SECTION "G"

TECHNICAL SPECIFICATIONS

SECTION 01110 – SUMMARY OF WORK

Part 1 GENERAL

A.01 SUMMARY

A. The Work specifically includes all work as represented by the Drawings (and all referenced Installation Manuals), the Specifications and all other Contract Documents issued for construction, including all subsequently approved revisions and addenda.

B. The project includes, but is not limited to, the following elements:

1. Locate concrete slab for pump station and the piping that the two irrigation pumps and the one recirculation pump connect to.

2. Install piping that is located beneath the slab for the three pumps and the enclosure drain.

3. Install six (6) conduits in the slab forms from the control panel to the three pumps; install conduit for the power line to the control panel.

4. Construct the concrete slab and housekeeping pads.

5. Unload Gorman-Rupp pumps (3), control panel and enclosure from truck.

6. Construct the two anchors for the SS cable.

7. Install the three (3) pumps and the control panel.

8. Install the influent and effluent piping for the three (3) pumps.

9. Install the three (3) influent hoses and connect each one to the appropriate float strainer. Assemble the three float strainers in the aluminum frame.

10. Install the enclosure over the three (3) pumps and control panel.

11. Connect the writing from the existing pull box to the enclosure connection.

12. Install power and instrumentation wiring from the control panel to the three (3) pumps.

13. Start-up and Testing.

    a. Perform functional and performance testing of all equipment systems and provide start-up demonstration and personnel training.

A.02 RELATED SECTIONS

A. Contract General Conditions.

A.03 COORDINATION

b. Coordinate with operations and maintenance personnel to maintain uninterrupted operation of existing pumping equipment and critical site equipment.

B.01 OWNER-FURNISHED EQUIPMENT

A. The products to be supplied at the Project Site by the District under a separate purchase order are summarized as follows:

1. Gorman-Rupp Pump Station (two (2) irrigation pumps and one (1) recirculation pump, with control panel and protective enclosure)
2. Contractor shall be responsible for installation of all pump components in accordance with the Gorman-Rupp Installation Procedures accompanying the Drawings.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

SECTION 03200

CONCRETE REINFORCEMENT

03200-1.01 DESCRIPTION SCOPE

A. This section specifies reinforcing steel for use in reinforced concrete.

03200-1.02 RELATED WORK

B. Requirements of this section include, but are not limited to, requirements specified in the following sections:

1. Section 04000 – Shop Drawings, Product Data, and Sample Submittals
2. Section 03300 – Cast-In-Place Concrete

03200-1.03 QUALITY ASSURANCE

C. REFERENCES:

1. The publications referred to hereinafter form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. The largest edition of referenced publications in effect at the time of bid shall govern. In case of conflict between the requirements of this section and the listed standards, the requirements of this section shall prevail.

2.

Reference	Title
ACI 315	*Details and Detailing of Concrete Reinforcement*
ASTM A82	*Steel Wire, Plain, for Concrete Reinforcement*
ASTM A185	*Steel Welded Wire Fabric, Plain, for Concrete Reinforcement*
ASTM A615	*Deformed and Plain Billet-Steel Bars for Concrete Reinforcement*
ASTM A706	*Low-Alloy Steel Deformed Bars for Concrete Reinforcement*
ASTM A775/A775M	*Epoxy-Coated Reinforcing Steel Bars*
AWS D1.4	*Structural Welding Code-Reinforcing Steel*
CRSI-PRB	*Placing Reinforcing Bars*
CRSI-MSP 1	*Manual of Standard Practice*
FEDSPEC QQ-W-461H	*Wire, Steel, Carbon (Round, Bare, and Coated)*

03200-1.04 SUBMITTAL

D. The following information shall be submitted for review in accordance with Section 40:

1. Bar placement drawings.

2. Bar lists and bending details.

3. Certified mill test reports.

4. Welder qualification certificate in accordance with AWS D1.4.

5. Bar support catalog sheets.

03200-1.05 BAR REINFORCEMENT

E. Reinforcing bars shall be deformed billet steel in conformance with ASTM A615, including supplementary requirements. Bars shall be Grade 60, except ties or field-bent bars where specified shall be Grade 40. Bars to be welded shall be Grade 40 or shall be deformed billet steel conforming to ASTM A706. ASTM A616 or ASTM A617 steel shall not be used. Bars provided as dowels for future construction and bars where specified shall be epoxy-coated in conformance with ASTM A775. Bars shall be free of rust, oils, or other substances which might impair bond with concrete. Bars shall be stored under cover and not in contact with ground.

03200-1.06 WIRE FABRIC

F. Wire fabric shall be welded steel mesh conforming to ASTM A185.

03200-1.07 WIRE AND PLAIN BARS

G. Wire used as reinforcement and bars used as spiral reinforcement in structures shall be cold drawn steel conforming to ASTM A82.

03200-1.08 TIE WIRE

H. Tie wire shall be minimum 16 gage annealed steel conforming to FEDSPEC QQ-W-461H.

03200-1.09 BAR SUPPORTS

I. Bar supports coming into contact with forms shall be CRSI Class 1 plastic protected or Class 2 stainless steel protected and shall be located in accordance with CRSI MSP-1 and placed in accordance with CRSI PRB. Concrete block supports shall be provided for footing and slabs on grade and shall have compressive strength at least as great as required in Section 90 for concrete element being placed. Stainless steel or plastic protected plain steel supports shall be provided for other work.

03200-1.10 FABRICATION

J. Bends and lap splice lengths in reinforcing bars shall conform to ACI 315. Reinforcing

steel shall not be bent or straightened in a manner which will injure the material. Bars with kinks or with bends not shown shall not be used. Heating or welding bars shall be performed in accordance with AWS D1.4 and shall only be permitted where specified or approved by the Engineer. Bars shall not be welded at the bend. Reinforcing bars shall be fabricated according to the Plans.

03200-1.11 PLACEMENT

K. Reinforcing steel shall be placed in accordance with CRSI PRB and CRSI MSP-1.

L. Reinforcing steel shall be positioned accurately and secured against displacement by using annealed iron wire at intersections and shall be supported by concrete or metal chairs, spacers or metal hangers. Tack welding of cross bars is not acceptable. Bars shown on the Plans shall not be repositioned (buried) to act as support bars. Additional bars shall be provided as required for supports. Steel rods and pegs may be used to support reinforcing steel on rock foundations. Reinforcing steel shall be placed in such a manner as to not damage waterproofing membrane or plastic lining which has been previously applied or constructed. Reinforcing steel shall be shop-bent or slightly relocated where necessary to clear waterstop. Reinforcing steel shall not be placed on fresh concrete or forced into fresh concrete.

M. Supports for embedded items shall not be welded to the reinforcement. Additional reinforcement may be provided for this purpose.

03200-1.12 SPLICING

N. Reinforcing steel shall be spliced as shown. Additional splices may be provided where approved by the Engineer.

O. In slabs, beams, girders and walls, reinforcing steel shall not be spliced in areas of maximum stress. Splices of adjacent bars shall be staggered at least one splice length, unless otherwise specified. Splices in welded wire fabric shall be at least 1 1/2 meshes wide.

03200-1.13 CLEANING

P. Reinforcing steel shall be cleaned so that no mill rust scale, dried concrete, or other coatings that may reduce bond are present immediately before concrete placement. Reinforcement reduced in section is not acceptable. When concrete placement is delayed, reinforcement shall be cleaned by sandblasting if directed by the Engineer.

3200-1.14 REPAIR OF EPOXY COATING

Q. Epoxy coating damage need not be repaired in cases where the damaged area is 0.1 square inch or smaller. All damaged areas larger than 0.1 square inch shall be repaired in conformance with ASTM A775.

***END OF SECTION**

SECTION 03300

CAST-IN-PLACE CONCRETE

03300-1.01 SECTION INCLUDES

A. Formwork for cast-in-place concrete, including shoring and form supports, and installation of embedded items.

03300-1.02 REFERENCED SECTION

B. The following Sections are referenced in this Section

1. Section 52 – Concrete Reinforcement

2. Section 75 – Miscellaneous Metal

3. Section 76 – Anchor Bolts

03300-1.03 SUBMITTALS

C. Shop Drawings

1. Reinforcing steel in accordance with the latest editions of the CRSI Manual of Standard Practice and ACI SP.

2. Curing compound data.

3. Complete data on the concrete mix, including aggregate gradations and admixtures, in accordance with ASTM C94.

4. Data compiled by a certified Testing Laboratory from a minimum of 30 previous compression tests and 10 previous drying shrinkage tests, for each mix design submitted.

D. Quality Control Submittals

1. Manufacturer's application instructions for curing compound.

2. Ready-mix delivery tickets for each truck in accordance with ASTM C94.

03300-1.04 QUALITY ASSURANCE

E. Codes and Standards

1. Comply with all Federal, State, and Local Codes and Safety Regulations.

2. In addition, comply with the provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:

a. California Building Code, 2019 Edition, CBC.

b. Formwork: Unless otherwise specified, follow the recommendations of ACI 347.

c. Concrete and Reinforcement: Unless otherwise specified, meet the requirements of ACI 301 and 318/318R.
d. Hot Weather Concreting: Conform to ACI 305R.

03300-1.05 ENVIRONMENTAL REQUIREMENTS

F. Do not use curing compound where solvents in the curing compounds are prohibited by state or federal air quality laws. Use only water curing methods.

03300-1.06 CONCRETE

G. Ready-mixed meeting ASTM C94, Option A.
   1. Portland Cement: ASTM C150, Type II.

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

I. Admixtures
   1. Air-Entraining: ASTM C260.

2. Water-Reducing: ASTM C494, Type A or D.

3. Superplasticizers: ASTM C494, Type F or G.

4. Fly Ash: ASTM C618, Class C or F.

5. Color Pigments: Inert mineral or metal oxide pigments, either natural or synthetic; resistant to lime and other alkalis.

J. Mix Design

1. Minimum 28-day Compressive Strength when cured and tested in accordance with ASTM C31 and C39.
   a. Building footings, walls, slabs, and pads: 4,000 psi
   b. Site Concrete: 3,000 psi
2. Coarse Aggregate Size: 1½ inches and smaller.

3. Slump Range: three to five inches.

4. Air Entrainment: Between one and three percent by volume.

5. Water Reducers: Use in concrete without plasticizers.

K. Proportions

1. Design mix to meet aesthetic and structural concrete requirements.

2. Water-cement ratio (or water-cement plus fly ash ratio) shall control amount of total water added to concrete as follows:

Coarse Aggregate Size	W/C Ratio
1½ inch	0.48
1 inch	0.45

3. Minimum Cement Content (or Combined Cement Plus Fly Ash Content When Fly Ash is Used):
   a. 540 pounds per cubic yard for concrete with 1½-inch maximum size aggregate.
   b. 564 pounds per cubic yard for one-inch maximum size aggregate.
   c. Increase cement content or combined cement plus fly ash content, as required to meet strength requirements and water-cement ratio.
   d. Mixing: Minimum 70 and maximum 270 revolutions of mixing drum. Non-agitating equipment is not allowed.

B. Cast-in-Place Anchor Bolts, Expansion Anchors, Headed Studs, Epoxy Adhesive Anchors and Dowels: see Sections 75 and 76.

C. Expansion Joint Filler: ASTM D994, ½ inch thick, or as shown.

D. Waterstops

1. Manufactured from virgin polyvinylchloride (PVC) conforming to the Corps of Engineers Specification No. CRD-C572.

2. 6-inch, heavy-duty Flex-Bulb or flat strip as manufactured by the Greenstreak Company, Water Seals, Inc., or equal; and as shown on the structural drawing details.

