTRAL</b>	<b>WHITE</b>

GROUND

GREEN

13.3 Conductors to be installed in the wireways of high-intensity discharge or fluorescent lighting fixtures shall be suitable for the temperatures to be encountered. Conductor insulation shall be silicone rubber or accepted equal.

13.4 Unless otherwise specified, all conductors shall be suitable for installation in conduits or cable trays.

13.5 Unless otherwise specified, the following types of conductors referred to in **Section 16K** of these Special Provisions or shown on the Contract Drawings shall be used:

TYPE	DESCRIPTION
1	SINGLE-CONDUCTOR POWER AND CONTROL CABLE, RATED 600 V:  TYPE XHHW-2 SINGLE-CONDUCTOR POWER AND CONTROL CABLE, ANNEALED COPPER, STRANDED, RATED 600 V, FLAME-RETARDANT, MOISTURE RESISTANT THERMOSET INSULATION, RATED 90°C FOR WET AND DRY LOCATIONS. INSULATION COLOR SHALL BE AS SPECIFIED IN <b>PART 13.2</b> . SIZES 1/0 AWG AND LARGER SHALL BE SUITABLE FOR CABLE TRAY APPLICATIONS. THE CABLE SHALL BE AS MANUFACTURED BY SOUTHWIRE, CERROWIRE, OR EQUAL.
2	MULTI-CONDUCTOR POWER CABLE, RATED 600 V:  TYPE XHHW-2 MULTI-CONDUCTOR POWER CABLE, UL-LISTED AS TYPE TC-ER. THE CONDUCTORS SHALL BE ANNEALED BARE COPPER CLASS B STRANDED, RATED 600 V, WITH FLAME-RETARDANT, MOISTURE RESISTANT THERMOSET INSULATION, COLOR CODED PER ICEA METHOD 4, RATED 90°C FOR WET AND DRY LOCATIONS, WITH AN ANNEALED BARE COPPER CLASS B STRANDED GROUND CONDUCTOR AND OVERALL FLAME-RETARDANT, MOISTURE AND SUNLIGHT RESISTANT PVC JACKET. THE CABLE SHALL BE SUITABLE FOR INSTALLATION IN CABLE TRAYS OR CONDUITS. THE CABLE SHALL BE AS MANUFACTURED BY GENERAL CABLE, ALLIED WIRE AND CABLE, OR EQUAL.
3	MEDIUM-VOLTAGE (MV) SHIELDED SINGLE CONDUCTOR, RATED 5-KV:  5-KV SINGLE-CONDUCTOR CABLE, UL-LISTED AS TYPE MV-105. THE CONDUCTOR SHALL BE ANNEALED BARE COPPER COMPACT CLASS B STRANDED, WITH EXTRUDED SEMICONDUCTING STRAND SCREEN AROUND THE CONDUCTOR, 115 MILS OF ETHYLENE PROPYLENE RUBBER (EPR) INSULATION WITH AN INSULATION LEVEL OF 133%, EXTRUDED SEMICONDUCTING INSULATION SCREEN, 25% MINIMUM OVERLAPPED 5 MIL BARE COPPER SHIELDING TAPE. THE CONDUCTORS SHALL BE ENCLOSED IN AN OVERALL FLAME-RETARDANT, MOISTURE AND SUNLIGHT RESISTANT POLYVINYL CHLORIDE (PVC) JACKET. THE CABLE SHALL BE SUITABLE FOR INSTALLATION IN CABLE TRAYS OR CONDUITS. THE CABLE SHALL BE AS MANUFACTURED BY GENERAL CABLE, SOUTHWIRE, OR EQUAL.
4	MEDIUM-VOLTAGE (MV) SHIELDED SINGLE CONDUCTOR, RATED 15-KV:  15-KV SINGLE-CONDUCTOR CABLE, UL-LISTED AS TYPE MV-105. THE CONDUCTOR SHALL BE ANNEALED BARE COPPER COMPACT CLASS B STRANDED, WITH EXTRUDED SEMICONDUCTING STRAND SCREEN AROUND THE CONDUCTOR, 220 MILS OF ETHYLENE PROPYLENE RUBBER (EPR) INSULATION WITH AN INSULATION LEVEL OF 133%, EXTRUDED SEMICONDUCTING INSULATION SCREEN, 25% MINIMUM OVERLAPPED 5 MIL BARE COPPER SHIELDING TAPE. THE CONDUCTORS SHALL BE ENCLOSED IN AN OVERALL FLAME-RETARDANT, MOISTURE AND SUNLIGHT RESISTANT POLYVINYL CHLORIDE (PVC) JACKET. THE CABLE SHALL BE SUITABLE FOR INSTALLATION IN CABLE TRAYS OR CONDUITS. THE CABLE SHALL BE AS MANUFACTURED BY GENERAL CABLE, SOUTHWIRE, OR EQUAL.

TYPE	DESCRIPTION
5	<p>SHIELDED MULTI-CONDUCTOR CONTROL CABLE, RATED 600 V: (VERIFY MANUFACTURERS' DATA FOR AVAILABLE NO. OF CONDUCTORS OF A PARTICULAR WIRE GAUGE)</p> <p>TYPE XHHW-2 MULTI-CONDUCTOR CONTROL CABLE, UL-LISTED AS TYPE TC, SIZE #16, #14, #12 OR #10 AWG AS SPECIFIED IN THE CONDUIT SCHEDULE OF <b>SECTION 16K</b>. THE CONDUCTORS SHALL BE ANNEALED BARE COPPER CLASS B STRANDED, RATED 600 V, WITH FLAME-RETARDANT, MOISTURE RESISTANT THERMOSET INSULATION, COLOR CODED PER ICEA METHOD 1 TABLE E-2, RATED 90°C FOR WET AND DRY LOCATIONS. THE CABLE SHALL HAVE AN OVERALL METALLIC-TAPE SHIELD AND DRAIN WIRE. THE CONDUCTORS SHALL BE ENCLOSED IN AN OVERALL FLAME-RETARDANT AND SUNLIGHT RESISTANT POLYVINYL CHLORIDE (PVC) JACKET. THE CABLE SHALL BE SUITABLE FOR INSTALLATION IN CABLE TRAYS OR CONDUITS. THE CABLE SHALL BE AS MANUFACTURED BY GENERAL CABLE, COLEMAN CABLE, OR EQUAL.</p>
6	<p>UNSHIELDED MULTI-CONDUCTOR CONTROL CABLE, RATED 600 V:</p> <p>TYPE XHHW-2 MULTI-CONDUCTOR CONTROL CABLE, UL-LISTED AS TYPE TC, SIZE #16, #14, #12 OR #10 AWG AS SPECIFIED IN THE CONDUIT SCHEDULE OF <b>SECTION 16K</b>. THE CONDUCTORS SHALL BE ANNEALED BARE COPPER CLASS B STRANDED, RATED 600 V, WITH FLAME-RETARDANT, MOISTURE RESISTANT THERMOSET INSULATION, COLOR CODED PER ICEA METHOD 1 TABLE E-2, RATED 90°C FOR WET AND DRY LOCATIONS. THE CONDUCTORS SHALL BE ENCLOSED IN AN OVERALL FLAME-RETARDANT AND SUNLIGHT RESISTANT POLYVINYL CHLORIDE (PVC) JACKET. THE CABLE SHALL BE SUITABLE FOR INSTALLATION IN CABLE TRAYS OR CONDUITS. THE CABLE SHALL BE AS MANUFACTURED BY GENERAL CABLE, SOUTHWIRE, OR EQUAL.</p>
7	<p>SINGLE-PAIR INSTRUMENTATION SHIELDED CABLE, RATED 300 V:</p> <p>SINGLE-PAIR CABLE, RATED 300 V AND 105°C, THE CONDUCTORS SHALL BE ANNEALED BARE COPPER CLASS B STRANDED, SIZE 16 AWG, PVC- OR XLPE-INSULATED, TWISTED-PAIR, COLOR CODED BLACK AND WHITE, WITH OVERALL-CABLE METALLIC-TAPE SHIELD, TINNED-COPPER DRAIN WIRE AND FLAME-RETARDANT PVC JACKET. THE CABLE SHALL BE SUITABLE FOR INSTRUMENTATION AND CONTROL APPLICATIONS AND FOR INSTALLATION IN CABLE TRAYS OR CONDUITS. THE CABLE SHALL BE AS MANUFACTURED BY GENERAL CABLE, OKONITE, OR EQUAL.</p>
8	<p>SINGLE-TRIAD INSTRUMENTATION SHIELDED CABLE, RATED 300 V:</p> <p>SINGLE-TRIAD CABLE, RATED 300 V AND 105°C, THE CONDUCTORS SHALL BE ANNEALED BARE COPPER CLASS B STRANDED, SIZE 16 AWG, PVC-INSULATED, TWISTED-TRIAD, COLOR CODED BLACK, WHITE AND RED, WITH OVERALL-CABLE METALLIC-TAPE SHIELD, TINNED-COPPER DRAIN WIRE AND FLAME-RETARDANT PVC JACKET. THE CABLE SHALL BE SUITABLE FOR INSTRUMENTATION AND CONTROL APPLICATIONS AND FOR INSTALLATION IN CABLE TRAYS OR CONDUITS. THE CABLE SHALL BE AS MANUFACTURED BY GENERAL CABLE, OKONITE, OR EQUAL.</p>
9	<p>MULTIPLE-PAIR INSTRUMENTATION SHIELDED CABLE, RATED 300 V:</p> <p>MULTIPLE-PAIR SHIELDED CABLE, RATED 300 V AND 105°C, THE CONDUCTORS SHALL BE ANNEALED BARE COPPER CLASS B STRANDED, SIZE 16 AWG, PVC-INSULATED, TWISTED-PAIRS, EACH PAIR COLOR CODED BLACK AND WHITE WITH ONE(1) CONDUCTOR IN EACH PAIR IDENTIFIED ALPHA-NUMERICALLY, WITH INDIVIDUAL-PAIR AND OVERALL-CABLE METALLIC-TAPE SHIELDS, TINNED-COPPER DRAIN WIRE AND SUNLIGHT-RESISTANT PVC JACKET. THE CABLE SHALL BE SUITABLE FOR INSTALLATION IN CABLE TRAYS OR CONDUITS. THE CABLE SHALL BE AS MANUFACTURED BY GENERAL CABLE, OKONITE, OR EQUAL.</p>
10	<p>MULTIPLE-TRIAD INSTRUMENTATION SHIELDED CABLE, RATED 300 V:</p> <p>MULTIPLE-TRIAD SHIELDED CABLE, RATED 300 V AND 105°C, THE CONDUCTORS SHALL BE ANNEALED BARE COPPER CLASS C STRANDED, SIZE 16 AWG, PVC-INSULATED, TWISTED-TRIADS, EACH TRIAD COLOR-CODED BLACK, WHITE AND RED WITH ONE(1) CONDUCTOR IN EACH TRIAD IDENTIFIED ALPHA-NUMERICALLY, WITH INDIVIDUAL-TRIAD AND OVERALL-CABLE METALLIC-TAPE SHIELDS, TINNED-COPPER DRAIN WIRE AND SUNLIGHT-RESISTANT PVC JACKET. THE CABLE SHALL BE SUITABLE FOR INSTALLATION IN CABLE TRAYS OR CONDUITS. THE CABLE SHALL BE AS MANUFACTURED BY GENERAL CABLE, OKONITE, OR EQUAL.</p>

TYPE	DESCRIPTION
11	ALLEN-BRADLEY CONTROLNET CABLE: TYPE RG-6 COAXIAL SHIELDED CABLE. FOR USE OUTSIDE CONTROL PANEL - BELDEN CAT. NO. 1190A. FOR USE INSIDE CONTROL PANEL – ALLEN BRADLEY CAT. NO. 1786-RG6F.
12	MULTIMODE FIBER-OPTIC CABLE (SEE <b>PART 1</b> )
13	THERMOCOUPLE EXTENSION CABLE FOR FLARE STATIONS: ASA TYPE KX, RATED 300 V, 200°C, 2-CONDUCTOR, SIZE 16 AWG, SHIELDED CABLE WITH TEFLON INSULATION. THE CABLE SHALL BE AS MANUFACTURED BY BELDEN WIRE AND CABLE, TE WIRE AND CABLE, OR EQUAL.
14	CONDUCTORS FOR FLARE STATION CONTROL CIRCUITS (VALVES, FLAME SCANNERS, IGNITION TRANSFORMERS PRIMARIES, ETC.): STRANDED TIN-PLATED COPPER, RATED 600 V, TEFLON INSULATED CONDUCTOR, SIZE 14 AWG, RATED FOR CONTINUOUS OPERATION AT 200°C. CONDUCTORS SHALL BE AS MANUFACTURED BY RADIX WIRE CO., COLEMAN CABLE INC., OR EQUAL.
15	CONDUCTORS FOR FLARE STATION IGNITION TRANSFORMER SECONDARIES: HIGH-TEMPERATURE CONDUCTORS RATED 10 kV, 250°C, SIZE 16 AWG. CONDUCTORS SHALL BE AS MANUFACTURED BY RADIX WIRE COMPANY, TEVELEC, OR EQUAL.
16	SINGLE CONDUCTOR CABLE FOR FIRE/GAS ALARM INITIATION AND NOTIFICATION APPLIANCES: TYPE TFFN, #16 AWG, STRANDED-COPPER, RATED 600 V, 90°C, WITH HEAT AND MOISTURE-RESISTANT PVC INSULATION AND NYLON JACKET. CONDUCTORS SHALL BE AS MANUFACTURED BY SOUTHWIRE, ENCORE WIRE CORPORATION, OR EQUAL.
17	SINGLE CONDUCTOR CABLE FOR CONTROL OF IRRIGATION CONTROL VALVES: TYPE UF, RATED 600 V, SOFT-DRAWN BARE SOLID-COPPER CONDUCTORS, SIZE #14, #12, #10 OR #8 AWG AS SPECIFIED ON THE CONTRACT DRAWINGS OR IN THE CONDUIT SCHEDULE OF <b>SECTION 16K</b> . THE OVERALL COVERING SHALL BE POLYVINYL CHLORIDE (PVC), AND SUITABLE FOR DIRECT BURIAL IN THE EARTH. INSULATION OF EACH INDIVIDUAL CONDUCTOR SHALL BE COLOR CODED BY THE CONDUCTOR MANUFACTURER TO DISTINGUISH THIS CONDUCTOR FROM ALL OTHER 24 V CONDUCTORS. THE CABLE SHALL BE AS MANUFACTURED BY PAIGE IRRIGATION, REGENCY WIRE, OR EQUAL.
18	METAL-SHEATHED MEDIUM-VOLTAGE (MV) SHIELDED MULTI-CONDUCTOR, RATED 15-KV: 15-KV MULTI-CONDUCTOR CABLE, UL-LISTED AS TYPE MV-105 AND TYPE MC-HL. THE CONDUCTOR SHALL BE BARE COPPER CLASS B STRANDED, WITH EXTRUDED SEMICONDUCTING STRAND SCREEN AROUND THE CONDUCTOR, 220 MILS OF ETHYLENE PROPYLENE RUBBER (EPR) INSULATION WITH AN INSULATION LEVEL OF 133%, EXTRUDED SEMICONDUCTING INSULATION SCREEN, 25% MINIMUM OVERLAPPED 5 MIL BARE COPPER SHIELDING TAPE, PHASE IDENTIFICATION TAPE, ANNEALED BARE COPPER CLASS B STRANDED GROUNDING CONDUCTOR. THE CABLE SHALL BE ENCLOSED IN MOISTURE-IMPERVIOUS, CONTINUOUS, CORRUGATED CONTINUOUS-WELDED COPPER-FREE ALUMINUM SHEATH WITH AN OUTER RED FLAME-RETARDANT, SUNLIGHT RESISTANT POLYVINYL CHLORIDE (PVC) JACKET. THE CABLE SHALL BE UL APPROVED FOR DIRECT BURIAL. THE CABLE SHALL BE AS MANUFACTURED BY SOUTHWIRE, OKONITE CABLE COMPANY, OR EQUAL.
19	INDOOR CATEGORY 6 ETHERNET (VOICE AND DATA) CABLE: CATEGORY 6, 4 UNSHIELDED TWISTED-PAIRS (UTP), #24 AWG SOLID BARE COPPER CONDUCTORS, INDUSTRIAL COLOR CODED, NON-PLENUM RATED WITH A BLUE FLAME-RETARDANT THERMOPLASTIC JACKET, 100 OHM NOMINAL INPUT IMPEDANCE FROM 1 TO 100 MHZ. THE CABLE SHALL COMPLY WITH ANSI/TIA/EIA STANDARD 568-C.2 (CATEGORY 6) AND BE SUITABLE FOR 100BASE-T FAST ETHERNET APPLICATIONS. THE CABLE SHALL BE AS MANUFACTURED BY MOHAWK, GENERAL CABLE, OR EQUAL.

TYPE	DESCRIPTION
20	<p>CONDUCTOR FOR PUBLIC ADDRESS SYSTEM SPEAKERS:</p> <p>TRAY CABLE SUITABLE FOR PUBLIC ADDRESS SYSTEM APPLICATION, RATED 300 V, 105°C WITH TINNED-COPPER, STRANDED, PVC-INSULATED, TWISTED CONDUCTORS, WITH OVERALL (100%) METALLIC-TAPE SHIELD, COPPER DRAIN WIRE AND FLAME-RETARDANT PVC JACKET. CABLE SIZE SHALL BE AS SHOWN ON CONTRACT DRAWINGS. THE CABLE SHALL BE AS MANUFACTURED BY BELDEN WIRE AND CABLE COMPANY, CONSOLIDATED ELECTRONIC WIRE &amp; CABLE, OR EQUAL</p>
21	<p>OUTDOOR INDUSTRIAL CATEGORY 5e ETHERNET CABLE:</p> <p>CATEGORY 5e, 4 UNSHIELDED TWISTED-PAIRS (UTP), #24 AWG SOLID BARE COPPER CONDUCTORS, INDUSTRIAL COLOR CODED, WATER BLOCKED FOR USE IN WET LOCATIONS WITH AN INNER BLACK POLETHYLENE JACKET, ALUMINUM TAPE OVERALL SHIELD, AND A SUNLIGHT RESISTANT OUTER POLETHYLENE JACKET, 100 OHM NOMINAL INPUT IMPEDANCE FROM 1 TO 100 MHZ. THE CABLE SHALL BE SUITABLE FOR: 100BASE-T FAST ETHERNET, 1000BASE-T GIGABIT ETHERNET, BROADBAND VIDEO, AND DIRECT BURIAL APPLICATIONS. THE CABLE SHALL BE AS MANUFACTURED BY MOHAWK, BELDEN, OR EQUAL.</p>
22	<p>INDOOR/OUTDOOR CATEGORY 6 ETHERNET CABLE:</p> <p>CATEGORY 6, 4 UNSHIELDED TWISTED-PAIRS (UTP), #23 AWG SOLID BARE COPPER CONDUCTORS, INDUSTRIAL COLOR CODED, WATER BLOCKED FOR USE IN WET LOCATIONS WITH A BLACK SUNLIGHT AND FLAME RETARDANT POLYOLEFIN JACKET, 100 OHM NOMINAL INPUT IMPEDANCE FROM 1 TO 100 MHZ. THE CABLE SHALL BE SUITABLE FOR: 100BASE-T FAST ETHERNET, 1000BASE-T GIGABIT ETHERNET, AND BROADBAND VIDEO APPLICATIONS. THE CABLE SHALL BE AS MANUFACTURED BY MOHAWK CABLE, WEST PENN WIRE, OR EQUAL.</p>
23	<p>OUTDOOR INDUSTRIAL CATEGORY 5e ETHERNET BACKBONE CABLE:</p> <p>CATEGORY 5e, 25 UNSHIELDED TWISTED-PAIRS (UTP) OR AS SPECIFIED IN THE CONDUIT SCHEDULE OF <b>SECTION 16K</b>, #24 AWG SOLID BARE COPPER CONDUCTORS, INDUSTRIAL COLOR CODED, WATER BLOCKED FOR USE IN WET LOCATIONS WITH AN INNER BLACK POLETHYLENE JACKET, A CORRUGATED ALUMINUM TAPE OVERALL SHIELD, AND A SUNLIGHT RESISTANT OUTER POLYOLEFIN JACKET, 100 OHM NOMINAL INPUT IMPEDANCE FROM 1 TO 100 MHZ. THE CABLE SHALL BE SUITABLE FOR: 100BASE-T FAST ETHERNET, 1000BASE-T GIGABIT ETHERNET, BROADBAND VIDEO, AND DIRECT BURIAL APPLICATIONS. THE CABLE SHALL BE AS MANUFACTURED BY MOHAWK OR EQUAL.</p>
24	<p>MULTICONDUCTOR VFD MOTOR CABLE:</p> <p>3 CONDUCTORS, ANNEALED TINNED STRANDED-COPPER, CROSS-LINKED POLYETHYLENE OR POLYOLEFIN INSULATION, RATED 1,000 V FLEXIBLE MOTOR SUPPLY CABLE, 90°C FOR DRY AND WET LOCATIONS, THREE(3) SYMMETRICALLY PLACED BARE COPPER GROUND CONDUCTORS, OVERALL COPPER TAPE SHIELD (100% COVERAGE), OVERALL SUNLIGHT-RESISTANT PVC JACKET. DESIGNED FOR MOTOR VARIABLE-FREQUENCY CONTROLLER OUTPUT CIRCUITS. THE CABLE SHALL BE AS MANUFACTURED BY BELDEN WIRE AND CABLE, AMERCABLE INCORPORATED, OR EQUAL.</p>
25	<p>MEDIUM-VOLTAGE (MV) NONSHIELDED SINGLE CONDUCTOR MOTOR CABLE, RATED 7.5-KV:</p> <p>7.5-KV SINGLE-CONDUCTOR NONSHIELDED CABLE, SIZE #8 THROUGH 4/0 AWG, UL-STYLE UL3575 UNRESTRICTED 150°C-7500V. THE CONDUCTOR SHALL BE TINNED COPPER MULTISTRANDED FOR FLEXIBILITY, WITH A SEMI-CONDUCTIVE SCREEN AROUND THE CONDUCTOR, CROSS-LINKED POLYOLEFIN INSULATION. THE CABLE SHALL BE SUITABLE FOR FEEDERS TO MOTORS ON 2.4-KV UNGROUNDED AND RESISTANCE GROUNDED SYSTEMS. THE CABLE SHALL BE MANUFACTURED BY CHAMPLAIN CABLE CORPORATION, PLASTELEC, OR EQUAL</p>

TYPE	DESCRIPTION
26	MEDIUM-VOLTAGE (MV) NONSHIELDED SINGLE CONDUCTOR, RATED 8-KV: 8-KV SINGLE-CONDUCTOR NONSHIELDED CABLE, SIZE #1/0 AWG THROUGH #750 KCMIL, CONSTRUCTED IN ACCORDANCE WITH UL-1072. THE CONDUCTOR SHALL BE BARE COPPER CLASS B COMPRESSED STRANDED, ETHYLENE PROPYLENE RUBBER (EPR) INSULATION. THE CONDUCTORS SHALL BE ENCLOSED IN AN OVERALL FLAME-RETARDANT, MOISTURE AND SUNLIGHT RESISTANT POLYVINYL CHLORIDE (PVC) JACKET. THE CABLE SHALL BE SUITABLE FOR CONNECTING THE NEUTRAL OF MEDIUM VOLTAGE TRANSFORMERS AND GENERATORS TO A NEUTRAL GROUNDING RESISTOR. THE CABLE SHALL BE MANUFACTURED BY SOUTHWIRE "EPR/PVC 8KV NON-SHIELDED CABLE", OR EQUAL
27	ALLEN-BRADLEY REMOTE-INPUT-OUTPUT TWINAX CABLE: BLUE HOSE, HIGH TEMPERATURE, TWO(2) CONDUCTOR #20 AWG TINNED COPPER CONDUCTORS, FEP INSULATED (1-CLEAR & 1-BLUE), TINNED COPPER BRAIDED SHIELD WITH OVERALL FOIL SHIELD AND DRAIN WIRE, AND BLUE FEP JACKET. THE CABLE SHALL BE AS MANUFACTURED BY BELDEN CAT. NO. 89463.
28	BAILEY CONTROLS DATA HIGHWAY CABLE: TWIN-AXIAL SHIELDED CABLE, BAILEY CONTROLS PART NO. NKPL01, CODE R2041
29	SINGLE-MODE FIBER-OPTIC CABLE

#### 14. INSTALLATION OF CONDUCTORS

##### 14.1 General.

14.1.1 Installation of all conductors shall be done according to the conductor manufacturer's recommendations. Only suitable conductor pulling equipment with smooth variable-speed control shall be used for installation of conductors in conduit. A dynamometer installed at the pulling end of the conductor installation shall be used for indication of actual tension on the conductors. Manufacturer-recommended maximum tension and sidewall pressure shall not be exceeded at any time.

14.1.2 Before pulling conductors in each new or existing conduit, a mandrel and a swab, properly sized for the conduit, shall be pulled through the conduit to ensure that the conduit is clear of any object that may damage the conductors.

14.1.3 UL-listed conductor-pulling compounds, compatible with the conductor insulation and coverings, shall be used. In addition to direct application of pulling compound to the conductors, conduit sizes of 2-inch and above extending one hundred(100) feet or more shall be pre-lubricated by the use of pulling compound bags attached to the conductor pull rope. The quantity of pulling compound bags shall be per the manufacturer's instructions. The conductor-pulling compound shall be American Polywater Corporation Cable Lubricant J or accepted equal.

14.1.4 Unless the conductors are being directly buried, they shall not come in contact with earth or concrete during installation. In order to install conductors without a splice, they shall be laid out on canvas or plastic spread on the ground for protection from contact with earth or concrete.

14.1.5 Conductors shall be pulled into place on the cable trays using tools specifically designed for the purpose. Sufficient number of rollers, sheaves and guides shall be used to limit tension in the conductors as recommended by the manufacturer.

14.1.6 All conductors shall be installed in a workmanlike manner. The conductors shall be neatly formed in all junction boxes, pull boxes, terminal boxes and control panels.

14.1.7 Bending radii of the conductors shall not be less than those required by NEC and conductor manufacturers.

14.2 Conductors to be Terminated by Others.

14.2.1 Installation of the conductors to be terminated in the existing electric switchboards, control panels, etc., by others (if so stated on the Contract Drawings) shall be performed as follows:

14.2.1.1 At least ten(10) feet of each cable shall be coiled in the respective existing enclosure. Two(2) feet of each cable's outer jacket shall be removed, and each conductor shall be stripped of 1/2-inch of insulation. A heat-shrink-type wire marker shall be placed and temporarily secured to each conductor so that the wire marker number remains visible.

14.2.1.2 The Contractor shall terminate all conductors in the proposed enclosures and perform continuity and megger testing of all circuits. Loop test of these circuits shall be performed according to the requirements of **Section 17A** of these Special Provisions.

15. CONDUCTOR SPLICING AND TERMINATION

15.1 Conductors Operating at Less Than 600 Volts.

15.1.1 Splicing:

15.1.1.1 Splicing of power conductors is allowed only if shown on the Contract Drawings. Conductors shall be installed as specified in **Part 14.1** of this Section.

15.1.1.2 If shown on the Contract Drawings, splicing shall be done in a neat and workmanlike manner using compression-type splice connectors made from high-conductivity metal compatible with the conductors. The splice connectors shall be securely attached to the conductors by crimping and compressing using a proper die in a hand- or hydraulic-operated compressing tool.

15.1.1.3 Control and instrumentation conductors shall not be spliced.

15.1.1.4 Splicing of conductors for lighting and receptacle circuits may be accomplished by using silicone-filled, twist-on type wire connectors.

15.1.1.5 Splices shall be provided with electrical insulation sufficient for the voltage rating of the conductors.

15.1.1.6 Splices shall be made waterproof by use of splice kits as manufactured by Plymouth Company, 3M Company, or accepted equal.

15.1.2 Termination:

15.1.2.1 All power conductors shall be terminated with compression-type connectors. The connectors shall be securely attached to the conductor by crimping and compressing using a proper die in a hand- or hydraulic-operated compressing tool. The connectors shall be made from high-conductivity metal compatible with the conductor.

Terminal blocks for termination of power conductors shall be copper, 600 V rated. The terminal blocks shall be Square D Class 9080, Type LB; Allen-Bradley Power Blocks; or accepted equal.

15.1.2.2 All control, instrumentation, control power and spare conductors for both internal (conductors that originate and terminate within the same enclosure) and external (conductors that originate outside of an enclosure) to all electric equipment, devices and instruments shall be terminated with insulated "snap-spade" or "locking-fork" compression-types connectors such as Burndy Type TP-LF, ILSCO Model SV-X, Thomas & Betts Series 18RA-FL or 14RB-FL. For terminal blocks or devices not suitable for "snap-spade" or "locking-fork" connectors, nylon insulated "pin" or "blade" connectors, such as Thomas & Betts Series KN14, 3M Series MNG, or accepted equal, shall be used.

Terminal blocks for termination of the control, instrumentation, control power and spare conductors external to all electric equipment, devices and instruments shall be copper, 600 V rated, channel-mount type. The terminal blocks shall have flat screw terminals with No. 8 screws. The terminal blocks shall be Square D Class 9080, Type KCB-1; Allen-Bradley Cat. No. 1492-CD3; or accepted equal.

Terminations of power conductors in motor terminal boxes shall be made with lead kits specifically designed for motor feeder terminations.

15.1.2.3 In each electrical enclosure, all circuits shall be segregated per type (instrument signal or power) and run in separate wireways.

15.1.2.4 Heat-shrinkable type, restamped wire markers shall be installed and shrunk on each end of each conductor within 3-inches of the conductor's tap, splice or termination on all conductors.

15.1.2.5 Within each enclosure where a tap, splice or termination is made, each conductor shall be identified by a unique number, tabulated in **Section 16K** of these Special Provisions and shown on the Contract Drawings, consisting of:

- a. its circuit number and
- b. a sequential number (shown in parenthesis) distinguishing this conductor from all other conductors in the same circuit.

If the circuits are not identified in the Contract Documents by numbers, the Contractor shall assign a unique identification number for each conductor. Each spare conductor shall also be assigned a unique identification number and shall be marked with this number and letters "SP."

15.1.2.6 Each multiconductor cable shall be identified by a unique number tabulated in **Section 16K** of these Special Provisions and shown on the Contract Drawings. If the multiconductor cables are not identified in the Contract Drawings by numbers, the Contractor shall assign a unique identification number for each multiconductor cable. A tag with an identification number shall be attached to each multiconductor cable at intermediate pull boxes and at the conduit stub-up locations.

15.1.2.7 All cable and conductor identification numbers shall be shown on all submittal drawings.

15.1.2.8 Wiring shall be run in wireways or shall be neatly grouped in packs using nonmetallic wiring bands and support devices.

15.1.2.9 Lacing of conductors or their splicing or tapping between terminal points is not acceptable.

15.1.2.10 All conductor insulation shall be rated 600 V ac. The conductor sizes for an electrical enclosure wiring shall match those of the external conductors that are specified in the Contract Documents.

15.1.2.11 Terminal blocks shall be arranged for radial field wiring, with a terminal provided for each shield, and segregated according to circuit voltage. At minimum, 10 percent spare terminal points on each terminal block group shall be provided. Separate terminal blocks and separate wiring compartments shall be provided for intrinsically safe and nonintrinsically safe conductors.

15.1.2.12 All electrical enclosure wiring for connection to external circuits shall be wired to interposing terminal blocks rigidly mounted on channels. The terminal blocks shall be located so as to provide adequate space for entrance and termination of the external cables. One(1) side of each field-connection terminal block shall be reserved exclusively for field use.

15.1.2.13 When an elementary or interconnection diagram shows more than one(1) wire connected to one(1) wiring point, a sufficient number of terminal points shall be connected internally to allow connection of only one(1) wire per terminal point on the outgoing side of the terminal blocks.

15.1.2.14 Identification of terminal blocks and terminal points shall be alphanumeric with each terminal block having a unique identifying

letter(s). Identification of each conductor shall include cable and wire numbers. Each spare conductor shall be identified by a cable and wire numbers and wired to a spare terminal block. The complete terminal block identifications and wire identifications shall be recorded on Contractor's wiring diagrams.

15.1.2.15 Wire shields shall be connected to terminals on the electrical enclosure terminal block adjacent to the active conductor terminals. The shields of incoming cables shall be continued up to the respective devices.

Wire shields shall be grounded only at one(1) point by connection to the control common ground bus of the corresponding electrical enclosure. If the enclosure does not have a control common ground bus, the wire shields shall be connected to the ac safety ground system.

15.1.2.16 The cases of all instruments, apparatus, relays and switching devices shall be grounded to the electrical enclosure. If utilized, programmable logic controllers (PLCs) and their components shall be grounded per PLC manufacturer's recommendation.

## 16. INSTALLATION OF EQUIPMENT

### 16.1 Seismic Restraint Requirements.

16.1.1 Equipment, components, and supporting structures furnished under this Section and all other Sections of **Divisions 16** and **17** of these Special Provisions shall be provided with sufficient strength to prevent excessive motion or damage due to a seismic event or vibrations. All equipment, components, appurtenances, and anchorage shall be designed to resist seismic forces in accordance with these Special Provisions.

## 17. MODIFICATIONS OF THE EXISTING ELECTRIC EQUIPMENT AND SYSTEMS

### 17.1 Temporary Shutdown of Existing Facilities or Hot-Tapping of the Existing Equipment.

17.1.1 The Contractor shall manage the work so as to minimize the number of shutdowns necessary to complete the work. It is the sole responsibility of the Contractor to identify all required shutdowns.

17.1.2 When a temporary shutdown of any existing equipment is necessary to perform the Contract work or when a hot-tap connection to any existing equipment is required, the Contractor shall submit a written request to the Engineer a minimum of five(5) working days in advance of the scheduled start of the shutdown or the hot-tap procedure. A detailed schedule of the Contractor's activities during each shutdown or hot-tap procedure shall be submitted with the written request, in accordance with **Section 1A** of these Special Provisions. The detailed schedule shall be accepted by the Districts prior to the shutdown or proceeding with the hot-tap work.

17.1.3 Unless otherwise specified, the District will remove and return all existing systems from/to service, and the time required to perform this work shall be part of the shutdown time.

17.1.4 The Contractor shall not start any construction work that requires the shutdown of any system until all proposed equipment and materials are delivered to the jobsite and ready for installation.

17.1.5 The number of work items scheduled during any one(1) shutdown shall be limited to guarantee completion of the work and to minimize coordination problems. All appropriate work, which can be accomplished prior to the shutdown without disrupting the plant's operation, shall be performed beforehand to minimize the actual work required during the shutdown. The work items, construction steps and procedures proposed by the Contractor for the shutdown shall receive the prior acceptance of the Engineer in accordance with the requirements for detailed schedules in **Section 1A** of these Special Provisions.

17.1.6 The District reserves the right to postpone any shutdown if high flow conditions are expected as a result of inclement weather or other upstream sewer conditions. The District reserves the right to postpone the shutdown of any equipment, system, or process if the shutdown would adversely affect the treatment process. Such postponement(s) will be in the Contractor's and the District's best interest and shall not be grounds for additional Contract time or extra work claims, except in accordance with the requirements of **Section 1A** of these Special Provisions.

17.1.7 The District will cooperate with the Contractor to startup a system after any temporary shutdown of plant facilities. The Contractor shall have sole responsibility to ensure that the facilities are ready for startup within the time specified in this Section.

17.2 Work Procedures and Constraints.

17.2.1 The Contractor may submit for the District's acceptance alternatives to the Electrical Construction Sequence described in **Part 17.3** of this Section. The District will consider those alternatives that would reduce the number and duration of shutdowns and coordination requirements or would reduce the risk of possible safety problems or plant operational problems.

17.2.2 The modifications of the existing equipment shall be performed as shown on the Contract Drawings and as described in this Section.

17.2.3 All shutdowns shall occur between the hours 7:00 am to 1:00 pm, although the Contractor may be required by the District to perform some work during other than normal working hours. There shall be minimum period of forty-eight(48) hours between two(2) consecutive scheduled shutdowns of the same equipment, unless a shorter period is accepted by the District's Operation Staff.

17.2.4 The Contractor shall provide temporary power for construction lighting and electric tools during the scheduled switchboard shutdowns.

17.2.5 The installation of temporary conduits and conductors shall meet all applicable requirements of the NEC.

17.2.6 The Contractor shall use Type SO cables, or equivalent heavy-duty cables, for all temporary power circuits shown on the Contact Drawings.

17.2.7 All acceptance testing, equipment inspections, protective device setting, and final checks shall be performed prior to commissioning of the respective equipment and in conjunction with the Electrical Construction Sequence described in **Part 17.3** of this Section. All testing shall be in accordance with **Sections 16A** and **16B** of these Special Provisions.

17.2.8 The Contractor may schedule their work in any manner they deem appropriate to complete the Contract work within the time allowed and within the time constraints established by this Section of these Special Provisions. The Contractor is cautioned that some of the work may have to be performed during other than normal working hours. The Engineer reserves the right to revise the schedule whenever they find it necessary to maintain work progression, or to protect the District's facility, or to maintain continuous satisfactory operation of existing facilities.