E. Bonding Compounds

1. Epoxy resin bonding compounds shall be used for wet areas and shall be Master Builder, Concresive Nos. 1001, 1001-LPL or 1180 as applicable; Sika Chemical Corporation, Sikadur 35, Hi-Mod LV, Sikadur 32, Hi-Mod, or Sikadur 31, Hi-Mod Gel as applicable; Burke Company 881 LPL Epoxy; or equal.

2. Non-epoxy bonding compounds shall be used for dry areas and shall be Burke Company, Acrylic Bondcrete; Imperial Chemical Industrial, Inc., Thoro System Products, Acryl 60; Thorobond; or equal.

3. Apply in accordance with the manufacturer's instructions.

F. Curing Compound

1. Material: Solvent based containing chlorinated rubber solids in accordance with ASTM C309, with additional requirement that the moisture loss not exceed 0.030 gram per centimeter squared per 72 hours.

2. Manufacturers and Products:

a. Chemrex Inc., Shakopee, MN; Masterkure CR.

b. Euclid Chemical Co.; Euco Super Floor Coat.

G. Surface Hardener

1. Required Use: Apply to finished surface of pump station interior concrete slabs-on-grade.

2. Premixed, noncolored, nonmetallic Master Builders, Mastercron; Sonneborn, Harcol; A. C. Horn Inc., Durafax; Burke Company Non-Metallic Floor Hardner; or equal.

3. Apply in accordance with manufacturer's instructions.

H. Moisture Proofer

1. Required Use: Apply to exterior surface of all below-grade concrete walls.

2. ChemSeal Foundation Gray by ChemMasters or equal.

3. Apply in accordance with manufacturer's instructions.

03300-1.08 FORMWORK

I. Form Materials

1. Use hard plastic finished plywood for exposed areas, and new ship lap or plywood for unexposed areas.

2. Earth cuts may be used for forming footings.

J. Form Ties

1. Fixed conical or spherical type inserts that remain in contact with forming material and allow for dry packing of form tie holes.

2. Ties shall withstand pressures and limit deflection of forms to acceptable limits.

3. Wire ties are not acceptable.

K. Construction

1. In accordance with ACI 347.

2. Make joints tight to prevent escape of mortar and to avoid formation of fins.

3. Brace as required to prevent distortion during concrete placement.

4. On exposed surfaces locate form ties in uniform pattern or as shown.

5. Construct so ties remain embedded in the wall with no metal within 1-inch of concrete surface when forms, inserts, and tie ends are removed.

L. Form Removal

1. Remove after concrete has attained 28-day strength, or approval is obtained in writing from Engineer.

2. Remove forms with care to prevent scarring and damaging the surface.

03300-1.09 PLACING CONCRETE

M. Place concrete in accordance with ACI 301.

N. Prior to placing concrete, remove water from excavation and debris and foreign material from forms. Check reinforcing steel for proper placement and correct discrepancies.

O. Before depositing new concrete on old concrete, clean surface using sandblast or bush hammer or other mechanical means to obtain a ¼ inch rough profile, and pour a cement-sand grout to minimum depth of ½ inch over the surface. Proportion 1 part cement to 2.5 parts sand by weight.

P. Place concrete as soon as possible after leaving mixer, without segregation or loss of ingredients, without splashing forms or steel above, and in layers not over two feet deep. Place within 1½ hours after adding cement to mix.

Q. Eight feet maximum vertical drop to final placement, when not guided with chutes or other devices to prevent segregation due to impact with reinforcing.

R. Hot Weather

1. Prepare ingredients, mix, place, cure, and protect in accordance with ACI 305R.

2. Maintain concrete temperature below 80 degrees F at time of placement, or furnish test data or provide other proof that admixtures and mix ingredients do not produce flash set plastic shrinkage, or cracking due to heat of hydration.

3. Ingredients may be cooled before mixing to maintain fresh concrete temperatures at 80 degrees F or less.

4. Make provisions for windbreaks, shading, fog spraying, sprinkling, ice, or wet cover, or other means to provide concrete with temperature specified.

5. Prevent differential temperature between reinforcing steel and concrete.

03300-1.10 COMPACTION

S. Vibrate concrete as follows:

1. Apply approved vibrator at points spaced not farther apart than vibrator's effective radius.

2. Apply close enough to forms to vibrate surface effectively but not damage form surfaces.

3. Vibrate until concrete becomes uniformly plastic.

4. Vibrator must penetrate fresh placed concrete and into previous layer of fresh concrete below.

03300-1.11 CONSTRUCTION JOINTS

T. Locate as shown or as approved.

U. Maximum Spacing Between Construction Joints: 40 feet.

03300-1.12 FINISHING

V. Floor Slabs and Tops of Walls

1. Screed surfaces to true level planes.

2. After initial water has been absorbed, float with wood float and trowel with steel trowel to smooth finish free from trowel marks.

3. Do not absorb wet spots with neat cement.

W. Unexposed Slab Surfaces: Screed to true surface, bull float with wood float, and wood trowel to seal surface.

X. Smooth Wall Finish

1. Patch tie holes.

2. Grind off projections, fins, and rough spots.

3. Patch defective areas and repair rough spots resulting from form release agent failure or other reasons to provide smooth uniform appearance.

Y. Tolerances

1. Floors shall not vary from level or true plane more than ¼ inch in 10 feet when measured with a straightedge.

Z. Exterior Slabs and Sidewalks

1. Bull float with wood float, wood trowel, and lightly trowel with steel trowel.

2. Finish with broom to obtain nonskid surface.

3. Finish exposed edges with steel edging tool.

4. Mark walks transversely at 5-foot intervals with jointing tool.

03300-1.13 FINISHING AND PATCHING FORMED SURFACES

AA. Cut out honeycombed and defective areas.

BB. Cut edges perpendicular to surface at least one-inch deep. Do not feather edges. Soak area with water for 24 hours.

CC. Finish surfaces to match adjacent concrete.

DD. Keep patches damp for minimum 7 days or spray with curing compound to minimize shrinking.

EE. Fill form tie holes with Non-shrink Grout.

03300-1.14 PROTECTION AND CURING

FF. Protect fresh concrete from direct rays of sunlight, drying winds, debris, and wash by rain.

GG. Keep concrete slabs continuously wet for a seven-day period. Intermittent wetting is not acceptable.

HH. Use curing compound only where approved by Engineer.

II. Cure formed surfaces with curing compound applied in accordance with manufacturer's directions as soon as forms are removed and finishing is completed.

JJ. Remove and replace concrete damaged by freezing.

KK. Provide adequate facilities for safe storage and proper curing of concrete test cylinders onsite for first 24 hours, and for additional time as may be required before transporting to test lab.

LL. Provide concrete for testing of slump, air content, and for making cylinders from the point of discharge into forms.

MM. Evaluation will be in accordance with ACI 301, Chapter 17 and Specifications.

NN. Specimens will be made daily, cured, and tested in accordance with ASTM C31 and ASTM C39.

OO. The Contractor will prepare test cylinders daily during concrete placement. Frequency of testing may be changed at discretion of the Engineer.

PP. Reject concrete represented by cylinders failing to meet the strength and air content specified.

END OF SECTION

SECTION 04000

SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

40-1.01 DEFINITIONS

A. Shop drawings are drawings, diagrams, schedules, and other data specially prepared for the work by Contractor or a Subcontractor to illustrate some portion of the work.

B. Product data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by Contractor to illustrate or describe materials or equipment for some portion of the work.

C. Samples are physical examples that illustrate materials, equipment, or workmanship and establish standards by which the work will be judged.

40-1.02 MANUFACTURER'S INSTRUCTIONS

A. For items of work required by the Contract Documents to be furnished, installed, or performed in accordance with a specified product manufacturer's instructions, procure and distribute necessary copies of the instructions to Engineer and all other concerned parties. Furnish, install, or perform the work in accordance with the instructions.

40-1.03 SUBMITTAL PROCEDURES

A. Submit to the Engineer shop drawings, product data, and samples as required by these Specifications.

B. Prepare and submit for Engineer approval a submittal schedule for Contractor's submission of shop drawings, product data, and samples.

C. Coordinate the submittal schedule with the contract schedule. Submittals will not be processed before the submittal schedule has been submitted to and accepted by Engineer. Adjust the submittal schedule to meet the needs of the construction process and the contract schedule. Submit two (2) copies.

D. Make submittals promptly in accordance with the submittal schedule and in such sequence as to cause no delay in the work or in the work of any separate contractor.

E. Review, mark up as appropriate, and stamp shop drawings, product data, and samples prior to submission. Submittals shall clearly indicate they have been reviewed by the Contractor for conformance with the requirements of the contract documents and for coordination with other sections. Submittals must have Contractor's stamp, initialed or signed, certifying to the review of the submittal, verification of materials and field measurements and conditions; and compliance of the information within the submittal with requirements of the work and of the contract documents. Notify Engineer in writing, at time of submission, of any changes in the submittals from requirements of the contract documents.

F. Begin no fabrication of work that requires submittals until the return of Engineer's final reviewed submittals.

G. Engineer will review Contractor's submittals, such as shop drawings, product data, and samples for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of Contractor as required by the contract documents.

40-1.04 SHOP DRAWINGS

A. Present information required on shop drawings in a clear and thorough manner. Identify details by reference to drawing and detail or schedule as shown and specified.
B. Submit one (1) reproducible transparency and three (3) opaque reproductions. After checking, Engineer will return the reproducible copy to Contractor.

40-1.05 PRODUCT DATA

A. Submit the number of copies needed for Contractor's use (a maximum of two), plus three (3) copies for Engineer. Submit the number specified in the section that requires them. One copy will be retained by Engineer.

B. Clearly mark each copy to identify products, models, options, and other data. Supplement standard information to provide information specifically applicable to the work.

40-1.06 SAMPLES

A. Submit samples of sufficient size and quality to clearly illustrate functional and aesthetic characteristics of the products with integrally related parts and attachment devices.

B. Submit the number of samples specified in individual specification sections. One sample will be retained by Engineer.

*** END OF SECTION ***

SECTION 05500

METAL FABRICATIONS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section describes the requirements, products, and methods of execution relating to metal fabrications approved for use on this Project.

1.02 SUBMITTALS

A. Shop Drawings: Include stamped and signed plans, elevations and details of metal fabrications and their connections. Show anchorage and accessory items. Furnish templates for anchors and bolts installed under other Sections.

B. Certifications: Include for each welder performing work on this Project, as specified.

1.03 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in successfully producing metal fabrications similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the work.

B. Welding Qualifications: Qualify welding processes and welding operators in accordance with AWS D1.1, D1.2, and D1.3 as applicable. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved. Furnish welder certifications.

1.04 PROJECT CONDITIONS

A. Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit, by accurate field measurements before fabrication. Show recorded measurements on shop drawings. Coordinate fabrication schedule to avoid delay of work.

1.05 SEQUENCING AND SCHEDULING

A. Painting: Items specified in this Section as having a shop applied prime coat will be job painted as specified in Section 09900, unless otherwise noted.