17.2.9 The District, as its discretion, will make reasonable efforts to shut down or isolate energized equipment and conductors in order for the Contractor to perform work in close proximity to these items. However, the Construction Sequence does not enumerate every instance where the Contractor shall be required to work in close proximity to energized low- and medium-voltage conductors and equipment in both existing and proposed manholes, cable trays, or equipment (switchboards, control panels, motor controllers, variable-frequency controllers, terminal cabinets, miscellaneous electrical enclosures, etc.) while work is performed on other (de-energized) conductors or equipment in these manholes, cable trays, or equipment. All such work shall be performed by personnel trained for working in close proximity to energized low- and medium-voltage conductors, splices and equipment and who utilize appropriate Personal Protective Equipment (PPE) and safety practices in accordance with the latest edition of NFPA 70E, Standard for Electrical Safety in the Workplace. The Contractor shall employ only qualified personnel to work in these areas who have received training in accordance with 29 CFR Section 1910.269(a)(2) of the Code of Federal Regulations. The Contractor shall submit to the District the training and experience of each employee engaged in working in close proximity to energized low- and medium-voltage conductors and equipment.

17.2.10 The District will attempt to keep the Contractor informed of changes to existing Contracts and award of subsequent Contracts that may affect him. Schedules of operations for other contractors working within the AK Warren Water Resource Facility area will be made available to the Contractor upon request.

17.2.11 The work described in this Section shall be shown in the Schedule of Operations specified in **Section 1A, Part 10** of these Special

Provisions. All construction steps, procedures and temporary facilities shall be accepted by the Engineer prior to implementation by the Contractor. The weekly updates of the Schedule of Operation shall show any changes in the proposed work, including the work to be performed during proposed shutdowns, and shall be made in accordance with the procedures set forth in **Section 1A, Part 10** of these Special Provisions.

17.2.12 The Contractor shall not be permitted to start any construction work that requires the shutdown and/or removal of any existing plant facilities or substantially interferes with the normal operation of the plant, until all proposed equipment and materials necessary to complete the work contemplated during the shutdown, removal, or interference are delivered to the job site.

Before any shutdown, partial shutdown, removal, or interference, the Contractor shall submit a written request for the shutdown. The request shall include a detailed description of the work to be completed, a detailed plan for the execution of the work, a list of the materials required to complete the work and a list of personnel or subcontractors that will be performing the work. The Contractor shall not be allowed to start work until the Engineer has accepted the request. The request will be used by the Engineer to ensure that the Contractor is ready for the shutdown, and that they can complete the work in the allotted time. In all cases, the District's Operation Staff will shut down the equipment, take it offline, and turn the equipment over to the Contractor. At the completion of the work, the District's Operation Staff will return the equipment to service.

17.2.13 Energizing and de-energizing of all electric equipment shall be performed only by the District's personnel.

17.2.14 The Contractor shall provide temporary power for construction lighting and electric tools during the scheduled switchboard shutdowns.

17.3 Electrical Construction Sequence. The following electrical construction sequence addresses only those items of electrical work that require shutdown of the existing facilities or equipment. To minimize system downtime during the switchboard modification, all preparatory work shall be completed prior to any shutdown. The following sequence outlines the recommended construction steps for installing the new MCCB for PNLBD F fed from the existing switchboard 1A2 via a bus tap connection.

17.3.1 Pre-Installation (No Shutdown Required)

- Install the new MCCB enclosure and supports.
- Pull and terminate feeder cables up to the existing switchboard 1A2 location.
- Prefabricate and verify the bus tap assembly for fit and alignment.
- Complete all labeling, safety planning, and shutdown coordination in advance.

17.3.2 Switchboard Shutdown

- The districts E&I staff shall be involved in all shutdown activities.
- De-energize and lock out the switchboard under approved loto procedures.
- Install the bus tap connections on the existing switchboard bus.
- Connect pre-pulled cables to the bus tap and MCCB.
- Reinstall covers and barriers; perform torque, insulation, and functional tests.
- Re-energize the switchboard and confirm MCCB operation.
- Estimation completion of this work should last eight (8) hours.

17.3.3 Post-Shutdown

- Complete downstream terminations and final testing.
- Label, update as-built drawings, and submit commissioning documentation.

18. MISCELLANEOUS REQUIREMENTS

Unless otherwise specified or shown on the Contract Drawings, the following requirements shall be met.

18.1 General.

18.1.1 All switches and pushbuttons shall be mounted 48-inches above the finished floor.

18.1.2 All convenience outlets shall be mounted 42-inches above the finished floor.

18.1.3 The material of each enclosure specified in the table of **Part 18.4** of this Section shall match the corresponding conduit.

18.1.4 Each control panel and each control station shall be housed in a NEMA Type 12 enclosure for installation indoor and in a NEMA Type 4 enclosure for installation outdoor or in a gallery.

18.1.5 All conductor insulation shall be rated 600 V ac. Minimum conductor size shall be No. 12 AWG for power circuits and No. 14 AWG for control circuits.

18.2 Receptacles.

18.2.1 The receptacles for installation in indoor locations shall be duplex, grounding, 2-pole, 3-wire, rated 125 V, 20 A, with stainless-steel coverplates.

18.2.2 The receptacles for installation in outdoor locations or in galleries shall be duplex, grounding, ground-fault circuit-interrupter type, 2-pole, 3-wire, rated 125 V, 20 A, with weatherproof coverplates and hinged snap covers.

18.2.3 The receptacles to be installed in hazardous locations, identified on the Contract Drawings, shall be housed in enclosures UL-listed for installation in these locations.

18.2.4 Receptacle covers shall be labeled with their respective panelboard circuit (e.g., "PNLBD 1AB/CKT 11") using DYMO Type IND 3/8-inch vinyl labels.

18.3 Lighting Switches.

18.3.1 Maintained-Contact Lighting Switches:

18.3.1.1 The lighting switches for installation in indoor locations shall have ivory finish and stainless-steel switchplate.

18.3.1.2 The lighting switches for installation in outdoor locations or in galleries shall have weatherproof box, switchplate and actuator.

18.3.1.3 The lighting switches to be installed in hazardous locations, identified on the Contract Drawings, shall be housed in enclosures UL-listed for installation in these locations.

18.3.1.4 The voltage rating of lighting switches shall be as shown on the Contract Drawings, the current rating shall be 20 A.

18.3.1.5 The lighting switches shall be as manufactured by Hubbell Lighting, Appleton, Crouse-Hinds, or accepted equal.

18.3.2 Momentary-Contact Lighting Switches:

18.3.2.1 Momentary-contact lighting switches shall be 3-position with spring return to the center position. The switches shall provide momentary closure of two(2) independent contacts, one(1) at top and the other at the bottom positions of the switch.

18.3.2.2 The switches shall have ivory finish and shall be provided with stainless-steel switchplates for indoor installation. For outdoor or

gallery installations, the boxes, switchplates and actuators shall be weatherproof.

18.3.2.3 The lighting switches shall be Bryant Cat. No. 4921I, Leviton Cat. No. 1257I, Hubbell Cat. No. 15571I or accepted equal.

18.4 Miscellaneous Items of Electric Equipment.

ITEM NO	DESCRIPTION
1	CIRCUIT BREAKER, MOLDED-CASE TYPE, MANUALLY OPERATED, TRIP-FREE FROM THE HANDLE, 3-POLE, 208 V AC, 100 AF, 100 AT, EQUIPPED WITH AN INTERCHANGEABLE TRIP UNIT PROVIDING INVERSE-TIME, THERMAL-ELEMENT OVERLOAD PROTECTION AND INSTANTANEOUS MAGNETIC SHORT-CIRCUIT PROTECTION ON ALL POLES. THE CIRCUIT BREAKER SHALL BE PROVIDED IN SURFACE-MOUNT NEMA TYPE 12 ENCLOSURE WITH EXTERNAL OPERATING HANDLE. THE INTERRUPTING RATING OF THE CIRCUIT BREAKER SHALL BE NOT LESS THAN 25 KA RMS SYMMETRICAL SHORT-CIRCUIT CURRENT. THE CIRCUIT BREAKER SHALL BE AS MANUFACTURED BY GENERAL ELECTRIC, EATON ELECTRICAL, OR EQUAL.
2	PHOTOCELL. LIGHTING CONTROL, IN "DS" COVER FOR USE WITH FS/FD. FACTORY SEALED SOLID STATE DESIGN, 3FC TO 8FC ON-OFF BAND, BUILT-IN 10 SEC DELAY, 8 YEAR OPERATING LIFE, 35-400 WATT LOAD RANGE, FOR HID, FIXTURES RATED 120-VAC, 60HZ.  THE PHOTOCELL SHALL BE COOPER CROUSE-HINDS CAT. NO. D2S20, OR EQUAL. THE FD BOX SHALL BE COOPER CROUSE-HINDS CAT. NO. FD12

19. LIGHTING FIXTURES

19.1 All lighting fixtures shall be provided complete with all glassware, lamps, fittings, end plates, sockets, reflectors, ballasts, wiring, hangers, poles and accessories to complete the installation.

19.2 The lighting fixture voltage shall be as shown on the Contract Drawings.

19.3 The Contractor shall provide, install and connect all lighting fixtures as shown on the Contract Drawings and as specified in this Section.

19.4 All lighting fixtures shall bear the label of the Underwriters Laboratories for the required location and usage.

19.5 The location of all lighting fixtures shall be as shown on the Contract Drawings. In the event obstructions or difficulties are encountered in locating lighting fixtures, the District reserves the right to direct the Contractor to relocate, adjust mounting heights or change locations as necessary to suite the field conditions.

19.6 The Contractor shall provide, install and connect all lighting fixtures and their accessories as shown on the Contract Drawings and identified in the following table:

## SECTION 16A – ELECTRICAL WORK

ITEM	TYPE	MOUNTING	SIZE	ENCLOSURE	VOLTS	LUMENS PER FIXTURE	WATT PER FIXTURE	FINISH	FEATURES	MANUFACTURER/ TYPE
A	LED	SURFACE MOUNTED	24"x5.1"	CAST & EXTRUDED ALUMINUM – POLYESTER POWDER COATED, 18-8 STAINLESS STEEL HARDWARE, 304 STAINLESS STEEL MOUNTING BRACKET, MOLDED SILICONE GASKETING, 3/4" THREADED NPT END-CAPS STANDARD	MVOLT (120/277V)	2000 L.	13.7 W.	CORROSION RESISTANT SUPER DURABLE TGIC THERMOSTETPO WDER COAT FINISH	EMX LED SERIES, 24 INCH, 2000 LUMENS, FLAT FROSTED POLYCARBONATE LENS, MEDIUM DISTRIBUTION, 4000K, 80 CRI WHITE, SUPER DURABLE	HOLOPHANE, EMX L24 2000LM FPFL MD 40K 80CRI DWHXD OR EQUAL
B	LED	WALL-MOUNTED	11.53" X 15.54" 'x 4'	HEAVY GRADE A360 CAST ALUMINUM	MVOLT (120/277V)	3000 L.	28 W.	ZINC-INFUSED SUPER DURABLE TGIC THERMOSTET POWDER COAT FINISH	WALLPACK FULL CUTOFF LED, LED PERFORMANCE PACKAGE P10, 3000 SERIES CCT, VOLTAGE, TYPE II MEDIUM, FIELD ADJUSTABLE OUTPUT	HOLOPHANE, HLWPC2 P10 30K XX T2M OR EQUAL

## 20. NAMEPLATES

20.1 In addition to standard manufacturer's nameplates, engraved nameplates shall be provided for each switchboard and motor control center unit, control panel, panelboard, transformer and any other piece of electric equipment provided under this Contract. These nameplates shall include the labels to identify all internal devices inside each of these electrical equipment.

20.2 Nameplates shall be laminated phenolic resin. Engraving shall show black uppercase letters on white background. Nameplate lettering shall be, at minimum, 1/4-inch high. Edges of 1-1/2-inches-high and larger nameplates shall be beveled. Nameplates shall be fastened to equipment and devices by threaded stainless-steel machine screws. Adhesive-type nameplates are not acceptable.

20.3 The nameplates on the enclosures of field-installed combination motor starters, circuit breakers, transformers, panelboards, selector switches, manual control stations, etc., shall be engraved with the equipment designation and its equipment and/or instrument tag number shown on the Contract Drawings. Some examples of the nameplate engravings on the enclosures of field-installed equipment are shown in the table below.

EQUIPMENT ENCLOSURE	NAMEPLATE ENGRAVING
SELECTOR SWITCH HS-23E01A OF RETURN ACTIVATED SLUDGE PUMP P-23E-01	RETURN ACTIVATED SLUDGE PUMP P-23E-01 HS-23E01A
COMBINATION MOTOR STARTER OF WASTE ACTIVATED SLUDGE PUMP P-23E-01	WASTE ACTIVATED SLUDGE PUMP P-23E-01
VALVE FV-27F06 CONTROL STATION HIK-27F06	VALVE FV-27F06 IK-27F06
TRANSFORMER 8	TRANSFORMER 8

20.4 The engraved samples of the proposed nameplates shall be included in the submittals of the respective equipment.

## 21. FIELD TESTING

21.1 General.

21.1.1 The Contractor shall submit for the District's acceptance a detailed Test and Startup Plan developed and stamped by an Electrical Engineer registered by the State of California. No testing or startup activities shall be performed until the plan is accepted by the District. As a minimum, the plan shall include the following:

- a. Qualifications of the test and startup personnel.
- b. Listing of test equipment to be used.
- c. Listing of visual and mechanical inspections to be performed.

- d. Listing of electrical tests to be performed.
- e. A test procedure for each test to be performed.
- f. Step-by-step sequential procedure for the commissioning of the proposed switchgear and associated feeder circuits.

21.1.2 Unless otherwise specified, all testing shall be in accordance with the latest edition of ANSI/NETA Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems (ANSI/NETA ATS).

21.1.3 Where independent testing is specified, the testing organization shall meet the following requirements:

21.1.3.1 The testing organization shall be an independent, third-party entity which can function as an unbiased testing authority, independent of the manufacturers, suppliers and installers of the equipment or systems being evaluated.

21.1.3.2 The testing organization shall be regularly engaged in the testing of electrical equipment, devices, installations and systems.

21.1.3.3 The testing organization shall use technicians who are regularly employed for testing services.

21.1.3.4 An organization having the designation of "NETA accredited Company" issued by the InterNational Electrical Testing Association meets the above criteria.

21.1.3.5 Testing technicians shall be trained and experienced concerning apparatus and systems being evaluated and shall be capable of conducting the tests in a safe manner and with knowledge of the hazards involved. Technicians shall be certified in accordance with ANSI/NETA ETT, Standard for Certification of Electrical Testing Personnel. Each on-site crew leader shall hold a Level III or higher current certification in electrical testing.

21.1.4 Field testing shall include final construction checking and testing to verify mechanical completion according to the requirements of the Contract Documents and functional tests to verify readiness of the equipment and systems for operation.

21.1.5 All instrumentation and control systems shall be tested according to the requirements of **Section 17A** of these Special Provisions.

21.1.6 The Contractor shall provide all materials, tools, test equipment, consumables and personnel required for the testing, setting and adjusting of all electric equipment and putting it into complete readiness for initial operation. All tests shall be made with proper regard for the protection of personnel and equipment. All test results shall meet the specified requirements.

21.1.7 All test information shall be recorded on forms prepared and provided by the Contractor and accepted by the District prior to testing. Recorded data shall include the following:

- a. Date of test
- b. Description and identification of the equipment tested
- c. Type of test and method applied
- d. Test equipment used
- e. Tabulated test data and results
- f. Name of persons performing test
- g. Environmental conditions at the time and place of test
- h. All other pertinent information

21.1.8 All test reports and records shall be submitted to the District for acceptance.

21.1.9 In performing any tests on equipment, the equipment manufacturer's instructions regarding recommended test and checkout procedures, special precautions and the like shall be strictly observed. When the test provisions specified in this Section conflict with manufacturer's recommended instructions, the latter shall take precedence.

21.1.10 After inspection by the District, all field testing, device setting, programming, or calibration shall be witnessed by a District's representative. The Contractor shall provide the District written notice a minimum of seven(7) days prior to any testing, device setting, or calibration.

21.1.11 The Contractor shall verify all field wiring terminations match accepted wiring, interconnection and instrumentation loop drawings.

21.1.12 The Contractor shall provide the District's representative two(2) as-built copies of all instrumentation loop diagrams and manufacturers' interconnection and wiring diagrams.

## 21.2 Insulation Resistance Tests and Measurements.

21.2.1 Insulation resistance tests and measurements shall be performed on all electric equipment and wiring, except when specifically instructed otherwise by the District or equipment manufacturers. If, in accordance with the Contract Documents, any existing conductors are to be rerouted or extended, the insulation resistance tests and measurements shall also be performed on these existing conductors.

21.2.2 The following voltages shall be used for the insulation resistance tests and measurements of all equipment and circuit conductors. The test voltage shall be applied for one(1) minute.

NOMINAL CIRCUIT VOLTAGE (VOLTS)	TEST VOLTAGE (VOLTS DC)	MINIMUM RESISTANCE (MEGOHM)
UP TO 100	100	0.5
101 TO 300	500	1.0
301 TO 600	1000	2.0
2300 AND ABOVE	5000	20.0

21.2.3 Electronic devices, equipment and instruments shall not undergo these insulation resistance tests and measurements.

21.2.4 Insulation of each conductor of a multiconductor cable shall be measured individually to all other conductors bonded together and connected to the ground. When several single conductors are run in the same conduit, insulation resistance shall be obtained as for multiconductor cables. If the values of resistance obtained do not meet the specified requirements, the Contractor shall replace the defective conductors and repeat the tests.

### 21.3 Panelboard

21.3.1 All equipment shall be tested in accordance with the applicable sections of ANSI/NETA ATS.

21.3.2 These tests shall be performed by an independent testing organization.

21.3.3 The Contractor shall perform contact resistance tests on all low-voltage circuit breakers and switches rated 100 AF and above. The tests shall be in accordance with NETA requirements and the equipment manufacturer's instructions.

21.3.4 All control circuits shall be checked for agreement with the wiring diagrams.

21.3.5 All devices shall be set according to the requirements of **Parts 1.1** of this Section.

21.3.6 The Contractor shall test, adjust and calibrate miscellaneous control devices. Test procedures shall be in strict accordance with manufacturers' instructions.

### 21.4 Phasing Tests.

21.4.1 The Contractor shall make all necessary phasing tests on the following equipment:

- a. Buses
- b. Panels

21.5 Protective Device Coordination Study and Arc Flash Analysis.

21.5.1 The District's design of the proposed power distribution system, including the coordination of all protective relays and low-voltage protective devices, is based on the particular protective relays and low-voltage adjustable circuit breakers specified in the Contract Documents.

21.5.2 To obtain the District's acceptance of "equal" protective relays or low-voltage adjustable circuit breakers, the Contractor shall include in their electric switchgear submittal a protective device coordination study performed, stamped and signed by a professional engineer registered in the State of California.

21.5.3 The protective device coordination study shall include time-current curves graphically indicating on the log-log forms the coordination proposed for the system. The curves shall show, as applicable, utility relay and fuse characteristics, medium-voltage protective relays and fuse characteristics, low-voltage circuit breaker trip device characteristics, pertinent transformer characteristics, pertinent motor and generator characteristics, and all other devices down to the largest branch circuit and largest feeder circuit breaker in each switchboard and each motor control center. The study shall show adjustable settings for ground fault protective devices.