PART 2 - PRODUCTS

2.01 FERROUS METALS

A. General: For fabrication of metal work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness.

B. Steel Plates, Shapes and Bars: ASTM A36.

C. Steel Tubing: Cold formed, ASTM A500; or hot-rolled, ASTM A501.

D. Structural Steel Sheet: Hot-rolled, ASTM A1011; or cold-rolled ASTM A1008, Class 1.

E. Galvanized Structural Steel Sheet: ASTM A653, galvanized in accordance with ASTM A525, G90 coating designation.

F. Steel Pipe: ASTM A53; type and grade selected by fabricator; black finish unless galvanizing is indicated or specified; standard weight, schedule 40, unless otherwise indicated.

G. Gray Iron Castings: ASTM A48, Class 30.

H. Malleable Iron Castings: ASTM A47, grade selected by fabricator.

2.02 FASTENERS

A. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A, with hex nuts, ASTM A563, and flat washers.

B. Machine Screws: ANSI B18.6.3.

C. Lag Bolts: ANSI B18.2.1.

D. Wood Screws: Flat head, carbon steel, ANSI B18.6.1.

E. Plain Washers: Round, carbon steel, ANSI B18.22.1.

F. Lock Washers: Helical, spring type, carbon steel, ANSI B18.21.1.

G. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry and equal to 4 times the load imposed when installed in concrete, determined in accordance with ASTM E448.

2.03 GROUT

A. Non-Shrink Non-Metallic Grout: Euclid Chemical Co. "Euco N-S Grout", L&M Construction Chemicals, Inc. "Crystex", Master Builders Technologies, Inc. "Masterflow 928 and 713" or equal.

2.04 PAINT

A. Metal Primer: SSPC 20, Type 2.

1. Exposed to view items in non-inmate accessible areas to be field painted shall be primed with a primer compatible with final finish coats specified in Section 09900.

B. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in galvanized steel; Rust-Oleum Corp. "Zinc-Rich Cold Galvanizing Compound", Tnemec 90-93, ZRC Chemical Products Div. of Norfold Corp. "ZRC Cold Galvanizing Compound" or equal.

2.05 FABRICATION, GENERAL

A. Workmanship:

1. Use materials of size and thickness indicated or required to produce strength and durability in finished product for use intended.

2. Work to dimensions indicated,

3. Form exposed work true to line and level with accurate angles and surfaces and straight, sharp edges.

4. Ease exposed edges to a radius of approximately 1/32-inch, unless otherwise indicated.

5. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

6. Weld corners and seams continuously, complying with AWS recommendations. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces. Welds shall be imperceptible in the finished work.

7. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use Phillips flat- head countersunk screws or bolts for exposed fasteners, unless tamperproof security screws are indicated.

8. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware and similar items.

B. Galvanizing: Provide zinc coating for items indicated or specified to be galvanized, as follows:

1. ASTM A153 for galvanizing iron and steel hardware.

2. ASTM A123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299-inch thick and heavier.

C. Fabricate joints exposed to the weather to exclude water or provide weep holes.

D. Shop Painting:

1. Shop paint miscellaneous metal work, except members or portions of members to be embedded in concrete or masonry, surfaces and edges to be field welded, and galvanized surfaces.

2. Remove scale, rust and other deleterious materials before applying shop coat. Clean off heavy rust and loose mill scale in accordance with SSPC SP-2, SP-3, or SP-7.

3. Remove oil, grease and similar contaminants in accordance with SP-1.

4. Brush or spray on primer in accordance with manufacturer's instructions, at a rate of 2.0-mils thickness for each coat.

5. Apply one shop coat to fabricated metal items, except apply 2-coats to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish from the first.

6. Primer on exposed to view items to be field painted shall be smooth and suitable for application of final finish coats specified in Section 09900.

7. Apply a heavy coat of bituminous paint, compounded for application in 30-mil coat, to metal surfaces in contact with concrete, masonry and dissimilar metals. Do not apply on exposed surfaces.

2.06 MISCELLANEOUS METAL FABRICATIONS

A. Loose Bearing and Leveling Plates: Provide for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area. Drill to receive anchor bolts and for grouting as required. Galvanize after fabrication.

B. Miscellaneous Framing and Supports:

1. Provide miscellaneous framing and supports not a part of structural steel framework, as required to complete work.

2. Fabricate to sizes, shapes and profiles shown or required.

3. Fabricate from structural steel shapes and plates and steel bars of welded construction using mitered joints for field connection.

4. Cut, drill and tap units to receive hardware and similar items.

5. Furnish integrally welded anchors for casting into concrete or building into masonry.

6. Finish: Galvanize exterior frames and supports, shop prime interior frames and supports.

C. Bollards: Fabricate bollards from galvanized steel pipe of diameter and height indicated. Embed in concrete footings, fill with concrete and close top end by welding a ¼ inch steel plate in place or provide a smooth concrete domed cap.

D. Pipe and Conduit Shrouds: Fabricate from 16-gauge galvanized steel with security fasteners at 12-inches on center. At “wet areas”, fabricate from 16-gauge stainless steel with No. 4 finish.

E. Roof Walkways:

1. Shall be a system made for roof top walkways to be mounted on the standing seam of the metal roofs specified in Section 07416. Products of the United Interlock product line of the Unistrut Corporation are referenced. Similar system of other manufacturers are acceptable so long as the components and strengths are equal to the Unistrut system. Include details on shop drawings.

2. Planks: 9- or 12-inches wide, as indicated; 18-gauge galvanized steel, ASTM A446 steel with G90 galvanized coating.

a. Height: 2-1/2-inches.

b. Surface: Slotted, anti-skid (via 1/8-inch high stamped teeth).

c. Leg Shapes: Male-female and double male.

d. Lengths: As required. Offset butt joints in adjacent pieces.

3. Connection Accessories:

a. Manufactured to accommodate the deck provided. All components shall be galvanized.

b. Walkways Across Seams: Support on/from standing seam with bolts with recessed washer and rib clip, 2 per plank, each third rib.

c. Walkways Parallel to Seams:

1) 14-gauge galvanized steel support plates across seams, connect with bolt and rib clips. Space at 48-inches on center and at plank ends.

2) Connect plank to plates using 8-gauge galvanized hold down clips bolted to support plate, one each plank, each plate.

4. Installation:

a. All grating planks shall interlock with male/female legs (always a male leg on the outside).

b. All installation by bolting or screwing (no welding).

5. Finish: Custom color to match Color No. 6 specified in Section 09900.

PART 3 - EXECUTION

3.01 PREPARATION

A. Coordinate and furnish anchors, setting drawings, diagrams, templates, instructions, and directions for installation of anchors, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors.

3.02 INSTALLATION

A. General:

1. Fastening to In-Place Construction: Provide threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required. At inmate-accessible areas, tack-weld all bolts after installation.

2. Cutting, Fitting and Placement:

a. Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications.

b. Set work accurately in location, alignment and elevation, plumb,

level, true and free of rack, measured from established lines and levels.

c. Provide temporary bracing or anchors in formwork for items to be built into concrete, masonry or similar construction.

3. Fit exposed connections together forming tight hairline joints.

a. Weld connections not shop welded.

b. Grind exposed joints smooth and imperceptible, and touch-up shop paint coat.

c. Do not weld, cut or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and intended for bolted or screwed field connections.

4. Field Welding: Comply with AWS for procedures of manual shielded metal-arc welding, appearance and quality of welds, and methods used in correcting welding work.

5. Install prefabricated items in accordance with manufacturer's instructions.

B. Setting Loose Plates:

1. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve surface bond. Clean bottom surface of bearing plates.

2. Set loose leveling and bearing plates on wedges, or other adjustable devices.

3. Tighten anchor bolts after the bearing members have been positioned and plumbed.

4. Cut-off protruding ends of wedges flush with the edge of the bearing plate before packing with grout.

5. Use metallic non-shrink grout in concealed locations where not exposed to moisture; use non-metallic non-shrink grout in exposed locations.

6. Pack grout solidly between bearing surfaces and plates to ensure no voids remain.

C. Bollards: Anchor bollards in concrete with preset pipe sleeves. After bollards have been inserted into sleeves, fill annular space between bollard and sleeve solid with non-shrink, non-metallic grout.

3.03 ADJUST AND CLEAN

A. Touch-Up Painting: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0-mils.

B. Galvanized Surfaces: Clean field welds, bolted connections and abraded areas

and spot prime with specified primer applied to a minimum dry film thickness of 2.5-mils.

END OF SECTION

SECTION 05900

GENERAL PAINTING

05900-1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and incidentals required to evaluate surfaces, prepare surfaces, install coatings, test coatings and make ready for service all coatings, all as shown on the Plans and specified herein.

B. Except where specifically called out otherwise in this Section, it is the intent of these Contract Documents to provide coatings on all exposed miscellaneous metals, electrical cabinets and boxes, pipe, fittings, valves, and associated appurtenances. Minor items omitted in the schedule of work shall be included in the work of this Section where they come within the general intent of the Contract Documents as stated herein.

C. The following items will generally not be painted:

1. Nonferrous metals, unless specifically noted otherwise.

2. Packing glands and other adjustable parts and nameplates of mechanical equipment.

3. Stainless steel work.

4. Cementitious surfaces.

5. Plastic piping and materials.

6. Materials that will be buried (surrounded by soil) in the final installation. This does not include materials inside below ground vaults.

7. Products that have come from the manufacturer with coatings that are acceptable to the Engineer and which have a finish color complying with the color schedule in this Section.

05900-1.02 QUALIFICATIONS

D. The evaluation, preparation and coating shall be performed by well established reputable firms with at least 5 years experience in surface preparation and shop prime painting of the particular equipment to be coated.

E. The coatings shall be the products of well established reputable firms with at least 5 years experience in the manufacture of the particular materials hereinafter specified.

05900-1.03 SUBMITTALS

F. The Contractor shall submit, in accordance with the requirements of Section 40 the following materials and information:

G. Manufacturer's data describing composition, recommended surface preparations, environmental limits to be observed during application, time to recoat, recoating methods, thinning methods, application techniques, dry mil thicknesses and manufacturer's miscellaneous recommendations for protective coatings proposed for use.

H. Schedule of surfaces to be coated with proposed surface preparation, proposed coating materials, proposed number of coats for each coating material, proposed application methods, proposed dry film thicknesses, and proposed finish colors for each surface to be coated.

I. Representative samples or color charts showing the proposed finish colors.

J. Representative samples of coating materials applied to materials similar to those that will be coated here, if required by the Engineer.

K. Requests to accept the factory supplied coatings as adequate as a primer or primer and finish coat in the final installation.

05900-1.04 COORDINATION

L. The work of this Section shall be coordinated with other trades.

M. This shall include, but not be limited to, ensuring that:

1. The surface preparations and primer coats are compatible with the surfaces to be coated.

2. The primers are compatible with finish coatings to be used.

3. The finish coatings are compatible with primers to be used.

05900-1.05 GENERAL

N. Unless otherwise specified, materials, products, ratings and procedures shall conform to the following:

Salt fog resistance	ASTM B117
Chemical resistance	ASTM D1308
Stain resistance	ASTM D1308
Drying time	ASTM D1640

Humidity resistance	ASTM D2247
Measurement of volatile content of coatings	ASTM D2369
Measurement of non-volatile matter in coatings	ASTM D2697
Impact resistance	ASTM D2794
Coating hardness	ASTM D3363
Abrasion resistance	ASTM D4060
Coating adhesion	ASTM D4541

05900-1.06 MATERIALS

A. All painting materials shall be delivered in unbroken packages, bearing the manufacturer's brand and name. Paint shall be used without adulteration. Paint shall be mixed, thinned, and applied in strict accordance with the manufacturer's directions for the applicable materials and surfaces and with the Engineer's approval.