21.5.4 Perform Arc Flash analysis according to the IEEE 1584 guidelines and equations presented in NFPA 70E-2021, Annex D. Analysis shall be performed in conjunction with short circuit analysis and protective device time-current coordination analysis.

21.5.5 In addition to a PDF copy of the complete protective device coordination and arc flash analysis, an electronic copy of protective device and arc flash analysis application source code (.MDF and .OTI files) shall be installed on a USB Flash Drive and submitted to the District.

21.5.6 Protective device coordination study and arc flash analysis software shall be ETAP (Operation Technology) to match existing database.

21.6 Ground Resistance Test.

21.6.1 This test shall be performed by an independent testing laboratory.

21.6.2 The ground resistance test shall consist of separate measurements of the resistance to ground of the grounding system of the entire installation and the resistance to ground of "control common" system.

21.7 Electric Equipment and Systems Functional Test.

21.7.1 General:

21.7.1.1 All electric equipment shall be inspected, cleaned and checked completely for detailed electrical and mechanical operation and functions. All circuits shall be free of shorts, grounds, or faulty connections before energizing.

21.7.1.2 After completion of inspection of electric equipment and systems, the Contractor shall notify the District of their readiness to conduct the electric equipment and systems functional test to be witnessed by the District's representative. The notification shall be received by the District at least three(3) days prior to the proposed date of the test.

21.7.1.3 The Contractor shall demonstrate that the electric equipment and systems, including all protection and interlock circuits, operate under normal and simulated fault conditions according to all requirements of the Contract Documents.

## 22. SUBMITTAL REQUIREMENTS

### 22.1 General.

22.1.1 Submittals shall cover all electric and instrumentation systems, equipment, devices and materials to be provided under this Contract.

22.1.2 Except for field testing data, the drawings and data specified in this Section shall be accepted by the District prior to installation of the equipment.

22.1.3 Submittals shall be made according to the requirements of **Division 1** of these Special Provisions.

22.1.4 Each hard-copy submittal shall be bound in a standard-size, 3-ring, loose-leaf, hardcover binder or a standard-size, 3-hole, soft-cover binder.

22.1.5 Submittals shall include manufacturer's name, equipment, device and material identification, type, model, catalog number, and other information confirming compliance with the requirements of these Special Provisions.

22.1.6 Each item of a submittal shall be identified and assigned a sequential number. Manufacturer's literature shall be marked to indicate the particular item being submitted, and all other items shall be marked out.

22.1.7 The proof of compliance with applicable standards and listing by the Underwriters Laboratories (UL), Factory Mutual (FM), Canadian Standards Association (CSA) or Electrical Testing Laboratory according to the requirements of **Part 4** of this Section shall be provided. Submittals for control panels shall name a proposed manufacturer of the control panels who is listed under the "Industrial Control Panels" category of the UL Electrical Construction Equipment Directory.

22.1.8 Submittals not meeting all the above requirements will be returned without review.

22.2 Drawings and Data.

22.2.1 Except for field testing data, the drawings and data specified below shall be accepted by the District prior to delivery of equipment to the job site.

22.2.2 Drawings and data for each piece of equipment including, but not necessarily limited to, switchboard, motor control center, transformer, unit substation, variable-frequency controller, control panel, control station, DCS cabinet, cable tray, etc., shall include, but not necessarily be limited to, the following, as applicable:

22.2.2.1 Test and Startup Plan according to the requirements of **Part 21.1** of this Section.

22.2.2.2 Elementary (schematic) diagrams. The elementary diagrams shall correspond to those included in the Contract Drawings. In addition to a paper copy, an electronic copy of each elementary diagram, in the format of Bentley Systems, Inc., MicroStation, shall be provided. Each elementary diagram shall show:

- a. Terminal identification numbers assigned by the equipment manufacturer.
- b. Internal conductor identification numbers assigned by the equipment manufacturer.
- c. External conductor identification numbers assigned according to **Part 15.1.2.5** of this Section.
- d. Equipment and instrument tag numbers shown on the Contract Drawings.

22.2.2.3 Wiring (point-to-point) diagrams. The wiring diagrams shall be developed by the equipment manufacturer. The wiring diagrams shall show physical arrangement of all electric devices, terminals and interconnecting wiring. All interconnecting wiring shall be shown by lines. Each wiring diagram shall be annotated with the tag and wire numbers shown on the Contract Drawings as well as the equipment manufacturer- or Contractor-assigned terminal numbers. In addition to a paper copy, an electronic copy of each wiring diagram, in the format of Bentley Systems, Inc., MicroStation, shall be provided. Each wiring diagrams shall show:

- a. Terminal identification numbers assigned by the equipment manufacturer.
- b. Internal conductor identification numbers assigned by the equipment manufacturer.

- c. External conductor identification numbers assigned according to **Part 15.1.2.5** of this Section.
- d. Equipment and instrument tag numbers shown on the Contract Drawings.

22.2.2.4 Interconnection diagrams. Each interconnection diagram shall be a paper copy of the respective interconnection diagram, included in the Contract Drawings, with Contractor-assigned terminal identification numbers shown in red.

22.2.2.5 Layout drawing showing all dimensions, orientation of all components and terminal blocks, access requirements and nameplates. The drawing shall be accompanied with the following information:

- a. Panel surface preparation and finish data.
- b. Bill of materials cross-referenced to parts and components shown on Drawings.

22.2.2.6 Catalog information on each electric device and instrument.

22.2.2.7 Manufacturer's data on maximum allowable pull tension for each type of conductor or cable.

22.2.2.8 Placement drawing showing plan, front elevation, and section views; details of conduit ingress/egress; wireway and junction box locations; conduit numbers and routing; and indication of adequate clearances for operation and maintenance of the equipment.

22.2.2.9 Drawing showing complete details of foundation and anchoring and seismic calculations according to the requirements of **Part 16** of this Section.

22.2.2.10 Factory test reports.

22.2.2.11 All field-testing data according to the requirements of **Part 21** of this Section.

## 23. OPERATION AND MAINTENANCE MANUALS

23.1 The Contractor shall submit for the District's acceptance the Operation and Maintenance (O&M) manuals for all electric equipment and systems provided under **Division 16** of these Special Provisions. These manuals shall be provided in addition to any instructions packed with the equipment, and they shall be submitted for the District's acceptance within sixty(60) days after shipment of the equipment.

23.2 Each O&M manual shall have a table of contents, and it shall be assembled with the tab sheets placed before instructions covering each subject. Instruction sheets shall be legible with large sheets of drawings

folded in. Each O&M manual shall consist of one(1) or more volumes, each bound in a standard-size, 3-ring, loose-leaf, hardcover binder.

23.3 O&M manuals shall include, but not necessarily be limited to, the following:

23.3.1 The names, addresses, and telephone numbers of each subcontractor installing equipment and systems and the local representatives for each item of equipment and each system.

23.3.2 All drawings and data listed in **Part 22.2** of this Section.

23.3.3 An instruction manual containing the following applicable information for each piece of electric equipment and system:

23.3.3.1 Introduction and general description, purpose, function, theory of operation, diagnosis and illustrations.

23.3.3.2 Installation instructions, test procedures, sequences, tolerances.

23.3.3.3 All field-testing data according to the requirements of **Part 21** of this Section.

23.3.3.4 Maintenance instructions including information on overhaul, calibration and troubleshooting.

23.3.3.5 Lists of recommended spare parts, for all instruments and equipment provided under **Division 16** of these Special Provisions, for operation of the equipment for three(3) years following expiration of the equipment guarantee. The lists shall include the addresses of nearest to the job site locations where the spare parts can be obtained, the ordering procedures, nomenclature, and current price of each recommended spare part.

23.4 The O&M manuals not meeting the above requirements will be returned without review.

23.5 The Contractor shall provide ten(10) sets of the District-accepted O&M manuals.

## 24. EQUIPMENT DELIVERY AND STORAGE

24.1 Equipment and material shall be properly stored, adequately protected and carefully handled to prevent damage before, during and after installation.

24.2 Preparation for shipment shall be according to manufacturers' standards. Manufacturers shall be solely responsible for the adequacy of the provisions employed in preparation of equipment for shipment and delivery to its destination in good condition when handled by commercial carrier systems. The District reserves the right to inspect and accept the equipment packaging prior to shipment.

24.3 Each component shipped separately shall be individually crated and tagged with its unit number. Relays, contactors and any other components having moving parts that may be damaged in transit shall be securely blocked and braced to prevent damage during shipment.

24.4 Each shipping section of stationary structures shall be provided with a permanently attached, readily visible identification tag. Shipping sections of stationary structures shall be provided with removable lifting angles or plates suitable for crane hooks or slings. Removable steel-channel baseplates, permitting the use of pipe rollers or dollies without damaging the frame steel of the equipment, shall be provided.

24.5 Electrical conduit shall be stored to provide protection from the weather and accidental damage. Plastic conduit shall be stored on even supports and in locations not subjected to direct sunlight or excessive heat. Conductors shall be sealed, stored and handled carefully to avoid damage to the outer covering or insulation and damage from moisture and weather.

SECTION 16C

ELECTRIC PANELBOARDS

1. SCOPE

This Section sets forth the specifications for the proposed electric panelboard

2. GENERAL

2.1 The Prefabricated Restroom Manufacturer shall provide all labor, tools, equipment, and materials required to furnish, install, adjust, test, and deliver in proper operating condition the electric panelboards and the associated electrical loads that are part of the prefabricated restroom system. The Contractor shall provide all labor, materials, and connections for any additional loads shown on the Contract Drawings that are not connected by the Prefabricated Restroom Manufacturer. The Contractor shall make these final connections after installation of the panelboard is complete.

2.2 All work shall conform to the requirements of **Section 16A** and **Division 1** of these Special Provisions unless otherwise specified.

2.3 Panelboard circuits are designated on the Contract Drawings as follows:

XXX-Y-LZZ, where:

- XXX - Alphanumeric identification of the switchboard where a panelboard is located
- Y - Alpha identification of the panelboard
- ZZ - Panelboard circuit number

2.4 Panelboard submittals shall conform to the requirements of **Section 16A** of these Special Provisions.

3. PROPOSED PANELBOARDS

3.1 Each proposed panelboard shall be provided with the following features and devices:

3.1.1 Type: Dead-front, door with concealed trim clamps, hinges and flush-mount lock.

3.1.2 Circuit Breakers:

3.1.2.1 Thermal-magnetic, molded-case type, quantity and rating as shown on the panelboard schedule. Series rated circuit breakers are not acceptable. Unless otherwise shown on the Contract Drawings, both the main and branch circuit breakers shall be rated, at minimum, at 22 kA of

interrupting capacity. Circuit breakers shall be suitable for 75 degrees C rated conductors.

3.1.2.2 Circuit breakers with frame ratings of 400 A and above shall be UL-listed for application in their intended enclosures for 100 percent of their continuous ampere ratings.

3.1.2.3 Circuit breakers for use in dc circuits shall be UL-listed for dc application.

3.1.2.4 All circuit breakers shall have provisions for padlocking their handles in the OPEN position.

3.1.2.5 Asterisks in the panelboard schedule indicate GFCI-type circuit breakers.

3.1.3 Buses: Main, neutral and ground buses shall be copper.

3.1.4 Directory: A typewritten directory showing circuit numbers and complete designation of each branch circuit.

3.1.5 Nameplate: Engraved with the panelboard designation shown on the panelboard schedule.

SECTION 16I

FIRE ALARM SYSTEM

1. SCOPE

This Section sets forth the specifications for the proposed Fire Alarm System.

2. GENERAL

2.1 The Contractor shall supply all tools, equipment, materials, including conduits and conductors, and labor required for providing and installing a complete working Fire Alarm System as shown on the Contract Drawings and specified in this Section.

2.2 All work shall conform to the requirements of **Section 16A** and **Division 1** of these Special Provisions, unless otherwise specified.

2.3 All materials, devices and equipment shall be new products manufactured in strict accordance with the requirements of these Special Provisions and governing codes and standards.

2.4 All equipment shall be designed for operation in ambient temperature ranging from 0-degrees C to 50-degrees C and relative humidity ranging from 10 percent to 90 percent noncondensing.

2.5 All work shall be a unit responsibility of a single subcontractor possessing a valid C10 (Electrical Contractor) license and having experience in making similar installations. Evidence of such qualifications shall be provided to the District, in writing, prior to commencing the work. The qualification evidence shall include the following:

2.5.1 The names and qualifications of supervisory and design personnel to be directly responsible for the preparation of the submittals and the supervision of the installation and testing of the Fire Alarm System.

2.5.2 A list of three(3) completed similar installations, including names and addresses of owners, names of the projects, and dates of completion.

3. CODES AND STANDARDS

The design, equipment, materials and installation of the Fire Alarm System shall conform to the requirements of the latest edition of National Fire Alarm Code (NFPA 72) and all applicable codes and standards, at the time of bid, listed in **Section 16A** of these Special Provisions and referenced below.

- a. NFPA 72 National Fire Alarm Code

- b. NFPA 90A Installation of Air Conditioning and Ventilating Systems
- c. Underwriters Laboratory (UL) Fire Protection Equipment Directory
- d. Factory Mutual Approval Guide
- e. California Fire Code
- f. California Building Code
- g. Local Code Amendments

4. SYSTEM DESCRIPTION

4.1 General.

4.1.1 The Fire Alarm System shall include an alarm control unit, remote annunciator, fire alarm initiating devices (smoke detectors and manual pull stations), notification appliances, and all auxiliary devices and wiring required for a complete working system meeting all requirements of these Special Provisions and all applicable requirements of the codes and standards referenced in **Part 3** of this Section.

4.1.2 All system components shall be approved by the California State Fire Marshal.

4.2 Alarm Control Unit.

4.2.1.1 Actuation of a fire alarm initiating device of any zone shall cause actuation of strobe lights and generation of a fire alarm tone by the notification appliances.

4.2.1.2 The circuits of all initiating devices and notification appliances shall be monitored for the integrity of the interconnecting conductors so that the occurrence of a single open or a single ground fault condition in these circuits and their restoration to normal condition shall be automatically annunciated by an audible and visible TROUBLE signal distinctive from the ALARM signal.

4.2.1.3 A single open or a single ground fault condition of the interconnecting circuits shall not cause ALARM signal.

4.2.1.4 A wire-to-wire short-circuit fault in the notification appliance circuit shall result in TROUBLE signal.

4.2.1.5 Each zone of the system shall be provided with one(1) auxiliary relay, energized under normal condition and de-energized under alarm condition, and one(1) auxiliary relay, energized under normal condition and de-energized under MALFUNCTION condition. Each relay shall have four(4) Form C contacts rated 5 A, 120 V ac.

4.2.1.6 Alarm control unit shall be designed to operate on a 120 V, 60 Hz primary power source. The secondary power source shall be provided from a rechargeable battery equipped with a battery charger. Upon failure of the primary power source, TROUBLE signal shall be annunciated, and the alarm system shall automatically transfer to the secondary power source. Upon restoration of the primary power source, the alarm system shall automatically retransfer from the secondary to primary power source.

The battery shall have sufficient capacity to operate the system for 24 hours under maximum normal load and, at the end of that period, operate all alarm notification appliances for five(5) minutes.

#### 4.3 Fire Alarm Notification Appliances.

4.3.1 Each notification appliance shall be a combination audible/visual device with the following features:

- a. Suitable for operation with the alarm control unit
- b. Visual notification: Light strobe rated 117 candela
- c. Audible notification: Siren rated 82 dBA (reverberant) at ten(10) feet at minimum voltage
- d. Suitable for outdoor use
- e. Suitable for wall mounting
- f. Factory painted red and labeled FIRE
- g. If two(2) or more combination audible/visual devices are located in the same room and spaced less than fifty-five(55) feet apart, the light strobes shall be synchronized as required by NFPA 72, Part 6-4.4.1

4.3.2 Combination audible/visual notification appliances shall be Wheelock Model No. MT-24-WM-VFR or accepted equal.

#### 4.4 System Monitoring.

4.4.1 Each control valve affecting the proper operation of a fire protection system, including automatic sprinkler control valves, standpipe control valves, sprinkler service entrance valve, valves at fire pumps, isolating valves for pressure type waterflow or supervision switches, whether supplied under this Contract or existing, shall be electrically monitored to ensure its proper position. Each tamper switch shall be provided with a separate address.

### 5. SUBMITTAL REQUIREMENTS

5.1 Submittal shall conform to the general requirements of **Section 16A** of these Special Provisions and as specified here within.

5.2 Submittal shall include catalog sheets, manufacturer's descriptive literature, installation manuals, instruction manuals, parts lists and internal elementary diagrams of all items of fire alarm equipment and materials specified in this Section of the Special Provisions and shown on the Contract Drawings.

5.3 Prior to submitting to the District, the Contractor shall obtain acceptance of the AHJ of the following documentation:

5.3.1 Interconnection and wiring diagrams showing all system components and terminal and wire identification numbers.

5.3.2 Site and building plans showing the physical locations of all alarm system conduits and equipment.

5.3.3 Catalog sheets, manufacturer's descriptive literature, installation manuals, instruction manuals, parts lists and internal elementary diagrams of all items of equipment.

5.3.4 Voltage drop calculations.

5.3.5 Conduit fill calculations.

## 6. TESTING

The Contractor shall arrange for and conduct an inspection and test of the completed fire alarm system to demonstrate that the system is in working order. The Contractor shall arrange for the witnessing of the inspection and test by both the AHJ and the District's representatives.

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SECTION 16J

ELECTRICAL INSTALLATION DETAILS

1. SCOPE

This Section sets forth the requirements for electrical installation details.

2. GENERAL

2.1 The installation detail drawings included on the Contract Drawings, do not necessarily cover the entire scope of the installation details drawings that may be required by the Contractor to accomplish its work as defined in the Contract Documents. Any additional installation detail drawings, deemed by the Contractor necessary for accomplishing its work, shall be developed by the Contractor at no additional cost to the District. These drawings shall be submitted for the District's acceptance.

2.2 Electrical installation detail drawings are not to scale. They are diagrammatic and do not show detail requirements. Additional electrical fittings (such as conduit bodies, cable and cord fittings, junction boxes, elbows, couplings, reducers, unions, etc.), fasteners, brackets, etc., required to ensure installation and operation of the equipment according to the manufacturers' requirements and general requirements of the Contract Documents, shall be provided by the Contractor at no additional cost to the District.

2.3 Grounding of all electric devices and enclosures shall be as shown on the Contract Drawings and as specified in **Section 16A** of these Special Provisions.

2.4 All work shall conform to the requirements of **Section 16A** and **Division 1** of these Special Provisions.

2.5 Unless otherwise shown on the electrical installation detail drawings, the device supports, and all their components, to be installed in the areas designated as corrosive shall be constructed of Type 316 stainless steel. All stainless steel that is to be welded shall be Type 316L. The device supports, and all their components, to be installed in all other areas shall be constructed of aluminum.