B. Finish painting shall be done with primers that are compatible with the protective coatings to be used.

C. No paint containing lead will be allowed. Oil shall be pure boiled linseed oil or approved equal.

D. All recommendations of the paint manufacturer in regards to the health and safety of workmen shall be followed.

E. Materials exceeding storage life recommended by the manufacturer shall be rejected.

F. All paint to be used in contact with potable water shall be EPA approved for that use and shall comply with the requirements NSF 61.

G. All protective coatings shall comply with the volatile organic compound regulations of the California Air Quality Control Board.

05900-1.07 SAFETY AND HEALTH REQUIREMENTS

H. The Contractor shall comply with the requirements of Cal OSHA and OSHA Safety and Health Standards for Construction and the applicable requirements of regulatory agencies having jurisdiction, as well as manufacturer's printed instructions, appropriate technical bulletins, manuals, and material safety equipment for persons working in or about the project site.

I. The Contractor shall require all persons to wear protective helmets while in the

vicinity of the work. Workers engaged in sandblasting operations or who are near sandblasting operations shall wear eye and face protection devices and air purifying halfmask or mouthpiece respirators with appropriate filters. Workers sandblasting or near sandblasting operations shall wear barrier creams on any exposed areas of skin.

J. Where ventilation is used to control hazardous exposure, explosion-proof equipment shall be used. Forced air ventilation shall be used to reduce the concentration of air contaminants to the degree such that a hazard does not exist and to assist in the proper curing of coatings applied in a confined area. Air circulation and exhausting of solvent vapors shall continue until coatings have fully cured.

05900-1.08 SCAFFOLDING

K. The Contractor shall supply, erect, and remove all scaffolding, ladders, and temporary platforms, required for all painting work. This scaffolding shall be permitted to be used by other trades for hanging and replacing fittings, fixtures, and appurtenances which have been temporarily removed to allow for the proper proceeding of the painting work. The work of the other trades shall not interfere with or impede the painters' work. The support or bracing of any part of any scaffolding from or to any wall or permanent ladder is strictly prohibited. All scaffolding shall be strongly and safely built as an independent structure supported only by the floor and/or ground.

05900-1.09 PROTECTION OF SURFACES NOT BEING COATED.

L. Protection of surfaces not to be painted shall be provided throughout the painting operation. Dripped or spattered paint shall be promptly removed. Lay drop cloths in all areas where painting is being done to adequately protect flooring and other work from all damage during the operation and until the finished job is accepted.

M. The Contractor shall take all necessary precautions to ensure that no surfaces which are not explicitly scheduled to receive coating are protected from any the accidental or unintentional application of any coating. The surfaces to be protected shall include, but not be limited to:

1. Equipment nameplates.
2. Bearing surfaces.
3. Rotating equipment.
4. Any vegetative material.
5. Soil.
6. Any object which is not within the area of work as shown on the Contract Drawings.

7. Any private property which is not the property of the Owner.

8. Electrical contacts.

9. Lighting fixtures.

10. Any surface, which if painted, will interfere with the proper operation of the equipment.

05900-1.10 PAINTING SCHEDULE

N. All exterior final colors, unless otherwise specified herein, will be selected by the Bolinas Community Public Utility District based on the color samples submitted by the Contractor.

O. Protective coatings shall be applied in accordance with the following table:

ITEM	COATING SYSTEM	NO OF COATS	DFT (MILS)	EXTERIOR COLOR
Leading edge of all concrete trip hazards	Universal Epoxy primer Aliphatic Urethane Enamel	1 1	2.0 – 3.0 2.0 – 3.0	Safety Orange
Exterior of non-buried valves in water piping	Epoxy primer Aliphatic Urethane Enamel	1 1	4.0 – 8.0 2.0 – 3.0	Sky Blue
Water pipe supports	Epoxy primer Aliphatic Urethane Enamel	1 1	4.0 – 8.0 2.0 – 3.0	Sky Blue
Exterior of non-buried water piping	Epoxy primer Aliphatic Urethane Enamel	1 1	4.0 – 8.0 2.0 – 3.0	Sky Blue
Concrete at contact points with aluminum	Alkali resistant coating	2	6.0-8.0	-
Ferrous items at contact points with concrete	Bitumastic troweling mastic	1	50.0-75.0	-
Electrical equipment w/ factory applied finish coat	Field touchup as needed with materials from by manufacturer	-	-	To match shop coating
Ductile iron pipe with fusion bonded epoxy coating	Field touchup as needed with materials from by manufacturer	-	-	To match shop coating
Miscellaneous ferrous items exposed to weather	Epoxy primer Aliphatic Urethane Enamel	1 1	4.0 – 8.0 2.0 – 3.0	To match adjoining piping or structure
Fire pump package	Field touchup as needed with materials supplied by manufacturer	-	-	To match shop coating
Non-buried galvanized ferrous electrical conduit	No field applied coating			
Miscellaneous ferrous items not called out above but galvanized	No field applied coating			
Stainless steel items not called out above (excepting stainless steel parts incorporated in items called out above)	No field applied coating			
Concrete items not called out above	No field applied coating			

C. Epoxy primer shall be used when the surface to be coated is ferrous.

D. Universal epoxy primer shall be used when the surface to be coated is non-ferrous.

E. If the Contractor believes that the shop applied coatings meet the requirements of the primer or finish coating and primer, he shall request in writing that a well defined piece or pieces of equipment be exempted from the requirements to apply new coatings. The Engineer shall respond in writing to this request. The decision of the Engineer shall be final and is not subject to appeal. If the Engineer denies the request, the Contractor shall coat the piece of pieces of equipment in question in accordance with these Contract Documents.

F. Non-buried means not surrounded by soil in the final installation and includes all items which are above ground and all items inside vaults.

G. It may be assumed that the exterior surfaces of the piping, valves and fittings within the vault will not be submerged or subjected to splash action.

05900-1.11 PREPARATION OF SURFACES

H. All surfaces to be coated shall be prepared in accordance with the manufacturer's recommendations regarding surface preparation and these Contract Documents.

I. Immediately prior to priming, all ferrous surfaces which will be submerged or exposed to splash action, shall be blast cleaned in accordance with SSPC-SP 10/NACE No. 2.

J. Immediately prior to priming, all ferrous surfaces which will not be submerged or exposed to splash action in the final installation, shall be blast cleaned in accordance with SSPC-SP 6/NACE No. 3.

K. Before a prime coating is applied, surfaces shall be dry and free of mill scale, rust, dirt, dust, oil, grease, and other foreign material.

L. Surfaces which have received a coating of primer which will be incorporated in the work shall be prepared in accordance with SSPC-SP2.

M. Galvanized steel that is not factory-primed shall be cleaned of all dirt, oil, grease, and foreign matter, by wiping down with solvent cleaner in accordance with SSPC-SP1.

N. Ductile iron pipe and valves and couplings shall be cleaned of all dirt, oil, grease, etc., by wiping down with a solvent cleaner in accordance with SSPC-SP1, rinsed with clean water and dried.

05900-1.12 APPLICATION

A. Application shall strictly follow the coatings manufacturer's recommendations and the Contract Documents. Where the manufacturer's recommendations and the

Contract Documents conflict, the Contractor shall bring the matter to the attention of the Engineer who shall make a binding decision.

B. Each coat of paint shall be applied at the rate specified by the manufacturer to achieve the minimum dry mil thickness specified. If material has thickened or must be diluted for application by spray gun, the coating shall be built up to the same film thickness achieved with undiluted material. One gallon of paint as originally furnished by the manufacturer shall not cover a greater area when applied by spray gun than when applied unthinned by brush. Deficiencies in film thickness shall be corrected by the application of additional coats. On porous surfaces, it shall be the painter's responsibility to achieve a protective and decorative finish either by decreasing the coverage rate or by applying additional coats of paint.

C. All work shall be done in a workmanlike manner, leaving the finished surfaces free from drops, waves, holidays, laps, or brush marks.

D. Primer and intermediate coats of paint shall be unscarred and completely integral at the time of application of each succeeding coat. Each coat shall be subject to the inspection and approval of the Engineer before the next succeeding coat is applied, and defective work of any kind shall be deemed sufficient cause for recoating the entire surface involved.

E. Sufficient time shall be allowed between coats to insure proper drying, unless these Specifications or manufacturer's recommendations specifically state otherwise. Excessive time or exposure between coats shall not occur in cases where such excessive time or exposure will impair the bond between coats.

F. Backfilling operations required for any item that has been painted including pipe and walls shall not commence for a minimum of 48 hours after completion of the painting application or a longer period if recommended by the paint manufacturer.

G. All paint shall be at room temperature before applying, and no painting shall be done when the temperature is below 40 degrees Fahrenheit, in the dust-laden air, when rain or snow is falling, or any trace of moisture exists on the surfaces to be painted.

H. No paint shall be applied when the temperature is less than 8 degrees Fahrenheit above dew point unless the dew point is rising and the temperature is at least 5 degrees above dew point.

I. Successive coats of paint shall be tinted so as to make each coat easily distinguishable from each other with the final undercoat tinted to the approximate shade of the finished coat.

J. Finish surfaces shall not show brush marks or other irregularities. Undercoats shall be thoroughly and uniformly sanded with No. 00 sandpaper or equal to remove defects and provide a smooth even surface.

K. Painting shall be continuous and shall be accomplished in an orderly manner so as to facilitate inspection. Materials subject to weathering shall be prime coated as quickly as possible. Surfaces of exposed members that will be inaccessible after erection

shall be cleaned and painted before erection.

L. All surfaces to be painted as well as the atmosphere in which painting is to be done shall be kept warm and dry by heating and ventilation, if necessary, until each coat of paint has hardened. Any defective paint shall be scraped off and repainted in accordance with the Engineer's directions.

M. Before final acceptance of the work, all damaged surfaces of paint shall be cleaned and repainted as directed by the Engineer.

N. Any pipe scheduled to be painted which has received a coating of a tar or asphalt-compound shall be painted with two coats of an approved paint proven capable of preventing bleed through painting before successive coats are applied per the schedule.

05900-1.13 QUALITY CONTROL

O. At the request of the Engineer, samples of the finished work prepared in strict accordance with these Contract Specifications shall be furnished and all painting shall be equal in quality to the approved samples. Finished areas shall be adequate for the purpose of determining the quality of workmanship. Special colors shall be furnished to the satisfaction of the Engineer where standard chart colors are not satisfactory.

P. Wet mil thickness test shall be taken periodically in random areas as the painting progresses or dry mil thickness tests shall be taken at random areas after the prescribed cure time has elapsed. The average of any three random tests must equal the specified mil thickness. The Contractor shall repaint any areas not having the required mil thickness as specified, at the Contractor's expense.

Q. The Contractor shall check for holidays on metal surfaces with a low-voltage holiday detector.

R. The Engineer may use the Contractor's film thickness gauges and holiday detector for additional checking.

S. Coatings shall be applied with clean equipment in good repair. Traps on air sprayers shall be checked frequently and blotter tests shall be conducted on each sprayer each morning and afternoon before work commences.

T. Temperature and humidity shall be checked each morning and afternoon and appropriate adjustments shall be made to application methods, thinning methods and drying times.

59-1.13 CLEAN UP

A. The work site shall at all times be kept free from accumulation of waste material and rubbish caused by employees or work. At the completion of the painting remove all tools, scaffolding, surplus materials, and all rubbish from and about the site and leave

work "broom clean" unless more exactly specified.