2.6 All fasteners, such as bolts, U-bolts, clamps, straps, nuts, washers, anchors, etc., shall be made of Type 316 stainless steel.

2.7 All reinforced bars shall conform to the requirements of ASTM A 615, Grade 60.

2.8 Grout to be used for device supports shall be composed of one(1) part of Portland cement and not more than 3-1/2 parts of sand by volume with sufficient amount of water for placing. The grout shall be mixed, handled and placed according to the manufacturer's instructions.

2.9 Aluminum surfaces bearing or embedded in concrete shall be prepared per SSCP-SP1 and SSPC-SP3 and then given one(1) coat of an epoxy primer by International Integrated 270WB, Tnemec Series 69 Hi-Build Epoxiline II, Amercoat 385, Carboline 893, Corchem 235, Sherwin Williams Hi-Solids catalyzed epoxy Series B62, or accepted equal. The coating shall be allowed to cure before concrete is poured against it. The total dry film thickness shall be, at minimum, 2 mils.

3. SUBMITTAL REQUIREMENTS

3.1 Submittal shall conform to the requirements of **Section 16A** of these Special Provisions.

3.2 In addition to all applicable requirements of **Section 16A** of these Special Provisions, the submittal for the proposed supports specified in this Section of these Special Provisions shall include the list of all electric devices intended for mounting on each support.

4. ELECTRICAL INSTALLATION DETAIL DRAWINGS

Electrical installation details are provided in the drawing set, Sheet E-6.

SECTION 16K

ELECTRICAL CONDUIT SCHEDULE

1. SCOPE

This section provides the schedule of the electrical conduits shown on the drawings. The conduits not included in the schedule are identified on the drawings.

2. GENERAL

2.1 Each column of the electrical conduit schedule is defined in the following table.

<b>NO</b>		SEQUENTIAL NUMBER OF TABLE ROW		
<b>CONDUIT/ CABLE TRAY</b>	<b>NO</b>	CONDUIT OR CABLE TRAY NUMBER: RX-Y-Z (CONDUIT NUMBER)	X	SWITCHBOARD OR CONTROL PANEL NUMBER
		CTX-Y-Z (CABLE TRAY NUMBER)	Y	SEQUENTIAL NUMBER
			Z	CIRCUIT POWER CLASS (SEE SECTION 16A)
	<b>FROM</b>	START OF CONDUIT RUN OR CABLE TRAY		
	<b>TO</b>	END OF CONDUIT RUN OR CABLE TRAY		
<b>SIZE (IN)</b>	CONDUIT SIZE OR CABLE TRAY WIDTH IN INCHES. EXAMPLES:  4 - 4-INCH CONDUIT 9x6 - 9-INCH WIDE, 6-INCH DEEP CABLE TRAY  THE MAXIMUM WIDTH OF EACH CABLE TRAY RUN (IDENTIFIED BY ITS CABLE TRAY NUMBER) IS INDICATED; REFER TO THE DRAWINGS FOR ACTUAL WIDTH OF EACH PART OF A CABLE TRAY RUN.			
<b>CIRCUIT NO</b>		CX-Y-Z	X	SWITCHBOARD OR CONTROL PANEL NUMBER
			Y	SEQUENTIAL NUMBER
			Z	CIRCUIT POWER CLASS (SEE SECTION 16A)
<b>CONDUCTOR</b>	<b>TYPE</b>	THE TYPE OF CONDUCTORS DESCRIBED IN SECTION 16A		
	<b>QTY</b>	NUMBER OF SINGLE-CONDUCTOR CABLES OR		
		NUMBER OF CONDUCTORS IN A MULTICONDUCTOR CABLE OR		
		NUMBER OF SINGLE-PAIR (SINGLE-TRIAD) CABLES OR		
	NUMBER OF PAIRS (TRIADS) IN MULTIPLE-PAIR (MULTIPLE-TRIAD) CABLES			
	<b>SIZE (AWG/KCMIL)</b>	SIZE OF CONDUCTORS IN AWG OR KCMIL		
<b>N/GND (AWG/KCMIL)</b>		SIZE OF NEUTRAL OR GROUND CONDUCTORS IN AWG OR KCMIL		
<b>REMARKS</b>		MISCELLANEOUS INFORMATION		
NOTE: EACH INDIVIDUAL CONDUIT IS LISTED IN THE SCHEDULE AS MANY TIMES AS MANY INDIVIDUAL CIRCUITS IT CONTAINS.				

SECTION 16K - CONDUIT SCHEDULE

NO	CONDUIT/CABLE TRAY				CIRCUIT NO	CONDUCTOR			N/GND (AWG/KCMIL)	REMARKS
	NO	FROM	TO	SIZE (IN)		TYPE	QTY	SIZE (AWG/KCMIL)		
1	R1A2-001A-4	SWBD 1A2	MCCB PNLBD F	1.5	C1A2-001A-4	1	3	3	8	
2	R1A2-001B-4	MCCB PNLBD F	PNLBD F	1.5	C1A2-001A-4	1	3	3	8	
3	RFAPS-001-2	EX HORN/STROBE V2-7	Strobe V2-8	0.75	CFAPS-001-2	16	2	16	-	
4	RFAPS-002-2	Strobe V2-8	Strobe V2-9	0.75	CFAPS-001-2	16	2	16	-	
5	RFAPS-003-2	Strobe V2-9	Strobe V2-10	0.75	CFAPS-001-2	16	2	16	-	
6	RFAPS-004-2	Strobe V2-10	Horn/Strobe V2-11	0.75	CFAPS-001-2	16	2	16	-	
7	RFAPS-005-2	Horn/Strobe V2-11	Horn/Strobe V2-12	0.75	CFAPS-001-2	16	2	16	-	
8	RSCP-001-1	Security Control Panel	LOCAL SCP WOMEN'S RESTROOM	2	CSCP-001-1	22	2	-	-	CAT6
9	RJCI-001-1	JCI PANEL	SYSTEM INTEGRATION POINT 1	0.75	CJCI-001-1					CONDUCTOR PROVIDED BY JOHNSON CONTROLS
10	RJCI-001-1	JCI PANEL	SYSTEM INTEGRATION POINT 2		CJCI-002-1					CONDUCTOR PROVIDED BY JOHNSON CONTROLS
11	RJCI-001-1	JCI PANEL	SYSTEM INTEGRATION POINT 3		CJCI-003-1					CONDUCTOR PROVIDED BY JOHNSON CONTROLS
12	R00F-001-3	PNLBD F	SYSTEM INTEGRATION POINT 1,2,3	0.75	C00F-001-3	1	2	12	12	
13	R00F-002-3	PNLBD F	AUTO DOOR OPENER 1,2	0.75	C00F-002-3	1	2	12	12	
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SECTION 17I

ACCESS CONTROL AND ALARM MONITORING SYSTEM

1. SCOPE

This Section sets forth the specifications for all proposed Access Control System components.

1.1 The Work of this Special Provision includes, but is not limited to, the following:

1.1.1 Access Control System hardware configuration

1.1.2 Access Control System software configuration

1.1.3 All necessary Access Control System and OS software Licenses

1.1.4 Access Control System power supplies and accessories

1.1.5 Staff Training

1.1.6 System Administration and Operation

1.1.7 The supply and installation of system cabling, as needed, excluding Ethernet cabling

1.1.8 Termination of system cabling, as needed, excluding Ethernet cable

1.1.9 Identification and labeling of all system cables

1.1.10 Testing of all devices and cables

1.1.11 Providing As-Built drawings

1.1.12 Providing test results

2. ACCESS CONTROL SYSTEM DESCRIPTION

2.1 The Women's Restroom Access Control System consists of security equipment such as controllers, multi-Class smartcard readers, egress devices, magnetic door contacts, duress alarms, and power supplies that are used to control secure areas. These components will be integrated into the existing system. Access control will be provided on selected doors.

2.2 ACS equipment will be wired back to the Access Control Panel located in the Admin building.

2.3 Communications for Access Control Panels shall be by TCP/IP over the Local Area Network. Security will have its own VLAN (SVLAN) connection furnished by others.

2.4 The ACS panels will contain intelligence for stand alone operations of access control functions in the event of loss of communication between the panel and peer panels.

2.5 Contractor will be required to connect and utilize the existing database for the Owner's entire staff. This includes but isn't limited to time schedules, access levels for employees, access groups and user data, report templates, System Administration levels, data entry of all Owner's Employees, and other attributes as specified by the Owner.

2.6 Where indicated the access control system shall use multi-class smartcard readers. General Contractor (GC) shall be responsible for ensuring that all doors receiving access control security equipment are aligned properly, have the necessary door closing equipment, and also operate properly.

2.7 GUI maps shall be developed to show door alarms.

2.8 Coordination will be required with the door hardware contractor on interfacing the access control system with doors that have auto operators. An authorized credential read shall allow for the auto operator button to be activated. Auto operator will open the door only by the paddle on the wall being pushed.

2.9 Commissioning of components, equipment, and/or system specified in this division is part of the construction process, Documentation and testing of these components, equipment, and/or system, as well as training of the Owner's operation and maintenance staff on these components in coordination with the Owner's Representative and Commissioning Agent. Refer to General Commissioning Requirements - Section 01 91 13 for detailed commissioning requirements.

2.10 Related work in other sections:

2.10.1 Conduit

2.10.2 Plywood Backboards

2.10.3 Electrical Power

2.10.4 Grounding Busbar

2.10.5 Category 6A cables and terminations

2.10.6 Installation of Equipment

2.11 Contractor is responsible for final routing of all conduit. Access Control System vendor is responsible for all routing and installation of cabling for the Access Control System.

2.12 All equipment provided by the contractor and Access Control System vendor shall be new and shall meet or exceed the latest published specifications of the manufacturer in all respects. Access Control System vendor to provide latest model/revision of a specified piece of equipment at the time of installation. Obtain detailed installation instructions for the manufacturer of each component.

2.13 Required Pre-Construction Submittals:

2.13.1 Product cutsheets for all products and materials

2.13.2 Recommended application and installation methods

2.13.3 Drawings showing device locations and types, riser diagrams, wiring diagrams, approvals, and test data.

2.13.4 Complete shop drawings of all custom fabricated and assembled products.

2.13.5 Drawing identifying all terminals and illustrating all device wiring connections and details.

2.13.6 Operating instructions

2.14 Required Post-Construction Submittals:

2.14.1 As-Built Documents including shop drawings, cutsheets, operating manuals, and warranty information.

2.15 Obtain all necessary approvals and permits from Local Authorities, as required. The entire installation shall meet or exceed the minimum standards and requirements of the following:

2.15.1 Underwriters' Laboratories, Inc. listing service

2.15.2 NFPA 72 and National Fire Codes

2.15.3 Codes as accepted and/or modified by the local Authorities:

2.15.3.1 National Electric Code

2.15.3.2 Americans with Disabilities Act (ADA)

2.15.3.3 Underwriters' Laboratories, UL 1971 for Hearing Impaired

2.16 Service Support

2.16.1 The Contractor and Access Control System vendor shall maintain at trained staff capable of performing support tasks. Access Control System vendor shall have no less than 5 years' experience with similar types of systems and equipment.

2.16.2 The Access Control System vendor shall have a 24-hour service staff located within a 100-mile radius of the project site. Response to service calls shall be within a timely basis with phone contact expected within an hour. After receipt of the service request, on-site service shall be provided within 24 hours.

2.17 Warranty

2.17.1 The Access Control System modifications described herein shall carry a warranty on parts and labor for a period of one (1) year from date of substantial completion.

3. PRODUCTS

3.1 Card Reader.

3.1.1 Card readers must be compatible with existing Access Control System used throughout the Owner's campus.

3.1.2 The readers shall be installed in accordance with manufacturer instruction and electrical code. Card Reader shall not be mounted directly on metal.

3.1.3 The card readers shall be located in locations as specified on the contract drawings. Where indicated on the drawings, provide integrated keypad.

3.1.4 The Access Control System vendor shall provide 2 spare card readers.

3.1.5 Approved Manufacturer:

3.1.5.1 HID Signo Reader 40 (without keypad)

3.1.5.2 HID Signo Reader 40K (with keypad)

3.1.6 Approved Access Control Vendor:

3.1.6.1 Johnson Controls (JCI)

3.2 Access Control Controller.

3.2.1 The card readers shall be wired to a stand-alone Access Control Controller, located in the Women's Restroom Building. The stand-alone Controller shall be able to be integrated into the plant system at a later date. Door locks shall be manufactured by Corbin Russwin.

3.2.2 Controller shall be the iStar Edge G2 Controller by Software House. The Controller shall be sized to accommodate 4 doors (3 in Restroom + 1 available spare slot). Controller shall power locks with 24VDC power.

3.2.3 Controller shall be provided with a 24VDC power control panel installed beside the Controller.

SECTION 18A

GENERAL PIPING STIPULATIONS

1. GENERAL

1.1 Scope. These General Piping Stipulations apply, in general, to all piping. They shall supplement the detailed piping Sections, the Standard Specifications, and the equipment Sections.

1.2 Reference Standards. Where AWWA, ANSI, ASTM, or other standards are referenced, applicable requirements of the last revision shall apply except as otherwise noted in these Special Provisions. References to the Standard Drawings, or other standard construction details shall mean the Standard Drawings for Construction by County Sanitation Districts of Los Angeles County, which shall be made a part of the Contract Documents.

1.3 General Requirements. Above ground and below ground pipe systems shall be as indicated on the Contract Drawings and as specified in **Section 18B** of these Special Provisions. Piping systems not indicated on the Contract Drawings shall conform to the requirements of **Section 18B** designation for intended service. If the Piping Specifications for a piping system is not indicated on either the Contract Drawings or in **Section 18B**, then the following shall apply:

Above ground piping:	All pipe diameters	<b>Section 18B</b> , Designation C1
Below ground Piping:	Pipe diameter $\leq$ 3-1/2-inch	<b>Section 18B</b> , Designation X1
	Pipe diameter $\geq$ 4-inch	<b>Section 18B</b> , Designation D1

Suitable caps or blind flanges shall be furnished on pipes, valves, or branches that are to be left unconnected. Piping runs shown on the Contract Drawings shall be followed as closely as possible except for minor adjustments to avoid other piping or structural features. If major relocations are required, acceptance shall be obtained from the Engineer.

Where piping passes through the walls of tanks or channels below the water surface, the pipe shall have a wall collar and be cast directly into the concrete; sleeves or blockouts will not be acceptable. Above the water surface or through dry walls, a sleeve will be acceptable unless otherwise shown on the Contract Drawings. Wall pipe shall be ductile iron, Class 53 minimum, unless otherwise shown on the Contract Drawings. Wall flange shall consist of 1/4-inch steel seep ring halves, 1-1/2 to 2 inches beyond the outside diameter of pipe. The flange shall be installed in a machine cut groove in the pipe wall and sealed as shown on the Contract Drawings. The use of ductile iron thimbles shall also be acceptable at locations where space permits. Unless accepted otherwise by the Engineer, all sleeves shall be sealed. Spools or thimbles shall be cast in new walls unless otherwise accepted by the Engineer. Transitions from ductile iron wall pipe to steel gallery pipe are shown on the Contract Drawings as flanged joints. These flanged joints may be substituted by the Contractor at its expense by using Victaulic style 307 transition couplings or equal. Grooved joints shall conform to Pipe Material Specifications, **Section 18B** of these Special Provisions.

Materials shall be new. Materials shall be of the same type and manufacture for similar use, unless otherwise accepted. No item or material shall be installed for any purpose not recommended by the Manufacturer. Workmanship shall be of the best standard practice of the trade.

Steel accessories for use with buried piping shall not be allowed unless shown on the Contract Drawings or specified in these Special Provisions. Asbestos or items containing asbestos shall not be utilized.

The prefabrication of the entire piping of each system is not allowed. The prefabrication shall be done in a way such that any number of site adjustments can be made to accommodate the Contractor supplied equipment, valves, and the District-furnished equipment. The Contractor shall not prefabricate piping, either off-site or on-site, only based on the Contract Drawings and dimensions provided by the District. The Contractor shall verify all site conditions, dimensions, and flange orientations and shall closely coordinate with its own equipment suppliers and the information supplied by the District-furnished equipment before finalizing any piping spool fabrications. The Contractor shall specifically field verify connections to existing flanges for the rating and type of flange, bolt hole pattern, orientation, size of the flanges, and the face configuration (raised face vs. flat face) before proceeding with any fabrication. Any changes or delays due to discrepancies, which prevent piping and flange lineup, shall be the Contractor's responsibility.

1.4 Not Used.

2. TRENCH CONSTRUCTION

2.1 General. The following shall be in addition to requirements of the Standard Specifications.

2.2 Minimum Cover. Where pipe grades or elevations are not definitely fixed by the Contract Drawings, trenches shall be excavated to a depth sufficient to provide a minimum depth of 30 inches of backfill cover over the top of the pipe in all locations exclusive of pavement, treated, untreated, or stabilized base covers. Greater pipe cover depths may be necessary on vertical curves or to provide necessary clearance beneath other pipes, conduits, drains, drainage structure, or other obstructions encountered at normal pipe grades. Measurement of pipe cover depth shall be made vertically from the outside top of pipe.

2.3 Limiting Trench Widths. Trenches shall be excavated to a width which will provide adequate working space and pipe clearances for proper pipe installation, jointing, and embedment. However, limiting trench widths below an elevation 12 inches above the top of installed pipe shall be a maximum width equal to the outside diameter of pipe plus 16 inches, unless otherwise specified. If the new pipe is to be installed in a fill or backfill area, the Contractor shall complete the fill or backfill to a minimum of two(2) feet above the top of the pipe and then excavate the trench within the allowable trench width.

2.4 Pipe Bedding and Trench Backfill. The bedding shall be as specified in the Standard Specifications, **Section 306-6**, the detailed piping sections, and in this Section. The bedding and subbedding material for vitrified clay pipe, ductile iron pipe, piping with protective coating, PVC, and FRP shall be native or imported free-draining granular material having a sand equivalent of not less than thirty, or other material accepted by the Engineer. The subbedding material shall extend to a minimum of six inches below the bottom of the pipe barrel. The bedding material shall extend from the bottom of the pipe barrel to a minimum of one foot above the top of the pipe. Unless otherwise specified, the trench backfill material shall be select fill material placed in accordance with **Section 306-12** of the Standard Specifications.

If unstable material is encountered upon which the bedding material or pipe is to be placed and determined unsuitable by the Engineer, the material shall be removed as directed by the Engineer and replaced with granular bedding material compacted to 90 percent of maximum density. Payment for removal and disposal of unsuitable material and replacement with compacted granular bedding material shall be made under the appropriate bid item and will be based on in-place measurements of the actual volume of material removed.