B. Any partly used cans of paint remaining at the end of the job shall become the property of the Owner and stored by the Contractor as directed by the Engineer.

C. Upon completion, remove all paint where it has been spilled, splashed, or spattered on all surfaces, including floors, fixtures, equipment, furniture, etc., leaving the work ready for inspection.

D. Empty cans shall not be buried at any time.

*** END OF SECTION ***

SECTION 07500

MISCELLANEOUS METAL

07500-1.01 SECTION INCLUDES

A. Furnishing all material, supplies, equipment, tools, transportation, and facilities and performing all labor and services necessary for, required in connection with, or properly incidental to furnishing and installing miscellaneous metal, as described in this Section of the Specifications, shown on the accompanying Plans, or reasonably implied therefrom.

7500-1.02 REFERENCED SECTIONS

B. The following Sections are referenced in this Section

1. Section 40 – Shop Drawings, Product Data, and Sample Submittals
2. Section 59 – Painting

07500-1.03 SUBMITTALS

C. Comply with Section 40.

D. Certified test reports: Before delivery of any miscellaneous metalwork, provide certificates which attest to material compliance with these specifications.

E. Layout or installation shop drawings for all miscellaneous metals, including but not limited to, seat angles, brackets, flashing, pipe supports.

07500-1.04 MATERIALS

F. Wide Flange Beams: ASTM A992.

G. Structural Steel Shapes (other than Wide Flange Beams) and Plates: ASTM A36.

H. Structural Tubing (HSS): ASTM A500, Grade B.

I. Structural Pipe: ASTM A53, Grade B or ASTM A501.

J. Stainless Steel: ASTM A320, Type 316, as specified.

K. Machine Bolts, Nuts, and Washers: ASTM A307.

L. High Strength Bolts: ASTM A325 bearing-type connections.

M. Hardened Steel Washers: ASTM F436.

N. Heavy Hex Nuts: ASTM A563.

O. Welded Headed Studs: ASTM A108.

P. Welding Materials: AWS D1.1 and D1.3; type required for materials being welded.

Q. Cold-Formed Steel.

1. Framing including stud and track sections, clips, light gauge angles and break shapes.

2. Material shall be supplied by a manufacturer who is a member of the Steel Stud Manufacturer's Association (SSMA) and shall be ASTM A 653 Grade 33 for 18 GA and thinner material and ASTM A 653 Grade 50 for 16 GA and thicker material.
3. Straps, Ties, and Connectors: Simpson Strong-Tie Company Inc. or approved equal.
4. Fasteners shall be self-drilling sheet metal screws: Tek Screws by ITW Buildex or equal.

R. B-Line Pipe Anchors: Cooper B-Line or equal.

07500-1.05 FABRICATION

S. Fabricate structural steel members in accordance with AISC Specification.

T. Conform to Chapter 22, California Building Code; 2013 Edition (CBC).

U. Welding

5. Welder qualification requirements, welding procedures, etc. according to AWS D1.1 and D1.3.
6. Employ only certified welders.
7. Butt welds: Full penetration welds unless otherwise noted.
8. Arc welding electrodes: E70 Series.
9. All welds on hand and guardrails are to be ground smooth.
10. Tie plates: Welded as shown on the Plans.

V. Holes for bolts or rivets shall be punched or drilled 1/16-inch larger than normal bolt. Holes in column base plates may be 5/16-inch larger than anchor bolt diameter only if washers field welded to the base plate are provided under the nuts.

W. Zinc coating material: As specified in ASTM A153.

X. Zinc dust-zinc oxide coating: Conform to MILLSPEC DOD-P-20135.

Y. Coating: As manufactured by Z.R.C. Chemical Products Co., Galvicon Co., or equal.

07500-1.06 MISCELLANEOUS STEEL METALWORK

Z. Other miscellaneous steel metalwork including embedded and nonembedded steel metalwork, hangers, and inserts shall be as specified on the Plans and shall be hot-dip galvanized after fabrication unless otherwise specified.

07500-1.07 COATING REQUIREMENTS

AA. Hot-dip galvanize fabricated material where specified on the Plans and in this Section of the Specifications.

BB. Clean, prepare and shop prime other steel work in accordance with Section 59.

CC. Do not prime surfaces to be field welded.

DD. Touch-up primer in the field after welding is complete. Apply finish coats in the field in accordance with Section 59.

EE. Coatings in contact with potable water shall be NSF-61 approved for potable water applications.

07500-1.08 STEEL ERECTION

FF. Erect structural steel in accordance with AISC Specification.

GG. Make provision for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb and in true alignment until completion of erection and installation of permanent bracing.

HH. Do not field cut or alter structural members without approval of Engineer.

II. After erection, prime welds, abrasions, and surfaces not shop primed, galvanized, except surfaces to be in contact with concrete. Use a primer consistent with shop coat. Use primer recommended for galvanized surfaces.

JJ. Bolting: Securely bolt or weld the work as erection progresses to provide for all dead load, lateral forces and erection stresses.

07500-1.09 MISCELLANEOUS METALWORK

KK. General

1. Fieldwork shall not be permitted on galvanized items. Drilling of bolts or enlargement of holes to correct misalignment will not be allowed.
2. Protect dissimilar metals from galvanic corrosion by means of pressure tapes, coatings or isolators. Protect aluminum in contact with concrete or grout with a heavy coat of bituminous paint.
3. Metalwork to be embedded in concrete:
    a. Placed accurately and held in correct position while the concrete is placed or, if specified, recesses or blockouts shall be formed in the concrete.
    b. The surfaces of metalwork in contact with or embedded in concrete shall be thoroughly cleaned.
    c. If accepted, recesses may be neatly cored in the concrete after it has attained its design strength and the metalwork grouted in place.

LL. Seat Angles, Supports, and Guides

1. Set seat angles for grating and supports for floor plates so that they are flush with the floor and also maintain the grating and floor plates flush with the floor.

MM. Fabrication

1. Holes shall be punched 1/6-inch larger than the nominal size of the bolts, unless otherwise specified. Whenever needed, because of the thickness of the metal, holes shall be subpunched and reamed or shall be drilled.

2. Fabrication including cutting, drilling, punching, threading and tapping required for miscellaneous metal or adjacent work shall be performed prior to hot-dip galvanizing.

07500-1.10 FABRICATIONS REQUIREMENTS

NN. Steel members, fabrications and assemblies: Galvanized after fabrication in accordance with ASTM A123.

OO. Steel items weighing 100 pounds or less: Hot-dip zinc coated.

PP. Anchor bolts and nuts 5/8 inch and larger: Hot-dip zinc coated in accordance with ASTM A153.

QQ. Anchor bolts and nuts smaller than 5/8-inch and all other bolts, screws, nuts, washers and other minor steel fasteners: Mechanically zinc coated.

RR. Fabrication practices for products to be galvanized: In accordance with applicable portions of ASTM A143, A384 and A385.

07500-1.11 REPAIR OF DEFECTIVE GALVANIZED COATING

SS. Where zinc coating has been damaged after installation, substrate surface shall be first cleaned and then repaired with zinc dust-zinc oxide coating in accordance with ASTM A780. Application shall be as recommended by the zinc dust-zinc oxide coating manufacturer. Coating shall consist of multiple coats to dry film thickness of eight mils.

TT. Remove items not physically damaged, but which have insufficient or deteriorating zinc coatings, and items damaged in shipment or prior to installation from the project site for repair by the hot-dip zinc coating method.

07500-1.12 CLEANING

UU. After installation, damaged surfaces of shop primed metals shall be cleaned and touched up with the same material used for the shop coat.

END OF SECTION

SECTION 15010

GENERAL MECHANICAL PROVISIONS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide all labor, materials and equipment required to complete mechanical work shown on the Plans and specified in the contract documents. Equipment lists, presented in these specifications and as specified in the drawings, are included for the convenience of the Contractor and are not complete listings for all equipment, devices and material to be provided under this contract. The Contractor agrees to prepare his own material and equipment takeoff lists as necessary to meet the requirements of this Project.

B. Related Work Specified Elsewhere:

1. Division 3: Concrete Work
2. Division 5: Metals
3. Division 6: Wood and Plastics
4. Division 8: Doors and Windows
5. Division 9: Finishes
6. Division 16: Electrical

1.02 INCORPORATED STANDARDS

A. Published specifications, standards, tests or recommended methods of trade, industry or governmental organizations apply to work of this Section where cited by abbreviations noted below and noted in Division 1.

1. American Society of Mechanical Engineers (ASME)

2. American Water Works Association (AWWA)

3. Air Conditioning and Refrigeration Institute (ARI)

4. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)

5. National Electrical Manufacturers Association (NEMA)

6. National Fire Protection Association (NFPA)

7. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

8. Underwriters' Laboratories, Inc. (UL)

9. State and Local Fire Marshal requirements

1.03 ELECTRICAL WORK

A. Work Requirements: Line voltage and low voltage (48 volts and below) wiring within factory wired "package units" only. Other wiring is specified under Division 16. Coordinate with other trades, particularly Electrical.

B. Quality: Work shall comply with requirements of Division 16 and applicable Codes.

C. Wiring: All wiring shall be in conduit.

D. Substitutions: Be responsible for the cost of any changes in electric wiring resulting from approved substitutions in mechanical equipment.

1.04 SUBMITTALS OF MATERIALS AND EQUIPMENT

A. General: Make submittals of the following in accordance with Division 1. Detailed submittal requirements are given in individual Sections.

1. Material list.

2. Manufacturer's data - certified by the Factory's Corporate Officer.

3. Shop drawings - Contractors and Manufacturers.

4. Structural calculations.

5. Factory test reports.

B. Material List:

1. Submit a complete list of material and equipment proposed for the job, including manufacturer's name.

2. Reference all listings to paragraphs to which they are applicable.

3. List only name of manufacturer. Catalog numbers and performance data not to be included at this time.

4. Submit all materials and equipment, even if it is the same as specified or shown on the Plans.

C. Manufacturer's Data:

1. Submit after review of materials list. Include data for all material and equipment that will be installed.

2. Include complete catalog information such as construction, capacity, types, fan curves, pump curves, sizes, finish, mounting methods and operating noise levels. Provide factory certified submittals and test procedures.

3. Reference all listings to paragraphs to which they are applicable and submit in brochure form.

4. For any material specified as ASTM, Federal Specifications, or trade standards, furnish the manufacturer's or vendor's certification that the material furnished for the work does in fact equal or exceed such specifications.

D. Submittals shall be reviewed for general compliance of specifications and design only. Contractor shall be responsible for deviations from Plans or specifications, and for errors or omissions of any sort in submittals. Submittals of technical data and dimensions by vendor are not acceptable. All submittals shall be factory or manufacturer certified.

E. Conditions of Acceptance of Submittals:

1. No deviation will be permitted from Contract Documents, unless specifically so noted by Contractor and accepted by Engineer, regardless of approval of submittals.

2. Be fully responsible for any errors or omissions in submittals, even though submittals were accepted and such deviations were not noted.

3. Be responsible for adequate fit and coordination with all trades in the field.

4. Be responsible for erection installation techniques, for adequate bracing, deficiencies in strength and for maintaining safety of installation.

5. Be responsible for satisfactory performance of all work.

F. Shop Drawings: Submit the following to 3/8 inch scale or larger, and drawn by competent draftsmen.

1. Equipment layout drawings to scale, including equipment, ductwork, and connection to existing piping, including plumbing and sprinkler, accessories, showing clearance for operating and servicing. Indicate bottom elevations for all equipment.

2. Piping diagrams of all major systems, showing all equipment, accessories, sizes.

3. Shop drawings of all mechanical equipment supports.

4. Details and calculations by a registered structural or civil engineer of any changes in equipment supports due to changes in equipment manufacturer or other causes.

1.05 REVIEW OF CONSTRUCTION

A. Work may be reviewed at any time by the Engineer.

B. Advise Engineer that work is ready for review at following times:

1. Prior to concealment of contract items that have been completed.

2. When requirements of Contract have been completed.

C. Do not conceal work without Engineer's consent.

D. Maintain on job a set of specifications and Plans for use by Engineer.

E. Noncompliance: Should any of the work be covered up or enclosed prior to all required inspections and approvals, uncover the work as required and, after it has been completely inspected and approved, make all repairs and replacements with such materials as are necessary to the approval of the Engineer and at no additional cost to the Owner.

1.06 SERVICE CONNECTIONS

A. Refer to Division 1 for additional requirements.

B. Arrange and pay all costs for utilities required to complete all work of this section. Connection to all on-site services, payment of service charges and provision for and installation of temporary utilities are included in Contract price.

1.07 NOISE AND VIBRATION

A. Cooperate in reducing objectionable noise or vibration. If noise or vibration occurs, as a result of improper installation, correct these conditions at no cost to the Owner.

1.08 RECORD DRAWINGS

1. Refer to Division 1.

1.09 OPERATING AND MAINTENANCE DATA

A. General: Submit to the Engineer prior to acceptance of the installation, complete and at one time. Partial or separate data will not be accepted. Data shall consist of the following minimum submissions:

1. Piping Identification Schedule: Use Drawing item numbers.
2. Equipment: List of nameplates, including nameplate data and system served.

3. Manufacturer's Literature: Three copies of manufacturer's instructions for operation and maintenance of all mechanical equipment, including replacement parts list.

4. Written Instructions: Instructions for operation and maintenance of these systems composed of Operating Instructions and Maintenance Instructions and Maintenance Schedule. Refer to Division 1 for the number of copies

to be submitted to the Engineer for approval.

a) Operating Instructions: A brief description of the system indicating proper setting of switches and other equipment furnished for the purpose of providing control of the system and its components by the operator. Do not include adjustments requiring the technical knowledge of the service agency personnel.

b) Maintenance Instructions: A list of each item of equipment requiring inspection or lubrication, describing the performance of such maintenance, and the month of the year when each item of equipment should be inspected or serviced.

c) Maintenance Schedule: A list of each item of equipment requiring maintenance, showing the exact type of bearing on every component of each item of equipment, and the frequency when each item of equipment should be inspected or serviced.

B. Verbal Instructions: Upon completion of the work, and at a time designated by the Engineer, provide a competent engineer from each supplier of the afore-listed major items of equipment to instruct the Engineer and Owner's personnel in the operation and maintenance of the equipment supplied by his company.

C. Binders: Refer to Division 1.

1.09.1 MATERIALS

A. In addition to the requirements listed in Division 1, materials and equipment shall be those of major and reputable manufacturers with ability to render competent and thorough technical services through local organizations, and to expeditiously provide spare parts.

B. In addition to materials and equipment specified, also provide incidental materials required to effect complete installation. Such incidental materials and equipment shall be uniform throughout the installation. Equipment of the same type shall be of same manufacturer.

C. Restoration of Damage: Repair or replace, as directed by Engineer, materials and parts of premises which become damaged as result of installation of work of this Division. Remove replaced parts from premises.

D. Protection of Materials:

1. Protect materials, equipment and apparatus provided under this Division from damage, water, dust, or similar impairment, both in storage and

installation until Notice of Completion has been filed. Materials, equipment or apparatus damaged because of improper storage or protection will be rejected and must be removed from site.

2. Cap openings in pipes with manufactured caps or fittings. Do not use taped caps.

3. Protect premises and work of other Divisions from damage arising out of installation of work of this Division.

1.10 TESTING

A. In addition to the requirements listed in Division 1, provide tests specified hereinafter, where applicable. If requested, provide written verification that the tests have been successfully completed.

PART 2 - PRODUCTS

2.01 GENERAL

A. Conform to type and quality of equipment and materials as described in this part of the Specifications where applicable.

B. Products applicable to several mechanical trades are specified in this section. Products applicable to specific trades or for special applications are specified in other sections.

C. Similar products and materials specified in other sections supersede those specified in this section.

D. Provide equipment and materials of new and recent manufacture.

E. For each category of equipment and materials, provide the same manufacture and type.

2.02 VALVES

A. General:

1. Provide all valves of first quality of approved manufacturer, have proper clearances, and be tight at the specified test pressure.

2. All valves must be of the product of one manufacturer, except for special application.

3. Screwed end valves shall be used in copper tubing with proper adapters.

B. Butterfly Valves:

1. For above grade service: Bray, George Fischer, Asahi, or equal.

2. Valves 8" and smaller shall be provided with lever operator with position indicator.

C. Air Release Valves: Apco, Crispin, Swagelok, or equal.

D. Gate Valves:

1. For Water Service less than 100 psig.
   a) Valves 2" and Smaller: Bronze, screwed, 150# working pressure SWP with solid wedge disc, rising stem, inside screw and screw in bonnet. Jenkins 370, GF, Beulco, or equal.

2. PVC valves 3" and larger: Schedule 80 valves shall conform to ASTM 1785, D2467, F1498, F1970, ANSI B.1.20.1 and ANSI B16.5. Asahi, Sloane, Hayward or equal

E. Globe Valves:

1. Valves 2" and Smaller: Bronze, screwed, 150# SWP, with renewable composition disc and screwed over bonnet. Jenkins 106A or 106B; Stockham, Apco, or equal.

2. Valves 2-1/2" and 3" Iron body, bronze trim, flanged, 150# SWP, with renewable composition disc and crew over bonnet. Jenkins 107A or 2087; Stockham, Apco, or equal.

3. Valves 4": Iron body, bronze trim, flanged, 150# SWP, regrind-renew beveled disc and seat ring and outside screw and yoke. Jenkins 769; Stockham, Apco, or equal.

F. Swing Check Valves:

1. Valves 2" and Smaller: Bronze, screwed 125# SWP, with regrinding bronze disc and screw-in cap. Jenkins 92A; Stockham, Apco, or equal.

2. Valves 2-1/2" and Larger. Iron body, bronze trim, 125# SWP, with regrind-renew bronze disc and seat ring, and bolted cover. Stockham, Ametek, Apco, or equal.

G. Spring Loaded Check Valves:

1. Valves 2" and Smaller: Bronze body, guided bronze disc, bronze ring, 125# SWP, with stainless steel type 301 spring. Mueller, American Darling, Crispin, or equal.

2. Valves 2-1/2" and Larger: Iron body, flanged guided stainless steel type 302 spring. Mueller, American Darling, Crispin,or equal.

H. Ball Valves:

1. Valves 2" and Smaller - Bronze body, bronze ball, brass stem, Teflon seat, 150# SWP. Jenkins 32A, Swagelok, or equal.
2. 3": PVC socket with 1 psi maximum pressure drop at 100 gpm. Chemtrol, Plastiline, Hayward, or equal.

3. 4": PVC flanged, GF Model 560, Asahi, Hayward, or equal.

4. 6": PVC flanged, GF Model 560, Asahi, Hayward, or equal.

I. Cocks:

1. Cocks 2" and Smaller: All bronze, square head, screwed, 125 lbs. WOG, Hays, Homestead, or equal.

2. Cocks 2-1/2" and Larger: Flanged, lubricated, iron body and plug, 175 lbs. WOG, Hays, Homestead or equal.

J. Eccentric Plug Valves:

1. Valves 2" and Smaller: All bronze, screwed, 124 lbs. WOG, De Zurik 100, Mueller; or equal.

2. Valves 2-1/2" and Larger: Steel body, bronze plug, flanged, lever actuated, 125 lbs. WOG, De Zurik 100, Mueller, or equal.

K. Shut-off valves for pressure taps shall be Weksler AV34, Lunkenheier, Lokwood, or equal, with needle valve.

L. Backflow Preventers:

1. Reduced pressure type, Febco, Beeco, Zurn, or equal.

2. With ¾" GHT faucet connection, Watts Series 8, Febco, Beeco, or equal.

2.03 EQUIPMENT IDENTIFICATION

A. Each piece of motor-driven equipment shall be identified by stencil-lettered names with letters 1-1/2 inches high or smaller if required by limited space. The names shall correspond to those given on the control panels. Automatically started motors shall have a warning sign: "THIS MOTOR MAY START AT ANY TIME."

2.04 MOTORS AND DRIVES

A. Type: NEMA standard open drip-proof, totally enclosed air over (TEAO) or totally enclosed fan cooled (TEFC) type, as specified or indicated on Plans. 1.15 service factor on all motors. All motors shall be of the high efficiency, low noise type.

B. Manufacturers: General Electric, Gould, Baldor, or equal.

C. All motors designed to operate at full load continuously without exceeding NEMA standards. Motors one HP and larger, 480 volts, 3 phase. Motors smaller than one HP, 115 volt, single phase, with internal thermal overload protection unless specifically noted otherwise.

2.05 EQUIPMENT FRAMES

A. General: Mounting frames and/or brackets shall be provided to carry the load of the equipment without causing mechanical distortion or stress to the equipment.

B. Frame Types:

1. Type A frame is a wide flange structural steel frame with brackets. The maximum allowable deflection of any point on the loaded frame relative to the unloaded frame shall be 0.005 inch. A wide flange section depth greater than 1/10th the length of the longest frame member will be accepted as satisfying the deflection requirement.

2. Type B frame is a channel steel structural steel frame with brackets. The section depth shall be greater than 1/10th the length of the longest frame

member.

3. Type C frame is a steel bracket or gusset welded or bolted directly to the machine frame in order to accommodate the isolator.

4. Type D frame is a steel channel frame, concrete pour-in form reinforcing bars welded in place, bolting templates, and height saving brackets for side mounting isolators.

2.06 SEISMIC RESTRAINTS

A. General Requirements: Seismic restraints shall be provided for all equipment and piping in accordance with the mandate of Title 24, State of California Code Requirements (C.C.R.), Table T22-23J (Earthquake Zone 3). The minimum structural requirements for the restraints, including their attachment to the equipment or piping and the building structure shall be per SMACNA seismic restraints as approved by Office of the State Architect.

B. Seismic Restraint Systems for Piping:

1. All required Seismic Bracing shall be installed as per the State of California Administrative Code, Title 24, Division T-22 for horizontal force factors (c_p) of 0.5G in any direction.

2. Installation will be strictly to the Midland-Ross Corporation Superstrut Universal Seismic Support System and/or Guidelines For Seismic Restraints of Mechanical Systems and Plumbing Piping Systems as published by SMACNA.

3. Submittals shall reflect use of State of California PRE-APPROVED Seismic restraint system and bear approval number.

2.07 PIPE CLAMPS

A. General Requirements: Where noted on Drawings pipes shall be attached to concrete walls and floor with plastic pipe clamps.

PART 3 - EXECUTION

3.01 PLANS AND SITE

A. Locations:

1. All scaled and figured dimensions are approximate and are given for estimating purposes only. Before proceeding with any work, carefully check and verify all dimensions, sizes, lengths, etc.
2. So far as possible, the work has been indicated on the Plans in such positions as to suit and accommodate the work of the other trades, but the work as indicated is largely diagrammatic and is shown primarily for clarity. Contractor is responsible for the correct placing of his work and the proper location and connection of work in relation to the work of other trades.