Backfill shall not be jetted unless otherwise allowed in accordance with **Section 306-12.4** of the Standard Specifications. The backfill material for the upper three feet measured from the pavement surface (or finish grade where there is no pavement) shall be compacted to a relative compaction of 90 percent of maximum density by mechanical means as specified in **Section 306-12.3.2** of the Standard Specifications. Backfill for trenches beneath structures shall be mechanically compacted to a relative compaction of 95 percent of maximum density. See **Section 2B** of these Special Provisions for soil compaction testing requirements.

The pipe shall be laid as specified in **Section 306** of the Standard Specifications. In no case shall the pipe be installed in such a manner as to be supported by the couplings or pipe bells.

After each pipe has been graded, aligned, and placed into final position on the bedding material and shoved home, sufficient pipe bedding material shall be deposited and compacted under and around each side of the pipe and back of the bell or end thereof to hold the pipe in proper position and alignment during subsequent pipe jointing, bedding, and backfilling.

Embedment material shall be deposited, and compacted if required by the Engineer, uniformly and simultaneously on each side of the pipe to prevent lateral displacement of the pipe. Whenever crushed aggregate base is used as bedding for the pipe, the portion above the bottom of the pipe shall be vibrated sufficiently during the placement to ensure that all spaces beneath the pipe are filled.

Tamped backfill materials shall be placed in uniform layers per the Standard Specifications. Backfill materials shall have a moisture content, which will ensure that maximum density will be obtained with the compaction method used.

### 3. HANDLING

3.1 General. Pipe, fittings, valves, and accessories shall be handled in a manner that will ensure installation in sound, undamaged condition. Equipment, tools, and methods used in unloading, reloading, hauling, and laying pipe and fittings shall be such that they are not damaged. Hooks inserted in ends of pipe shall have broad, well-padded contact surfaces.

The Contractor shall provide slings with protective sleeves in order to protect the pipe coating.

Pipe and fittings shall be handled in accordance with the manufacturer's recommendations. Pipe may be stacked, as accepted by the Engineer, in accordance with the manufacturer's recommendations.

3.2 Damaged Coating or Lining. Pipe coating that has been damaged shall be repaired by the Contractor and accepted by the Engineer before installing the pipe.

Pipe and fittings in which the lining has been damaged or loosened shall be replaced by and at the expense of the Contractor. Where the damaged areas are small and readily accessible, the Contractor may be permitted to repair the lining, subject to acceptance by the Engineer.

### 4. CLEANING

4.1 General. The interior of pipe and fittings shall be thoroughly cleaned of all foreign matter before being installed and shall be kept clean until the work has been accepted. Lumps, blisters, and excess coating shall be removed from exterior spigot and interior bell surfaces. Such surfaces shall be wire brushed and wiped clean, dry, and free from oil and grease before placing the spigot in the bell. Joint contact surfaces shall be dry and free from oil, grease, and dirt and shall be kept clean until the jointing is completed. Pipe ends shall be taped or otherwise enclosed during shipment and storage. The tape or other protective measure shall only be removed immediately prior to cleaning and installation.

Prior to installation of piping, valves, and fittings in structures, sacking and concrete preparation shall be completed, and the work area shall be maintained in a broom clean condition during the installation. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being installed. No debris, tools, clothing, or materials shall be placed in the pipe.

If required, manual cleaning shall be utilized wherever possible on components and large piping which permit personnel access for cleaning. Manual cleaning shall consist of wire brushing, scraping, hose washing, and wiping with lint free rags.

Where wire brushing is used on austenitic stainless steel, it shall be performed only with stainless steel brushes. Brushes shall not have been previously used on any other material.

After field erection, all installed piping that conveys water shall be flushed with water having a quality equal to that normally conveyed in the system, at a minimum velocity of eight feet per second. All lube oil piping shall be flushed with oil. Steam piping shall be cleaned by blowing steam through the piping. All piping shall be flushed or steam blown until the filter or strainer in the loop is clean, which indicates the absence of foreign material in the line. All other lines shall be blown out with clean, dry compressed air. Contractor shall provide pumps, temporary piping, vents, drains, and strainers required to flush the piping adequately whether shown on the Contract Drawings or not. Contractor shall submit detailed flushing and cleaning procedures to the District for acceptance.

a. Austenitic Stainless Steel Piping.

At the completion of hydro-testing, the interior surfaces of austenitic stainless steel piping shall be cleaned using the following procedure:

Degrease the piping with an alkaline cleaner added to the water in the piping system. After circulation of the alkaline solution for eight hours, the piping system shall be completely drained and flushed with demineralized water. At completion of flushing operation, the pipe interior shall be pickled with a five percent ammoniated citric acid solution at 150 to 170 degrees F for a sufficient length of time to loosen all mill scale. Drain the acid solution and rinse the piping system with demineralized water at 170 degrees F. Drain rinse water and dry piping with clean dry compressed air. The Contractor shall submit the cleaning procedure to the Districts for acceptance.

Water used to flush and rinse stainless steel piping shall be demineralized water with a chloride content less than 50 PPM.

b. Ferritic Steel Piping.

1. All ductile iron and carbon steel used for water services shall be cleaned per **Subparagraph "d"** below.

c. Pickling and Coating of Carbon Steel Lube and Hydraulic Oil Piping.

The fabricated pipe shall be cleaned, pickled, and coated as follows:

1. Clean pipe mechanically by wiping and scraping off dirt, grease, and other undesirable foreign matter. A petroleum solvent shall be used.
2. The pipe shall be thoroughly cleaned in a hot caustic bath. The bath shall be a sodium hydroxide solution in proportion of eight ounces of sodium hydroxide to one gallon of water. Temperature of solution shall be 200 degrees F. Time of immersion shall be at least five minutes. This operation shall be continued until all dirt, grease, and paint are removed.
3. The piping shall be rinsed in hot water until excess sodium hydroxide is removed.

4. The pipe shall be removed from rinse bath and placed immediately in an acid pickling bath. Acid bath shall be a sulfuric acid solution, six percent concentrated by volume to which acryl inhibitor has been added. Temperature of solution shall be 140 degrees F. Time in acid pickling bath shall be as required to remove scale and rust and result in clean, bare metal.
5. The pipe shall be removed from acid pickling bath and immediately washed thoroughly with clear cold water.
6. As soon as pipe is thoroughly washed and all traces of acid are removed, and without allowing it to dry, the pipe shall immediately be coated with Richfield soluble oil type "DO" undilute.
7. Immediately after coating with oil, ends of pipe spools shall be closed with metal caps.
8. If suitable facilities are available, it is preferable to wash pipe with a neutral solution (pH equal to 7.0) immediately after removal from the acid pickling bath. This operation shall then be followed by cold water wash and coating, as specified in **Items 5 and 6** above.

**NOTE:**

- 1) Coating may be satisfactorily done by filling pipe with the coating oil, making sure that no air pockets exist, which will prevent thorough and complete coating.
  - 2) Agitation of the caustic and acid pickling solutions is helpful in obtaining satisfactory results and is permissible.
- d. Preparation of Ductile Iron Piping and Fittings and Carbon Steel Water Piping.
1. All piping and fittings shall be thoroughly brushed clean with heavy gauge wire brushes to remove any slag, rust, or scale on the inside of pipes. Burrs in the ends of fittings or pipe shall be reamed smooth.
  2. All construction debris shall be removed as far as possible. Dirt, sand, or trash shall be completely removed from the working area. All strainer screens shall be removed and cleaned.
  3. After all piping has been thoroughly cleaned, softened water with an alkaline industrial type cleaner shall circulate throughout the system. All strainers and screens shall be cleaned as deposits accumulate.
  4. The lines shall be dosed with a minimum of 35#/1000 gallon system capacity of an alkaline industrial type pipe cleaner containing surfactants, de-greasing agents, and phosphates for passivation of metal surfaces. The industrial cleaner and cleaning procedures shall be submitted to the District for acceptance. The caustic solution shall be circulated throughout the piping for a minimum of one day at the end of which the

system shall be completely drained and flushed. Minimum flush velocity shall be eight feet per second.

5. After the system has been flushed, softened water with a nitrite corrosion inhibitor for metal passivation shall be added to maintain 1500 mg/L nitrite in the system. The corrosion inhibitor shall be Betz #338, Calgon #405, or equal. Equivalent formulations must match each chemical constituent of either product specified above within three percent.
6. This inhibitor solution shall be circulated for a minimum of five days with additional inhibitor added as necessary to maintain recommended level.
7. If final start-up of the system will be delayed, water shall be circulated for eight hours once a week until normal operation begins. Inhibitor dosage shall be maintained and strainer screens cleaned if deposits accumulate.

4.2 Plugging Open End Pipes. Whenever pipe laying is stopped, the open end of the line shall be sealed with an accepted mechanical watertight plug. If pipeline installation is in a trench, water that may have entered the trench shall be removed prior to removing the plug. It is essential that no mud, trench water, or other foreign matter be permitted to enter the pipeline at any time.

## 5. CUTTING

Cutting shall be done in a neat manner without damage to the pipe or lining. Pipe cuts shall be smooth, straight, and at right angles to the pipe axis. Cutting of pipe shall be done with mechanical pipe cutters of an accepted type. Cut ends shall be, if applicable, reamed to full bore before assembling.

## 6. INSPECTION

Pipe and fittings shall be carefully examined for cracks and other defects while suspended immediately before installation in final position. Spigot ends of pipe shall be examined with particular care. Defective, damaged, or unsound pipe and fittings shall be rejected and removed from the site of the work.

## 7. INSTALLATION

Manufacturer's instructions and recommendations shall apply to installation of piping unless otherwise specified. When requested by the Engineer, the Contractor shall furnish the Manufacturer's printed installation instructions before pipe installation.

## 8. NOT USED

## 9. CONNECTIONS WITH EXISTING PIPELINES

See **Section 1B** of these Special Provisions. Where connections are made between new work and existing piping, the Contractor shall field check the locations and dimensions of the existing piping, size, type, and bolt hole orientation of existing flanges, and the connections shall be made using suitable fittings for the conditions encountered. Each connection with an existing pipe shall be made at a time and under conditions which will least interfere with plant operations, and as authorized by the Engineer. Facilities shall be provided for proper dewatering and for disposal of all water removed from the dewatered lines and excavations without damage to adjacent property. The Contractor shall assume that all existing pipelines are full of their service fluid. For connections to Districts' landfill gas headers, the Contractor shall provide containment for condensate liquid that may be in the line. The condensate shall be handled and disposed as directed by the Engineer.

For construction at Districts' landfill sites, the Contractor shall, at no additional cost to the District, provide and install temporary bypass piping, pipe supports, and valves to maintain site systems operational when connections to existing piping will result in system shutdowns for periods exceeding those specified in **Section 1B** of these Special Provisions. The proposed temporary piping and layout shall be accepted by the Engineer and shall be removed after completion of permanent piping. Temporary piping and valves shall be suitable (in size and material) for the intended service and shall conform to requirements of **Division 18** of these Special Provisions.

## 10. SPECIAL PIPING ITEMS

The table below contains specifications for special piping (SP) items. These specifications shall apply unless noted otherwise, whether or not the item is called out by special number.

SP#	Piping Item	Description
1	Restrained Mechanical Joint	A Restrained Mechanical Joint shall include a standard ductile iron sleeve or fitting with mechanical joint bell and follower gland at both ends to be installed on plain end pipe. The sleeve or fitting and gasket shall be of the same material lined and externally coated as described in the designations of this Section for the service pipe considered. The mechanical joints including the gaskets shall conform in all respects to ANSI/AWWA C111/A21.11. Bolts, nuts, and washers shall conform to the bolts, nuts, and washers specified for the mechanical couplings described in the designations of this Section for the service pipe considered. The sleeve or fitting shall conform to ANSI/AWWA C153/A21.53. The glands shall include a restraining mechanism that, when actuated, imparts multiple wedging action against the pipe, increasing the resistance of the coupling as pressure increases. Flexibility of the joint shall be maintained after burial. Glands shall be manufactured of ductile iron conforming to ASTM A 536 of the latest version. Restraining wedges shall be of ductile iron heat treated to a minimum hardness of 370 BHN. Gland dimensions shall be compatible with the standardized mechanical joint bell and tee-head bolts conforming to ANSI/AWWA C111/A21.11 and ANSI/AWWA C153/A21.53. Twist-off nuts shall be used to ensure proper actuating of the restraining wedges and prevent over-tightening during installation. The Restrained Mechanical Joint

SP#	Piping Item	Description
		shall have a working pressure of at least 250 psi with a minimum safety factor of 2:1.
2	Sleeve Type Transition Coupling	Middle rings ASTM A 536 ductile iron without pipe stops and at least five inches long for pipes less than 12 inches and at least seven inches for pipes 12-inches and greater. Bolts, nuts, and washers shall be 304 stainless steel. Followers shall be ASTM A 536 ductile iron. The interior of the middle rings (sleeves) shall be shop coated (lined) with a minimum of 16 mils of an epoxy recommended by the Manufacturer for the service conditions. Couplings shall be Romac 501, Smith-Blair 441, or equal. Reducing couplings shall be Romac R501, Smith-Blair R441, or equal.
3	Y-Patterned Strainers	Strainer shall be of the Y-pattern type with flush connection, cast iron body, 20 mesh 304 stainless steel screen and threaded ends. Strainers shall be rated for 300 psig maximum pressure at 150 degrees F. Strainers shall be installed in accordance with the Manufacturer's printed instructions and accepted shop drawings. There shall be sufficient clearance and working space around the strainers for cleaning purposes. Strainers shall be Spirax Sarco Model IT or equal.
4	Duplex Basket PVC Strainer	Duplex strainer shall consist of two simplex strainers connected by two diverter valves or three-way valves. A lever or other means shall indicate which strainer is in service. Strainers shall be of the basket type with flush connection, hand removable PVC cover, PVC body, 40 mesh 316 stainless steel screen, Viton seals, and flanged ends. Strainer shall be rated for 150 psig maximum pressure at 70 degrees F. Strainer shall be installed in accordance with the Manufacturer's printed instructions and accepted shop drawings. Strainer shall be Hayward All-Plastic, Spears, or equal.
5	Simplex Basket PVC Strainer	Strainers shall be of the basket type with flush connection, hand removable PVC cover, PVC body, 40 mesh 316 stainless steel screen, Viton seals, and flanged ends. Strainer shall be rated for 150 psig maximum pressure at 70 degrees F. Strainer shall be installed in accordance with the Manufacturer's printed instructions and accepted shop drawings. Strainers shall be Hayward All-Plastic, Spears, or equal.
6	Clay to Ductile Iron Pipe Transition Coupling	Coupling sleeve shall be manufactured of a corrosion-resistant, molded rubber and shall conform to ASTM C 425/ASTM C 1173. The coupling sleeve shall be secured onto the adjacent piping with Series 300 stainless steel worm-drive clamping bands. Couplings shall be equipped with 300 stainless steel shear rings and clamping bands. The shear rings and clamping bands shall have a minimum thickness of 0.012 inches and shall conform to ASTM A 240. The clamping bands shall be secured with 316 stainless steel nut and bolt clamp system, conforming to ASTM A 240.
7	CPVC Y-Strainer	Strainer shall be of the Y-pattern type with flush connection, removable screen, magnetic drain plug, cap, Viton O-ring seal, and CPVC body with solvent welded ends, unless otherwise shown on the Contract Drawings. Strainer shall be rated for 150 psig at 73 degrees F for pipe sizes two inches and smaller, and 90 psig at 73 degrees F for pipe sizes three inches and larger. Strainer screens shall be of 30 mesh CPVC, unless otherwise shown on Contract Drawings. Strainer shall be installed in accordance with the Manufacturer's printed instructions and accepted shop drawings. There shall be sufficient clearance and working space around the strainer for cleaning purposes. Strainer shall be Spears, Hayward All-Plastic, or equal.

11. INSTRUMENTATION CONNECTIONS

Where not shown or specified otherwise, instrumentation connections to process lines one inch and larger shall be one inch. Connections to process lines smaller than one inch shall be made with a tee and shall be the same size as the process line. Ductile iron pipe shall be directly tapped for instrumentation connections while connections to other pipes shall be made with weld-o-lets or tees as appropriate. Unless shown or specified otherwise, instrumentation block valves shall be eccentric plug valves (V203) except on PVC lines, which shall use ball valves (V301).

12. DISINFECTION

New or reconnected potable water (PW) lines shall be disinfected in accordance with the applicable requirements of AWWA C651. After the line is filled, the chlorinated water shall remain in the line for a period of not less than 24 hours.

13. AS-BUILT DRAWINGS

13.1 General. On the Contract Drawings, the Contractor shall show a complete picture of the piping and valve work as actually installed. These drawings shall be kept current with the construction. The Engineer shall have the right to inspect the as-built drawings as the work progresses. Progress payments may be withheld in the event that drawings are not updated monthly per **Section 1A** of these Special Provisions.

13.2 Acceptance. Upon completion of the work, these record drawings shall be signed by the Contractor, dated, and returned to the Engineer for acceptance. Accepted record drawings are a condition for final acceptance.

14. ABANDONMENT OF CONDUITS AND STRUCTURES

Conduits and structures shall be abandoned as specified in the Standard Specifications, **Section 306-3.3**. Process piping, other conduits, and structures not specifically identified in the Standard Specifications shall be abandoned as specified in **Section 306-3.3**, except that the Contractor shall provide mechanical caps or plugs on all conduits to be abandoned as shown in the Contract Drawings or as directed by the Engineer. The mechanical caps or plugs shall be similar in design and of like materials to the conduit to be capped and shall be suitable for the service intended as determined by the Engineer.

15. DRAWINGS AND DATA

15.1 General. All detailed requirements of "Piping Material Specifications", **Section 18B** of these Special Provisions, and those shown on the Contract Drawings shall be submitted for District's acceptance.

15.2 Pipe Items Requiring Submittals. The following piping items shall be submitted for acceptance in accordance with the procedure set forth in the "General Conditions", **Section 1A** of these Special Provisions.

- a. Items specifically called for in the detailed pipe sections.
- b. Any major deviations of piping from that detailed on the Contract Drawings.
- c. Any change of materials, jointing methods, or supports from that specified or detailed on the Contract Drawings.
- d. Pipe support details including manufacturer, model number, materials, and dimensional drawings.
- e. Details of additional supports not shown on the Contract Drawings, which are, required to adequately support the piping.
- f. Pipeline layout drawings and construction details for vitrified clay pipe, reinforced concrete pipes, buried ductile iron pipe, and bell end ductile iron pipe.
- g. All detailed pipe materials, grades, ratings, ASTM designations, manufacturer, physical properties, certifications for all different pipe size ranges, fittings, flanges, gaskets, couplings, unions, and all other hardware such as nuts, bolts, and washers, as specified in **Section 18B** of these Special Provisions.
- h. Generally, piping isometrics are not required, unless the Contractor makes a major modification to the routing as shown on the Contract Drawings. This requirement will be determined by the Engineer, and the entire isometric of the specific process pipe modified shall be submitted for acceptance.