3. Where apparatus and equipment have been indicated on the Plans, dimensions have been taken from typical equipment of the class indicated. Carefully check the Plans to see that the equipment will fit into the spaces provided.

4. Where equipment is furnished by others, verify dimensions and the correct locations of this equipment before proceeding with the roughing-in of connections.

5. Contact the Engineer before any digging and investigate and confirm all existing conditions.

3.02 INSTALLATION OF PIPING AND EQUIPMENT

A. General:

1. All materials shall be stored, handled, cut, joined and installed in accordance with manufacturer's recommendations as a minimum.

2. Conceal all piping within finished rooms, unless otherwise noted on Plans.

3. Cut pipe accurately to measurements established at the building; work into place without springing or forcing; properly clear all windows, doors, and other openings. Excessive cutting or other weakening of the building structure to facilitate piping installation will not be permitted.

4. Make all changes in the direction with fittings and changes in main sizes through eccentric reducing fittings. Unless otherwise noted, install water supply and return piping with straight side of eccentric fittings at top of pipe.

5. Provide sufficient swing joints, ball joints, expansion loops, and devices necessary for a flexible piping system.

6. Provide union and isolating valves on piping at all equipment or apparatus. Locate valves so that the equipment can be removed without dismantling any branch lines.

7. Install drain valves at all low points of each system to enable complete drainage, and air vents at all high points in the piping system to enable complete air venting.

8. Support piping independently at pumps and the like so that its weight will not be supported by the equipment.

9. Securely bolt in place to building structures all equipment, isolators, hangers, etc. Where detail of support is not shown, install equipment per SMACNA seismic requirements.

10. Pitch pipe lines as required for proper drainage and elimination of air.

11. Wire for hanging or strapping pipes is not permitted.

12. Support each run of piping independently from all other piping.

13. Pitch drain lines a minimum of one inch per 40 feet in the direction of flow, unless noted otherwise.

B. Equipment Access:

1. Install all piping, equipment and accessories to permit access for maintenance. Relocate piping, equipment and accessories as required to provide maintenance access at no additional cost.

2. Furnish access doors where specified in these specifications and where any valves, motors, and equipment requiring access for servicing, repairs, or maintenance are located in walls, chases or above ceilings. Coordinate the location of all access doors.

C. Equipment by Others: For roughed-in and final connections to equipment furnished by others ascertain exact sizes, services and locations before starting work. Verify accuracy of work shown on Plans before starting work. Contractor is responsible for providing proper installation.

3.03 SEISMIC RESTRAINING DEVICES

A. Scope: Provide seismic restraining devices at equipment and piping.

B. Piping System: Per Title 17, CAC requirements and UBC latest edition as indicated on Plans.

C. Equipment: Securely bolt in place to structure all equipment, tanks, isolators, hangers and similar items in accordance with applicable seismic criteria for the area (Earthquake Zone 3), and as defined in SMACNA Publishing Reference No. 4. Contractor shall submit calculations prepared and signed by a professional engineer in the State of California.

3.04 PIPE JOINTS

A. Screwed Piping:

1. Cut with machine cutter, hand pipe cutter or carborundum pipe wheel. Debur with file or scrapper or pipe reamer. Do not ream to exceed I.D. of pipe. Thread to ANSI B2.1 requirements.

2. Use Teflon tape on male thread prior to joining other services. No more than two full threads shall remain exposed after joining.

B. Copper Tubing:

1. Cut square; remove burrs and clean pipe and inside of female fitting to a bright finish with steel wool, wire brush, sandpaper or emery cloth. Apply solder flux with brush to tubing. Remove internal parts of solder-end valves prior to soldering.

2. Provide dielectric unions at points of connection of all copper tubing and any ferrous piping and equipment.

3. Joining for Copper Pipes:

a. Piping 1" and smaller: 95-5 solder, lead-free solder.

b. Piping larger than 1": Sil-fos brazing, 10001 F minimum, lead-free solder.

C. Solvent Welded PVC:

1. Select proper cement and primer per manufacturer's recommendations. Cut pipe per manufacturer's recommendations, ends must be square and beveled. Pipe end and fitting socket must be clean and dry. Join pipe and fittings per manufacturer's recommendations.

2. Apply primer on pipe end and inside socket fitting until surface begins to

dissolve. While primer is wet apply full coat of cement to pipe and inside socket fitting making sure there are no voids. Flow a second even coating to the pipe end while the cement is still wet.

3. While surfaces are still wet force pipe into the fitting socket giving pipe 1/4 turn and making sure pipe is fully bottomed in socket. Hold firmly for approximately 30 seconds.

4. Wipe away excess cement. Do not disturb joint until initial set has occurred.

D. Flanged:

1. Install per manufacturer's recommendations. Follow tightening procedure as recommended by the manufacturer.

2. Tighten bolts sufficiently to compress gasket and effect a seal, but not so tight as to distort flanges.

E. Push On:

1. Install per manufacturer's recommendations.

2. Bevel each spigot end to facilitate assembly.

3. Lubricate with a heavy vegetable soap solution immediately before joint is completed.

3.05 IDENTIFICATION OF VALVES

A. Where Required: Provide tags on valves installed on all mains and branch lines. Attach to valve with brass chain.

B. Tags: 1-1/2" diameter brass disc or laminated

C. Abbreviations: Same as for pipe identification.

D. Directions: Provide two typewritten charts showing the valve number together with their locations and use. Mount in approved 8-1/2 x 11 inch metal frame behind clear glass and installed as directed by the Engineer.

3.06 PIPING SYSTEM IDENTIFICATION

A. Identify all exposed piping with arrows showing direction of flow and its service.

B. Exposed piping means where exposed to view from the floor, ladder, above accessible ceilings, accessible shafts or other furred spaces.

3.07 PROTECTION, CARE AND CLEANING

A. Provide adequate means for, and fully protect, all finished parts of the materials and equipment against physical damage from whatever cause during the progress of this work and until final completion.

B. During construction, properly cap all lines and equipment nozzles so as to prevent entrance of sand, dirt, etc. Protect equipment against moisture, plaster, cement, paint, or other work of other trades by covering it with polyethylene sheets.

C. After installation has been completed, clean all systems.

1. Piping and equipment to be insulated: Clean exterior thoroughly to remove rust, plaster, cement, and dirt before insulation is applied.

2. Piping and equipment to be painted: Clean exterior of piping, ductwork and equipment, exposed in completed structure, removing rust, plaster, cement and dirt by wire brushing. Remove grease, oil, and similar materials by wiping with clean rags and suitable solvents. Touch up primer coat as required.

3. Motors, pumps and other items with factory finish: Remove grease and oil, and leave surfaces clean and polished.

4. Plumbing fixtures: Clean and polish fixtures immediately prior to final inspection of Engineer's occupancy. Clean floor drain grates, check each fixture to insure against trap stoppage.

3.08 LUBRICATION

A. Upon completion of the work and before turning over to the Owner, clean and lubricate all bearings except sealed and permanently lubricated bearings. Use only lubricant as recommended by the manufacturer.

3.09 NOISE AND VIBRATION

A. The entire system, including equipment, pipes, motors and all other parts must be noiseless and free of vibration transmission. If noise or vibration occurs, as a result of installation, correct these conditions at no cost to the Owner.

3.10 DAMAGE BY LEAKS

A. Be responsible for damage to any part of the premises caused by leaks in the pipe or fixtures or equipment installed under applicable section for the period of 12 months from the date of acceptance of the work by the Engineer.

3.11 TESTING SYSTEMS

A. General: All defects disclosed as result of the following or other tests or operations shall be promptly repaired by, and at expense of Contractor and to Engineer's satisfaction. Test shall comply with all necessary codes, rules, and regulations, as noted hereinbefore. Contractor shall supply all instruments, labor and tools required by tests. Any defective material and/or equipment shall be repaired, adjusted and replaced by new, like material and equipment, and retested before acceptance.

B. Operational Tests: Operational tests shall be made on all equipment and devices to determine proper compliance with specifications. All equipment shall function quietly and efficiently; any undue noise or vibration caused by malfunctioning of piping, and equipment shall be promptly repaired and/or corrected before acceptance.

C. Timing of Tests: Within 2 weeks of notification by the Engineer the Contractor shall put all systems and equipment into operation and shall continue operation of same for a continuous 48 hour period, until all adjusting, balancing, testing, demonstrations, instructions and cleaning of systems have been completed. Instructions and demonstrations required shall be given simultaneously with this operation.

3.12 COMPLETION

A. Before Final Review: The work hereunder will not be reviewed for final acceptance until Operating and Maintenance Data, Manufacturer's Literature, Valve Directories, Piping Identification Code Directory and nameplates specified herein have been approved and properly posted in the building and final cleaning has been completed.

B. Demonstration of Operations: When the installation is complete and adjustments specified herein have been made, operate the systems for an additional period of three days, during which time demonstrate to the Engineer that systems are completed and operating in conformance with these specifications.

END OF SECTION

SECTION 15060

PIPING AND APPURTENANCES

PART1 - GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment and incidentals required to install, complete, ready for operation, and field test all pipes and fittings as shown on the Plans and/or specified herein.

B. Piping shall be located substantially as shown. The Engineer reserves the right to make such modifications in locations as may be found desirable to avoid interference between pipes or for other reasons. Pipe fitting notation is for the Contractor's convenience and does not relieve him from laying and jointing different or additional items where required without additional compensation.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Concrete work is specified under Division 3.

B. Valves and other piping and plumbing related items are specified in the respective sections of Division 15.

1.03 SUBMITTALS

A. Submit to the Engineer for review as provided in Section 01340, shop drawings, detailed information on materials proposed, and installation methods and details.

B. All pipe and fittings to be installed under this Contract shall be inspected and tested at the factory as required by the standard specifications to which the material is manufactured. The Contractor shall furnish, in duplicate to the Engineer, sworn certificates of such tests and their results. In addition, all pipes to be installed under this Contract may be inspected at the factory for compliance with these specifications by an independent testing laboratory approved by the Engineer.

C. Fabrication and shipment of material furnished under this section shall not be commenced until the Engineer's review has been completed.

PART 2 - PRODUCTS

2.01PVC WASTEWATER PIPING AND PENETRATIONS

A. All plastic pipe and fittings shall be rigid, polyvinyl chloride (PVC). Material shall meet requirements of ASTM D1785. All joints and fittings for non-pressure applications and pressure applications shall be the socket type for solvent welded joints as designated in ASTM D2467, and shall be compatible with the pipe where installed.

B. Drain, Waste and Vent Pipe shall be PVC material conform to Class 12454-B, ASTM D1784.. Pipe and fittings shall conform to ASTM D2665. Unless otherwise specified, connections shall be solvent weld. Connections to traps, closet flanges and non-plastic pipe shall be with approved adapter type fittings designed for intended use.

C. Wall and deck piping penetrations shall be constructed of PVC and allow the connection of PVC piping to both sides of the penetration.

D. Joints, Couplings and Fittings

1. PVC joints shall be solvent weld joints.

2. All couplings and fittings shall be manufactured of the same materials as the pipe and installed in accordance with the approved Plans and Specifications, or as directed and approved by the Engineer.