\* \* \* \* \*

SECTION 18B

PIPING SPECIFICATIONS

1. SCOPE

This Section sets forth the requirements for the piping systems shown on the Contract Drawings.

2. GENERAL

The Contractor shall design, furnish, fabricate and install the piping systems including pipe, manual and actuated valves, fittings, flanges and other accessories in accordance with the requirements of this Section and as shown and described in the Contract Documents.

2.1 General Piping Stipulations. The General Piping Stipulation, **Section 18A** of these Special Provisions, shall apply to piping systems furnished under this Section.

2.2 Painting. Painting shall conform to the requirements of **Section 9A** of these Special Provisions.

2.3 Valves. Valves to be furnished as a part of the piping system shall conform to the requirements of **Section 18C** of these Special Provisions.

2.4 Elbows. All elbows shall be long radius unless otherwise shown on the Contract Drawings or called out in this Section.

2.5 Blind Flanges. Blind flanges wherever shown or specified in this Contract shall match the material, classification, rating and code requirements of the flanges used on the same piping specification.

3. APPLICABLE CODES AND STANDARDS

The piping systems shall conform to or exceed the requirements of the latest editions of the following Codes and Standards unless otherwise noted:

- American Institute of Steel Construction (AISC)
- American National Standards Institute (ANSI)
- American Petroleum Institute (API)
- American Society of Mechanical Engineers (ASME)
- American Society for Testing and Materials (ASTM)
- American Water Works Association (AWWA)
- American Welding Society (AWS)
- Hydraulic Institute Standards (HIS)
- Society for Protective Coatings (SSPC)

4. ABBREVIATIONS

The following abbreviations are used in the piping specifications:

BE	Bevel Ended
BF	Blind Flange
BW	Butt Welded
LW	Lap Welded
MJ	Mechanical Joint
PE	Plain End
SO	Slip-On
SW	Socket Welded
THD	Threaded
WN	Weld Neck

5. PIPING SPECIFICATIONS

The intent of the Piping Specifications is to provide the Contractor with a complete system including piping, valves, fittings and couplings. The connection types given in the individual piping specifications shall be used by the Contractor except where shown otherwise on the Contract Drawings. Similarly, valves specified in the piping specifications shall be installed by the Contractor except where a different valve is called out on the Contract Drawings. The various piping specifications are attached to this Section.

6. COUPLINGS

6.1 In a rigid designated system, all above ground pipelines with grooved couplings shall be provided with grooved couplings of RIGID construction or the pipe groove shall be located and cut to provide RIGID RADIUS CUT GROOVES. Flexible couplings will be acceptable only at couplings specifically called out as "Flexible Grooved Coupling" or in a flexible designated system.

6.2 Grooved and mechanical couplings for ductile iron piping systems that are either buried, submerged or located above the water surface in a covered tank or channel shall be of ductile iron construction with all 316 stainless-steel hardware including bolts, nuts, washers, and tie rods. For diameters larger than 24-inches, fusion-bonded epoxy carbon steel with all 316 stainless steel hardware is acceptable.

6.3 Mechanical couplings for carbon steel and stainless-steel piping systems that are either buried, submerged or located above the water surface in a covered tank or channel shall be made of 316 stainless steel including all bolts, nuts, washers and tie rods.

6.4 When shown on the Contract Drawings, outlet/tapping sleeves shall be made of heavy welded 18-8 Type 304 stainless steel per ASTM A 240. Finish

coating shall be fusion-bonded epoxy with a minimum thickness of 12 mils dry film thickness (DFT) applied per ANSI/AWWA C213. Finish fully passivated per ASTM A 380 is acceptable. Bolts, heavy hex nuts, and washers shall be Type 316 stainless steel. Sealing around the tapping area shall be provided by a positively confined Concave Wedge-type gasket, circular in cross-section and made of Buna-N, compound Smith Blair Grade 60, neoprene AWWA C111 Baker Grade 75, or equal. Outlet shall be heavy duty threaded with NPT thread. Outlet/tapping sleeves shall be Smith-Blair 622, Baker 428 or equal.

When shown on the Contract Drawings, service saddles shall have ductile iron ASTM A 536 bodies. Double bale shall be alloy steel for above ground non-submerged applications and Type 304 stainless steel with fusion-bonded epoxy finish, 12 mils thick minimum for buried or submerged applications. Finish coating shall be fusion-bonded epoxy with a minimum thickness of 12 mils DFT applied per ANSI/AWWA C213. Bolts, heavy hex nuts, and washers shall be Type 316 stainless steel. Gasket shall be Buna-N compound Smith Blair Grade 60, neoprene AWWA C111 Baker Grade 75, or equal. Outlet shall be heavy duty threaded with NPT thread. Service saddle shall be Smith-Blair 313 (steel straps) or 317 (stainless steel straps), Baker 429, or equal.

6.5 Grooved couplings for carbon steel and stainless steel piping that are buried, submerged or installed in covered tanks or channels shall be galvanized and supplied with ASTM A 193, Grade B8M, Class 2, Type 316 stainless-steel bolts and ASTM A 194, Grade 8M nuts. If not specified, the grooved ends shall be coated with 3 mils of the prime coat as specified in **Section 9A, Part 12** of these Special Provisions.

1.1 All mechanical couplings for buried application shall be restrained on restrained piping system unless otherwise directed by the Engineer.

DESIGNATION: P7  
MATERIAL: ULTRA VIOLET RESISTANT (UVR) POLYVINYL CHLORIDE (PVC)  
(SOLVENT WELDED; SOCKET END OR GROOVED)  
SYSTEM RATING: SCHEDULE 40

Item	Size	Schedule/ Class/ Rating	End Connection	Description
Pipe:	1/2" - 6"	40	PE	Material conforms to ASTM D 1784, Class 12454-B or 13454-B; Pipe conforms to ASTM D 1785, PVC 1120 or PVC 2116 Type I Grade 1. Dimensions conform to ASTM D 2122. Material contains UV inhibitor 3 parts of TiO2. See Notes.
	2" - 16"	80	GR	Material conforms to ASTM D 1784, Class 12454-B; Pipe conforms to ASTM D 1785, PVC 1120 Type I Grade 1. Piping shall be IPS sized. Material contains UV inhibitor 5 parts of TiO2. See Notes. Certa-Lok Yelomine or equal.
Fittings:	1/2" - 16"	40	SW	Material conforms to ASTM D 1784, Class 1254-B or 1345-B; Fittings conform to ASTM D 2466. Dimensions conform to ASTM D 2467. Material contains UV inhibitor 3 parts of TiO-2. See Notes.
	2" - 16"	80	GR	Material conforms to ASTM D 1784, Class 12454-B; Fittings conform to ASTM D 2466. Fittings shall be IPS sized. Material contains UV inhibitor 5 parts of TiO2. See Notes. Certa-Lok Yelomine or equal.
Flanges:	1/2" - 6"	40	SW	Material conforms to ASTM D 1784, Class 1244-B or 13454-B; Outside diameter and drilling of flanges conform to ASME B16.5. Flanges shall be flat faced. See Notes.
Gaskets:				Neoprene, full faced, 1/8" thick; hardness of 45 to 60 durometer ("A" scale).
Bolts, Nuts and Washers:				Bolt material conforms to ASTM A 193, Gr. B8M, Class 2 (316 SS); Pattern, dimension and thread conform to ASME B18.2.1, standard hex head pattern and ASME B1.1, coarse thread series, Class 2B fit. Nut material conforms to ASTM A 194, Gr. 8M (316SS); Pattern, dimension and thread conform to ASME B18.2.2, standard hex head pattern and ASME B1.1, coarse thread series, Class 2B fit.
Couplings:	2" - 16"	80	GR	Material conforms to ASTM D 1784, Class 12454-B; Pipe conforms to ASTM D 1785, PVC 1120, Type I Grade 1. Material contains UV inhibitor, 5 parts of TiO2. Restrained joints conform to ASTM D 3139. A flexible elastomeric seal (O-Ring) in the coupling conforms to ASTM F 477. See Notes. Certa-Lok Yelomine or equal.
Valves: Ball: V301 Ball Check: V715				

DESIGNATION: P7  
 MATERIAL: ULTRA VIOLET RESISTANT (UVR) POLYVINYL CHLORIDE (PVC)  
 (SOLVENT WELDED; SOCKET END OR GROOVED)  
 SYSTEM RATING: SCHEDULE 40

Item	Size	Schedule/ Class/ Rating	End Connection	Description
<p>Notes:</p> <ol style="list-style-type: none"> <li>1. At production, UVR PVC material used for pipe and fittings shall have an Izod impact resistance no less than 1.15 ft.lb/in, and a minimum of 7000 psi of tensile strength at yield. After 5000 hours of UV exposure in an UV test chamber in accordance with ASTM G 53, UVR PVC material used for pipe and fittings shall have an Izod impact resistance no less than 0.65 ft.lb/in, and a minimum of 7000 psi of tensile strength at yield. The Izod impact resistance test shall be in accordance with ASTM D 256. The tensile property test shall be in accordance with ASTM D 638.</li> <li>2. UVR PVC pipe, fittings, and couplings shall be accepted for potable water service and shall be listed under NSF-14 or another accredited testing laboratory with equivalent requirements.</li> <li>3. Solvent welded joints shall conform to ASTM D 2855 and ASTM D 2672, solvent cement shall conform to ASTM D 2564, and primer for solvent cement shall conform to ASTM F 656.</li> <li>4. Teflon thread lubricant shall be used on all valve unions. Teflon thread lubricant shall be used at all pipe unions if shown on the Contract Drawings.</li> <li>5. For piping 3 inches and smaller, a sufficient number of socket welded unions with EPDM O-rings shall be installed to allow any run of pipe to be disconnected, or any valve to be removed from the line without taking down adjacent runs. Install at least one union at each change in direction, one adjacent to each valve and one every 40 feet if none of the foregoing provisions apply. The provision of an adequate number of unions shall be rigidly adhered to whether or not such fittings are indicated on the Contract Drawings.</li> <li>6. Supports shall be provided at all points of directional change, including horizontal to vertical. PVC pipe shall be supported in a manner which permits contraction and expansion from temperature changes. Valves, check valves and other devices in the line shall be supported so that the weight or torque applied to the device does not place undue stress on the pipe. Where clamping of the pipe for the purpose of anchoring is required, the clamps shall be fitted with rubber or PVC type liners.</li> <li>7. For grooved restrained system, supports shall also be located within two feet on either side of the coupling.</li> <li>8. For grooved restrained system, machined-precision grooves on the pipe and in the coupling, when aligned, allow a spline to be inserted, resulting in a fully circumferential restrained joint that locks the pipe and fitting/coupling together. The O-ring in the coupling shall provide a hydraulic pressure seal.</li> <li>9. For grooved restrained system, for above ground, the restrained joint shall be of the non-permanent type, with a Teflon coated O-ring to allow disassembly and reuse.</li> <li>10. For grooved restrained system, for below ground, the restrained joint shall be of the permanent type, with a larger cross-section and non Teflon coated O-ring, rendering disassembly difficult. A lubricant shall be used to facilitate assembly.</li> <li>11. PVC resin shall be manufactured in an ISO 9000 certified resin plant.</li> </ol>				

DESIGNATION: P15  
 MATERIAL: POLYVINYL CHLORIDE (PVC) PLASTIC IRRIGATION PIPE (PIP)  
 SYSTEM RATING: SDR 41

Item	Nominal Pipe Size	Schedule/ Class/ Rating	End Connection	Description
Pipe:	≥ 8"	100 psig	SW	Material conforms to ASTM D 1784, Class 12454-B; Pipe conforms to ASTM D 2241 and D 2241 Annex. See Notes 1, 6, 7, and 8.
Fittings:		100 psig	SW/GKT	Material conforms to ASTM D 1784, Class 12454-B; See Notes 1 and 7.
Flanges:		150 psig	SW	Material conforms to ASTM D 1784, Class 12454-B; Outside diameter and drilling of flanges conform to ASME B16.5. Flanges shall be flat faced. See Note 1.
Saddles:			SW	See Note 10.
Gaskets:				<u>For Flanged Joints:</u> Neoprene, full faced, 1/8" thick; with shore "A" durometer hardness of 45 to 60. <u>For Gasketed Pipe and Fittings:</u> See Note 8.
Bolts, Nuts and Washers:				<u>For Flanges:</u> Bolts, washers, and nuts for flanged joints above ground on PVC pipe shall be hot dipped galvanized steel conforming to ASTM A 153-82, with hex heads and coarse thread series, Type 2 fit or stainless steel. Bolts and washers, and nuts for below ground service shall be stainless steel 304 or 316.
<p>Notes:</p> <ol style="list-style-type: none"> <li>Solvent welded joints shall conform to ASTM D 2855. Solvent primer to solvent cement usage ratio shall be 1.5:1.</li> <li>Care shall be exercised in assembling a pipeline with solvent welded joints so that stress on previously made joints is avoided. Handling of pipe following jointing, such as lowering the assembled pipeline into a trench, shall not occur until after the cure time recommended by the cement manufacturer has elapsed. The Contractor shall immediately support and/or anchor pipelines installed on slopes to reduce the stress at the solvent welded joints.</li> <li>Solvent primer shall be IPS Weldon P-70 or equal. Solvent cement shall be IPS Welder 27-11 or equal for 12" and smaller PVC piping and IPS Welder 27-19 or equal for 15-inch diameter and larger PVC piping. Solvent cement shall be heavy bodied and meet current South Coast Air Quality Management Districts (SCAQMD) requirements. Primer and cement shall be furnished by the supplier of PVC pipe and fittings.</li> <li>Supports shall be provided at all points of directional change, including horizontal to vertical. PVC pipe shall be supported in a manner which permits contraction and expansion from temperature changes. Valves, check valves and other devices in the line shall be supported so that the weight or torque applied to the device does not place undue stress on the pipe. Steel fittings and valve assemblies in PVC pipe runs shall be supported independently of the PVC pipe so that their weight will not be supported by or transmitted to the PVC pipe.</li> <li>Piping valves and appurtenances installed in locations exposed to sunlight shall have a protective coating against ultraviolet light. See <b>Section 9A</b> of these Special Provisions.</li> <li>All SDR 41 pipe shall be provided with solvent welded socket type joints, unless otherwise shown. Pipe stop point at the middle of the socket welded coupling shall be a shallow bevel. Socket welded couplings shall be manufactured by Spears Mfg. Co., or equal. "Crimped" pipe stop points at the middle of the socket welded coupling are not acceptable. Large diameter pipe is typically a custom order which requires a minimum run size and potentially long lead times. As an alternative, the Contractor may cut</li> </ol>				

DESIGNATION: P15  
 MATERIAL: POLYVINYL CHLORIDE (PVC) PLASTIC IRRIGATION PIPE (PIP)  
 SYSTEM RATING: SDR 41

Item	Nominal Pipe Size	Schedule/ Class/ Rating	End Connection	Description
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off the bells off gasketed push-on type pipe and connect the sections with solvent welded couplings. This alternative, if required, shall be provided at no additional cost to the District.

7. The dimensions of the SDR 41 pipe shall be as follows:

Nominal Size Pipe (Inches)	Outside Dimensions (Inches)	Minimum Wall Thickness (Inches)	Minimum Socket Depth (Inches)
8	8.160	.199	4.00
10	10.200	.249	5.00
12	12.240	.299	6.00
15	15.3	.373	7.50
18	18.701	.456	9.00
24	24.803	.605	12.00
27	27.953	.682	13.00

8. Expansion joints shall be Bell and Spigot rubber gasketed push-on type pipe per the Contract Drawings. Elastomeric seals (gaskets) shall comply with the requirements of ASTM F 477. Allowable deflection at each gasketed coupling shall be a maximum of 5 degrees. Deflection greater than 5 degrees requires a fitting.

9. Underground installation of PVC pipe shall be in accordance with ASTM D 2774 and these Special Provisions. When two or more pipelines are installed in the same trench, they shall be separated by a minimum horizontal clear distance of 6-inches unless otherwise accepted by the Engineer, and they shall be installed so that each pipeline, valve, or other pipeline component may be serviced or replaced without disturbing another pipeline.

10. All saddles shall be stub-type with a minimum wall thickness equivalent to Schedule 80 pipe. Saddles shall be solvent welded and clamped with 3/8-inch wide by 1/4-inch thick 316 stainless steel band clamps such as Band-It or equal. The header pipe penetration for 4-inch or smaller pipe saddle connections shall be made with a hole saw equivalent to the outside diameter of the joining pipe. For larger sizes, the saddle may be used as a template to scribe a guideline and a reciprocating saw (Milwaukee Sawzall or sabre saw) used to make the header penetration. Irregular shaped holes and holes that exceed the outside diameter of the joining pipe will not be accepted. The Contractor shall be responsible for removing the sawn plug, shavings, dust and other debris from the header pipe prior to mounting the saddle.

DESIGNATION: X1  
 MATERIAL: COPPER TUBE AND PIPE  
 SYSTEM RATING:

Item	Size	Schedule/ Class/ Rating	End Connection	Description
Pipe:	Up to 1/2"		Solder	Pipe conforms to ASTM B 68; Solder conforms to ASTM B 32, 95-5 tin-antimony or "lead free".
	5/8" - 8 "		Solder	Pipe conforms to ASTM B 88, Type K; Solder conforms to ASTM B 32, 95-5 tin-antimony or "lead free".
Fittings:	Up to 1/2"			Conform to ASTM B 16, brass, compression type tube connectors.
	5/8" - 8 "		Solder	Material conforms to ASTM B 75; Design and dimensions conform to ASME B16.22; Solder conforms to ASTM B 32, 95.5 tin-antimony or "lead free".
Flanges:		150	Solder	Material conforms to ASTM B 62; Dimensions conform to ASME B16.22 and ASME B16.24; Flanges shall be flat faced; Solder conforms to ASTM B 32, 95-5 tin-antimony or "lead free".
Bolts, Nuts and Washers:				<u>For Flanges:</u> Bolt material conforms to ASTM A 193, Gr. B7 (carbon steel); Pattern, dimension and thread conform to ASME B18.2.1, standard hex head pattern and ASME B1.1, Class 2A fit.  Nut material conforms to ASTM A 194, Gr. 2H (carbon steel); Pattern, dimension and thread conform to ASME B18.2.2, standard hex head pattern and ASME B1.1, Class 2B fit.
Gaskets:		150		<u>For Flanged Joints:</u> Conforms to ASME B16.21; Thickness shall be 1/16"; Material shall be nitrile binder with synthetic fiber and shall contain NO ASBESTOS.
Valves: Ball: V319 (3/8" - 2") Gate: V102 (1/4" - 3")				
Notes: 1. Copper tube with solder joint connections shall be cut square and have all burrs removed before joints are made. Both the inside of the fitting and the outside of the tube shall be cleaned and polished using fine sand cloth (00), cleaning pads or special wire brushes. Immediately after cleaning, a mildly corrosive flux containing zinc and ammonium chlorides shall be evenly distributed across the joining surfaces by applying the flux using a small brush or clean rag and rotating the fitting and tubing together. The joint shall be heated uniformly around the entire circumference of the fitting. The use of an oxyacetylene torch will not be allowed. Do not point the flame into the socket. Apply solder to the end of the fitting until the melted solder is absorbed and appears uniformly around the end of the fitting. Excess solder shall be removed by brushing while the solder is still in a plastic state. The joint shall be allowed to cool in still air at room temperature.  2. Where different pipe materials come in contact, isolate each type with dielectric couplings.  3. A coating shall be applied to the exterior surfaces of buried and concrete-encased copper tubing and brass piping. The coating shall be a conformable polyethylene-backed butyl tape, 35 mils thick, Polyken 930 by Tyco Adhesives; Tapecoat Company, Inc., Evanston, Illinois, or equal. Surface preparation, type of primer, application of primer and tape, and lapping tape shall be in accordance with coating Manufacturer's recommendations.				

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SECTION 18C

PROCESS VALVES

1. SCOPE

This Section sets forth the requirements for manual and actuated process valves, operators and other appurtenances as shown on the Contract Drawings.

2. GENERAL

The Contractor shall furnish all labor, equipment and material to install manual and actuated process valves complete with operators, specialty items and appurtenances as shown on the Contract Drawings and as specified in this Section. Pipe and valve purchase orders shall be coordinated to insure proper installation of the valves and piping in conformance with the specified requirements.

This Section does not include valving for heating, ventilating, air conditioning, plumbing and other related valves described in **Division 15** of these Special Provisions.

2.1 General Equipment Stipulations. All equipment furnished under this Section shall conform to the requirements of **Section 11A**, General Equipment Stipulations of these Special Provisions.

2.2 General Piping Stipulations. All piping furnished under this Section shall conform to the requirements of **Section 18A**, General Piping Stipulations of these Special Provisions.

2.3 Painting. Painting shall conform to the requirements of **Section 9A**, Painting of these Special Provisions, unless otherwise specified.

2.4 Electrical Work. Electrical work shall conform to the requirements of **Division 16** of these Special Provisions.

2.5 Not Used.

2.6 Applicable Codes and Standards. The valves shall conform to or exceed the requirements of the latest editions of the following Codes and Standards unless otherwise noted:

- American National Standards Institute (ANSI)
- American Society for Testing and Materials (ASTM)
- American Water Works Association (AWWA)
- American Welding Society (AWS)
- American Institute of Steel Construction (AISC)

- American Society of Mechanical Engineers (ASME)
- Hydraulic Institute Standards (HIS)
- Steel Structures Painting Council (SSPCA)
- American Petroleum Institute (API)
- Manufacturers Standardization Society (MSS)

## 2.7 Abbreviations.

CW	cold water, non-shock
CI	cast iron
CPVC	chlorinated polyvinyl chloride
DI	ductile iron
EPT	ethylene propylene terpolymer
EPDM	ethylene propylene diene monomer
FEP	fluorinated ethylene propylene
MI	malleable iron
NI	nickel
NRS	non-rising stem
NSF	National Sanitary Foundation
N/C	normally closed
N/O	normally open
OS&Y	outside screw and yoke
PTFE	polytetrafluoroethylene
PFA	perfluoroalkoxy
PP	polypropylene
PVC	polyvinyl chloride
RS	Rising stem
SBR	styrene butadiene rubber
SS	stainless steel
TFE	tetrafluoroethylene
UL/FM	U.L. listed/F.M. approved
WOG	cold water, oil, or gas, non-shock

## 3. MANUAL OPERATORS

3.1 General. All valves shall be provided with a manual operator unless otherwise specified in this Section or shown on the Contract Drawings.

The direction of rotation of the handwheel, lever, worm gear or wrench nut used to open each valve shall be counterclockwise (to the left) unless otherwise specified by the District. Each valve body or operator shall have cast thereon the word OPEN and an arrow indicating the direction to open.

Operator mounting arrangements and positions shall be as shown on the Contract Drawings or as directed by the Engineer.

3.2 Handwheel Operators. Manual handwheel type operator shall be provided on all valves unless otherwise specified in this Section or shown on the Contract Drawings.

3.3 Lever Operators. Locking, lever type operators shall be provided on all plug, ball and butterfly valves size 6-inch and smaller unless otherwise specified in this Section or shown on the Contract Drawings.

3.4 Worm Gear Operators. Weatherproof, enclosed, worm gear type operators shall be provided on plug, ball and butterfly valves size 8-inch and larger unless otherwise specified in this Section or shown on the Contract Drawings. Gear operators shall be sized for the hydrostatic test pressure in the line or the pressure rating of the valve, whichever is greater. Traveling nut operators are not acceptable with the exception of butterfly valves.

3.5 Wrench Nuts Operators. Wrench nut type operators shall be provided on all buried valves, on all valves which are to be operated through floor boxes and where specified in this Section or shown on the Contract Drawings. Wrench nuts shall comply with **AWWA C500, Section 3.16**, unless otherwise specified in this Section or shown on the Contract Drawings. Two(2) operating keys shall be furnished for operation of the wrench nut operated valves.

3.6 Chainwheel Operators. Chainwheel type operators shall be provided for all valves installed with a bottom of handwheel elevation more than six(6) feet nine(9) inches above the operating floor level. Each chainwheel operated valve shall be equipped with a chain guide which will permit rapid handling of the operating chain without "gagging" of the wheel and will also permit reasonable side pull on the chain. Operating chains shall be heavily plated with zinc or cadmium and shall be looped to extend to within four(4) feet of the floor below the valve. Chains obstructing walkways shall be hung on an adjacent wall when not in use.

3.7 Bevel or Spur Gears. Bevel or spur gear operators with handwheel of 2-inch op nut shall be provided on all 14-inch and larger gate valves unless otherwise specified. Type of gear operator shall be determined from the Contract Drawings, or if not shown, Contractor shall provide type of gear operator that best serves personnel access and service.

#### 4. EXTENSION STEMS AND STEM GUIDES

4.1 Extension Stems for Exposed Valves. Extension stems and stem guides shall be furnished and installed where specified in this Section or shown on the Contract Drawings.

Extension stems shall be of solid steel not smaller in diameter than the stem of the valve operator shaft. Extension stems shall be connected to the valve operator with a suitable flexible type coupling. All connections shall be as specified by the manufacturer or as specified in this Section. Stem couplings shall be of accepted design and construction. Bronze bushed stem guides of cast iron construction and adjustable in two(2) directions shall be furnished and rigidly installed where and as needed for proper and adequate support of extension stems.

4.2 Extension Stems for Buried Valves. Each extension stem for buried valves shall be provided with spacers which will center the stem in the valve

box and shall be equipped with a wrench nut. All buried valves shall be provided with ground level position indicators and directional arrows for closing.

5. BURIED VALVES

Each valve which is installed in direct contact with earth backfill shall be installed and inspected as follows:

5.1 Valve Corrosion Protection. All buried metallic valves shall be wrapped with a polyethylene sheet with a thickness of 8 mils. Material and installation shall conform to AWWA C105. All flanged buried valves shall be provided with Type 316 stainless steel nuts and bolts.

5.2 Thrust Blocks. All buried valves larger than 3-inches shall have thrust blocks unless otherwise directed by the Engineer.

5.3 Inspection. Each valve shall be inspected before installation to ensure that all foreign substances have been removed from within the valve body and shall be opened and closed to see that all parts are in first-class working condition. Geared valves shall be inspected to see that all gears are properly lubricated.

5.4 Valve Boxes. Valve boxes shall be provided for all buried valves.

The valve box design shall prevent the transmission of surface loads, impact, or shock through the box to the valve. Valve boxes shall be cast iron, extension sleeve type, suitable for the depth of cover required by the plans. Valve boxes shall be not less than 5-inches in diameter, shall have a minimum thickness at any point of 3/16-inch and shall be provided with suitable cast iron bases and covers. Covers shall have cast thereon designation of the service for which the valve is used.

All parts of valve boxes, bases and covers shall be coated by dipping in hot asphalt varnish.

Valves and valve boxes shall be set plumb. Each valve box shall be placed directly over the valve it serves, with the top of the box brought flush with the finished grade. After being placed in proper position, earth shall be filled around each valve box and thoroughly tamped for a distance on each side of the box of four(4) feet at the top of the pipe and two(2) feet measured at the top of the trench.

6. MANUAL VALVES

Manual valves are listed in the Manual Valve List attached to this Section of the Special Provisions. Manual valve types are identified by symbology or by a Manual Valve Number (V-###) on the Contract Drawings, or by symbology on the Contract Drawings and call-out in **Section 18B**, Pipe Material Specifications of these Special Provisions. Manual valve type, rating and construction shall conform to the requirements specified in this Section. All valves of the same type shall be of the same make unless otherwise accepted by the Engineer. Equals may be substituted for manufacturers listed.

Valves shall be line size except as shown otherwise specified in this Section or shown on the Contract Drawings. All valve packing shall be non-asbestos.

Ratings specified are minimum, and are steam working pressure unless noted otherwise.

Some of the listed valves may not be used in this project.

7. NOT USED

8. SUBMITTALS

- All valves required from process valve list with catalog cuts and materials of construction.
- Valve operators (**Part 3** and any Attachments, to this Section).

V #	Type	Service	Features	Materials	Size (inches)	End Connection	Mfg. & Catalog Number
Ball Valves (300)							
V319	Ball	Water	Class 150 CW; 2-piece valve with full port.	Bronze body; Brass ball; Silicon bronze stem; PTFE seat & stem packing.	2	Soldered	Nibco S-585HP-LF; or equal

\* \* \* \* \*

SECTION 18D

HYDROSTATIC/PNEUMATIC TESTING OF  
PIPING AND EQUIPMENT

1. GENERAL

1.1 Work Included. Hydrostatic/pneumatic leakage tests shall be conducted by the Contractor after installation of the piping and equipment. The procedure and equipment to be used shall be accepted by the Engineer prior to testing any line.

1.2 Pipelines With Allowable Leakage. Leakage tests and allowable leakage for vitrified clay pipe and other buried pipe in liquid service with slip-on joints shall be in accordance with **Sections 306-7.8.2** and **306-8.9.2** of the Standard Specifications and as specified in this Section.

Gravity sewers and process drain lines outside or under structures, except where otherwise specified, shall be tested for water exfiltration in accordance with **Section 306-7.8.2.2** of the Standard Specifications and as specified in this Section.

1.3 Pressure Pipes. The piping not covered above shall be tested as required in this Section and per applicable industry standards.

1.4 Pipeline Test Pressures. All pipelines exclusive of gravity drain lines and open vent lines to atmosphere shall be tested at 1.5 times piping rated pressure, unless shown otherwise in the table in **Part 5.5** of this Section.

1.5 General Requirements. The specified test pressures shall be as measured at the horizontal invert (bottom of pipe inside) of the lowest point of the piping under test. All testing procedures shall be per Section 137 of ANSI B31.1, Power Piping code.

Each pipeline shall be adequately braced and supported before tests are made. On lines which require thrust blocks, these blocks shall have been poured and the concrete set before the test is conducted. Partial backfilling between joints of pipelines in trenches is permissible to prevent movement under test pressure, subject to acceptance by the Engineer.

Pipelines that have no valves shall be closed with blind flanges or caps on the ends of the sections to be tested.

Unless air is to be the test fluid, all air shall be vented from the piping or the piping system before the test pressure is applied. Where it is necessary to bleed the air at the high point of a pipeline, an air release valve with an isolation valve accepted by the Engineer shall be installed at the high point by the Contractor. After the hydrotest has been concluded, the air release valve and the isolation valve shall remain in place.

Tests shall be made before the piping has been enclosed in any manner that will prevent inspection during the test.

## 2. TESTING EQUIPMENT

The Contractor shall provide necessary piping connections between the section of line being tested and the nearest available source of water, air, or other specified fluid, together with test pumping equipment, water meter, pressure gauge, and other equipment, materials, and facilities necessary to make the specified tests. The Contractor shall provide temporary sectionalizing devices and vents as required for testing. Vents are to be left plugged if not required for the permanent installation.

A soap or similar solution shall be used at each joint in the process air lines to detect leaks.

## 3. TESTING PROCEDURE

The test pressure in lines without allowable leakage shall be held for one hour, during which time there shall be no drop in pressure, unless otherwise specified in this Section. The test pressure in lines with allowable leakage shall be held in accordance with **Section 306-8.9.2** of the Standard Specifications. The Contractor, at its own expense, shall make necessary repairs or replacements in accordance with the specifications.

Repairing and testing shall be per ANSI Section 137 and shall be repeated until the pipeline installation conforms to the specified requirements and is acceptable to the Engineer.

## 4. LEAKAGE

It is intended that piping, whether tested after installation or not, shall be watertight or airtight and free from visible leaks, unless otherwise specified in this Section. Each leak which is discovered within one(1) year after final acceptance of the work by the District's Board of Directors shall be repaired by and at the expense of the Contractor.

## 5. SPECIFIC TESTING REQUIREMENTS

Inspection and testing shall be in compliance with the codes and regulations of the Los Angeles County Building and Safety Departments, the Los Angeles County Fire Department, and the latest applicable National Fire Protection Association (NFPA) codes.

Inspection and testing shall be in accordance with applicable plumbing codes.

5.1 General. The following procedures shall also be applicable to shop testing of Contractor-furnished equipment.

5.2 Static Pressure Test for Non-Pressure Piping and Equipment. All non-pressure pipe shall be tested for leakage. Equipment shall be blanked off and the piping system filled with water. A standpipe or other accepted method shall be used to obtain a pressure head of five(5) feet above the highest point of

the test section. Any leaks found shall be repaired by the Contractor using accepted methods. All atmospheric storage tanks, drums, and equipment shall be completely filled with water and inspected for leaks. Any leaks found shall be corrected by the Contractor using accepted methods. The minimum duration of static tests shall be four(4) hours. The Contractor shall supply all equipment to supply and remove the water and shall dry and clean all piping and equipment.

5.3 Hydrostatic Pressure Test for Pressure Piping. All process piping shall be hydrostatically tested, and any leaks corrected. Steel pipe systems shall be tested at a minimum of 150 percent of rated pressure. Cast ductile iron pipe shall be tested at its rated pressure. The duration of all tests shall be no less than one(1) hour and an accurate pressure gauge shall be installed at an accepted convenient point in the pipe for observation. The Contractor shall keep a log of all testing. All test pressures shall be in accordance with the table given in **Part 5.5** of this Section.

The Contractor shall provide the necessary facilities, water or compressed air, bulkhead, testing equipment, and labor required for testing and retesting. All costs of testing and retesting shall be borne by the Contractor.

The pressure pipe shall be observed for leakage. If air is used for testing, the joints shall be brushed with water and soap solution to aid in detecting leakage. Leaks at joints shall be corrected by accepted means.

All pressure piping shall be tested before insulation or coverings are applied, or piping is painted or concealed. Where controls and accessories are not designed to withstand pipe test pressure, they shall be properly isolated and protected against damage during such tests.

5.4 Expansion Joints. Each pipe system shall be adequately braced and supported to withstand testing condition without harming the system or any component of the system. The Contractor shall verify that expansion joints in all pipe systems that contain expansion joints can withstand the specified test pressure without exceeding the design pressure, its hydrotested pressure at the factory, or the allowable displacements of the expansion joint. The Contractor shall adequately brace or isolate any affected expansion joint(s).

If necessary, the Contractor shall remove such expansion joint(s) from the piping being hydrotested and shall replace it with spool piece(s) before hydrotesting.

5.5 Test Pressures.

Abbreviation	System	Test Fluid	Test Pressure (psig)
P15	1-inch PVC SDR 41 Irrigation Pipe	Water	90
X1	2-inch Type K Copper Water Pipe	Water	150

6. SUBMITTALS

The following submittals are required:

- Air Release Valve if needed for tests (**Part 1.5**).
- Log of Test Results for each pipe or equipment (**Part 5.3**).

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SECTION 18F

PIPE MARKINGS

1. GENERAL

1.1 Work Included. Buried pipeline and outlet identification markers shall be furnished and installed complete with fasteners and appurtenances, which are required for proper installation and functioning of the markers.

All buried pipelines and outlets shall be identified in accordance with these Special Provisions.

Above grade pipe markings shall be as specified in **Section 9A** of these Special Provisions.

1.2 General Equipment Stipulations. The requirements of General Equipment Stipulations, **Section 11A** of these Special Provisions, shall apply to this Section.

2. BURIED PIPELINE MARKERS

2.1 Material and Design Standards. Buried pipes shall be identified by continuous underground warning tapes as specified in the schedules shown below. Tapes shall be acid and alkali resistant polyethylene film, minimum 4 mil (0.004-inches) thick; with a minimum 1500 psi tensile strength as manufactured by Brady "Identoline", Seton, Harris Industries, or equal.

Abbr.	Pipe Identification Lettering	Tape Background Color	Color of Lettering
D	Drain	Green	Black
IRR	Irrigation	Purple	Black
S	Sewer	Green	Black
W	Water	Blue	Black

Tape Width, Letter Height and Repeat Schedule			
Pipe Size	Tape Width	Minimum Letter Height	Minimum Lettering Repetition
10-inch & smaller	3 inches	7/8-inch	6 inches
12-inch & larger	6 inches	2-inches	12 inches

2.2 Installation. Underground warning tapes shall be placed with printed side up, 12-inches, centered above each pipe. Additional underground warning tapes shall also be placed printed side up directly atop all buried horizontal piping (attached to the pipe) and risers. Tapes shall be attached to the pipe by spiral wrapping nylon line or twine, and by tying the ends of

the line when cut, or by wrapping plastic zip ties. The maximum distance between spirals or ties shall not exceed the following:

Pipe Size	Distance Between Spirals or Ties
2-inch and less	6 O.D.'s
2-1/2-inch thru 4-inch	5 O.D.'s
6-inch thru 8-inch	4 O.D.'s
10-inch and larger	3 O.D.'s

3. EXPOSED OUTLET MARKERS

3.1 General. Proposed hose bib outlets and fire hydrants shall be identified by permanent signs with the wording:

**"RECLAIMED WATER DO NOT DRINK".**

3.2 Material and Design Standards. Signs shall be fifteen(15) inches long by five(5) inches wide with rounded edges, baked enamel finish with black lettering on yellow background, 0.063-inch aluminum alloy 6061-T6 chemically treated to conform to Federal Specification Mil-C-5541 for acceptance of baked enamel finish, and shall have two(2) holes, 1/8-inch diameter, one(1) located 1/2-inch from each end and centered.

3.3 Installation. Signs shall be attached to hose bib risers, hydrants and other outlet locations by stainless steel fasteners.

4. DRAWINGS AND DATA

Complete installation drawings, together with detailed specifications and data covering material of tapes, size, color, and manufacturer data sheets shall be submitted for acceptance in accordance with the procedure set forth in the General Conditions, **Section 1A** of these Special Provisions.

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