3. Other couplings shall be as specified or approved by the Engineer

4. **Non-pressurized flexible pipe couplings shall be made from elastomeric PVC, with a single 300 Series Stainless Steel worm clamp at each end. They shall conform to ASTM D5926, C1173, and applicable portions of C443, C425, C564 and D1869.**

5. **Pressurized flexible pipe couplings within the treatment plant shall be single arched rubber expansion joints, fabricated from multiple plies of synthetic fiber and steel wire reinforced EPDM rubber, with 300 Series Stainless Steel backing rings and hardware. Pressurized flexible pipe couplings installed underground outside of the treatment plant may substitute butyl rubber. All backing rings shall be drilled to 150# ANSI standards**

E. Solvent cement to be used for the field construction of solvent welded joints shall conform to the standards of ASTM D2564.

2.02 HDPE PIPING

A.

2.03 DUCTILE IRON PIPE

B. Ductile iron pipe is to be used for all outdoor, above ground services, where PVC should not be used unless protected from UV sunlight rays and physical abuse or as shown on the Plans.

C. Pipe Material

1. Ductile iron pipe and fittings shall be in conformance with the requirements of ASTM A746, and shall have a minimum 35 mil polyethylene encasement in conformance with ASTM designation D1248. Class of pipe shall be as required for design loads.

2. For exposed service, ductile iron pipe shall be fusion epoxy coated exterior and interior.

D. Joints and Fittings

1. Push-on joints and rubber gaskets shall conform to ANSI A21.11. The gaskets shall be neoprene or other synthetic rubber, and shall meet the requirements of ASTM F477. Natural rubber gaskets will not be acceptable.

2. Mechanical joints shall conform to ANSI A21.10, fittings with rubber gasket joints shall conform to ANSI A21.11. All mechanical joints shall meet or exceed the pressure rating for the pipe class on which they are being used. Buried mechanical joints shall be wrapped with Denso tape.

3. Restrained mechanical joints shall conform to ANSI/AWWA-C111/ A21.11 and shall consist of a mechanical joint retainer gland incorporating cup pointed set screws as the restraint mechanism. The retainer gland shall be cast of high strength ductile iron and shall utilize standardized tee head bolts for gasket compression. Set screws shall be square head, heat treated steel. Set screws shall be tightened to the manufacturer's recommended torque by using a torque wrench. Assembly of the restrained joint shall be as recommended by the pipe manufacturer. Buried mechanical joints shall be wrapped with Denso tape. Acceptable manufacturers include EBBA Iron, Inc., Eastland, Texas, or equal.

4. Flange fittings shall conform to ANSI A21.10 and B16.1. Flanges shall be flat or raised faced unless otherwise required. Flange gaskets shall be rubber composition conforming to ANSI A21.10, and shall be suitable for the specified service. Thickness shall be 1/16-inch for pipe 10 inches and less and 1/8-inch for larger pipe. Flange assembly bolts shall be standard square head carbon steel machine bolts with heavy, hot pressed, hexagon nuts, ANSI B18.2. Threads shall conform to ANSI B1.1, coarse threaded series.

5. Bolt lengths shall be such that after joints are made up the bolts shall protrude through the nut, but not more than 1/2-inch. All nuts and bolts for use in submerged or buried service shall be galvanized or cadmium plated and shall be painted after assembly with a heavy bitumastic coating.

6. Fittings shall be lined and coated the same as pipe.

2.03 TUBING, FITTINGS, AND APPURTENANCES

A. Tubing, fittings, and appurtenances shall be PVC schedule 80 threaded and solvent welded; or equal thermosetting (cross linked) plastic; or HDPE (polyethylene) SDR 11 fusion welded, or equal thermoplastic (non cross linked), or copper ASTM B75 or B280 hard drawn. If copper tubing is used, the minimum wall thickness shall be 0.030" for 1/4" OD, 0.032" for 3/8" OD, 0.032" for 1/2" OD, 0.040" for 3/4" OD.

B. Flexible plastic tubing shall be installed for the services of the chemical metering pumps. Tubing, fittings and needle valves size of 3/8” and 1/4” shall be made of plasticized PVC and manufactured by Harrington Plastics, Tygon, Ryan Herco, or equal.

2.05 MECHANICAL PIPE PLUGS, ORIFICES

A. Pipe plugs are to provide stopping flow in a pipeline for maintenance or repair down stream or diverting flow around a work area. They shall be used when necessary in the weirs as shown in the Plans. Installation of the pipe plugs shall not require any tools and have plastic body with rubber sealing wastewater resistant material and manufactured by Stemar, Lansas Products, Petersen Products, or equal.

B. Flow control orifice resides in the flow controller, determining the flow volume. Made out of PVC and manufactured by GPK Products.

2.06 PIPING FASTENERS

A. Piping fasteners should securely lock a PVC pipe in place as shown on the Plans. They shall work on ratchet principle, be attachable to the concrete, made of nylon (Polyamide PA12) to be manufactured by IPS Plastics, or equal.

2.07 PIPING IDENTIFICATION

A. Plastic markers for identifying pipe shall conform to ANSI A13.1 and shall be as manufactured by W.H. Brady Company, Seton Name Plate Corporation, Marking Services Inc. or equal. Markers shall be the mechanically attached type that are

easily removable. Plastic coding markers shall not be individual letter type. Markers shall include directional arrows to show direction of flow.

PART 3 - EXECUTION

3.01 HANDLING PIPE AND FITTINGS

A. Care shall be taken in loading, transporting and unloading of pipe to prevent injury to the pipe or coating. Pipe or fittings shall not be dropped. All pipe and fittings shall be examined before installing, and no piece shall be installed which is found to be defective. Any damage to the pipe coating shall be repaired as directed by the Engineer.

B. All pipe and fittings shall be subjected to careful inspection just prior to being laid or installed.

C. If any defective pipe is discovered after it has been placed, it shall be removed and replaced with a sound pipe in a satisfactory manner at no expense to the Owner. All pipes and fittings shall be thoroughly cleaned before laying, shall be kept clean until they are used in the work, and when installed or laid, shall conform to the lines and grades required.

D. All rigid plastic pipes shall be delivered to the job site in truly straight lengths free from warps, bending or deformation of any kind. Rigid plastic pipe stored at the site shall be protected from the direct rays of the sun and shall be continuously supported (no blocking) in a manner to ensure that no plastic deformation of any kind takes place prior to being incorporated into the work.

3.02PIPE INSTALLATION

A. General

1. All piping and fittings shall be installed to match alignment as shown on the Drawings. Rigidly supported thrust anchors shall be provided where required. Any damage to linings shall be repaired to the satisfaction of the Engineer before the pipe is installed. Each length of pipe shall be cleaned out before installation.

2. All drain pipe shall be installed to provide continuous downhill flow from points of entry to point of discharge. Traps, sags, and other low points capable of retaining water shall be avoided.

3. All pipes shall be sound and clean before installation.

4. When cutting pipe is required, the cutting shall be done by machine method approved by the manufacturer, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of pipe to be used with a push-on joint bell shall be beveled to conform to the manufactured spigot end. Lining shall be undamaged.

5. Jointing

   a. Mechanical joints at valves, fittings and where designated shall be installed in accordance with the "Notes on Method of Installation" under ANSI Specification A21.11 and the instructions of the manufacturer. To assemble the joint in the field, thoroughly clean the joint surfaces and rubber gasket with soapy water before tightening the bolts. Bolts shall be tightened to the specified torques.

   b. Flanged joints shall be made using ring gaskets, nuts and bolts. The number and size of bolts shall conform to the same American Standard as the flanges.

   c. Bolts in flanged joints or mechanical joints shall be tightened alternately and evenly. Any retightening or reuse of nuts or bolts requires close inspection for thread galling before reinstallation. Any visible galling shall be grounds for rejection. Gaskets shall never be reused once tightened unless specifically authorized in writing by the manufacturers of both the gasket and the pipe.

   d. All valves, fittings, equipment and other appurtenances shall be set and jointed by the Contractor as indicated on the Plans and/or as required.

   e. All pipe and appurtenances connected to equipment shall be supported in such a manner as to prevent any strain being imposed on the equipment. When manufacturers have indicated requirements that piping loads shall not be transmitted to their equipment, submit a certification stating that such requirements have been compiled with.

B. Plastic Pipe

1. The installation of plastic pipe shall be strictly in accordance with the manufacturer's technical data and printed instructions.

2. In making solvent welded connections, clean dirt and moisture from pipe

and fittings, bevel pipe ends slightly with emery cloth, if necessary, and apply primer and solvent cement of the proper grade.

3. Contractor shall demonstrate to manufacturer's representative proficiency in solvent welding of Schedule 40 PVC pipe and provide certificate of completion of training to Engineer.

3.03 TESTING

A. Pipe, pumps, fittings, and appurtenances shall be water pressure tested for pressure and leakage once all the pipe is in place.

B. The Contractor shall supply all labor, materials and equipment required to conduct the test.

C. During the inspection for leakage, the pipe shall also be inspected for damage incurred during installation, and all such damage shall be repaired or pipe replaced as approved by the Engineer.

D. Mechanical piping and fittings exposed to view shall be watertight. Any leakage shall be repaired or pipe replaced and retested to meet the requirements at the expense of the Contractor.

3.04 CLEANING

A. At the conclusion of the work the Contractor shall thoroughly clean the entire pipe by flushing with water or other means to remove all dirt, stones, pieces of wood, or other material which may have entered during the construction period. Debris cleaned from the lines shall be removed from the lowest outlet. If, after this cleaning, obstructions remain, they shall be removed.

END OF SECTION

SECTION 15126
VALVES AND APPURTENANCES

15126-1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and incidentals and install, ready for operation, all valves, pump control valves, and appurtenances as shown on the Plans and/or specified herein.

15126-1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS

B. Piping is included under Section 64.

15126-1.03 QUALIFICATIONS

C. The valves and appurtenances shall be products of well established reputable firms with experience in the manufacture of the particular equipment hereinafter specified.

15126-1.04 SUBMITTALS

D. Submittals shall be as set forth in the General Requirements (Division 1) and Section 40.

15126-1.05 SUPERVISION AND OPERATING INSTRUCTIONS

E. A factory representative who has complete knowledge of proper operation and maintenance of the equipment shall be provided for one-half (1/2) working day to instruct representatives of the Engineer on the proper operation and maintenance of the equipment.

F. This instruction may be given at the same time as the inspection of the installation and testing, provided that the test is successful, and that the operating and maintenance instructions have been furnished to and approved by the Engineer.

15126-1.06 GENERAL

G. All valves shall be of the size and type shown on the Plans and all valves of the same type shall be from one manufacturer.

H. All valves shall have the name of the maker and the working pressure for which they are designed cast in raised letters upon some appropriate part of the body.

I. Unless specified or shown otherwise on the Plans, all valves shall have flanged, mechanical joint, or threaded ends.

J. All flange nuts and bolts shall be Stainless Steel Type 316 or 316L.

K. Valve Operators

1. Manual Operators

a) All valves shall be provided with manual operators, unless otherwise specified and/or shown on the Plans. Unless otherwise specified and/or shown, all exposed valves shall be furnished with an operating lever or wheel. All valves shall be capable of being opened and tightly closed by one person with a maximum required operating torque of 30 foot-pounds. Where this requirement cannot be met, a geared actuator shall be supplied such that the highest operating torque required does not exceed 30 foot-pounds.

b) Unless otherwise specified, wrench nuts shall be provided on all buried valves. All wrench nuts shall be 2-inch square and comply with Section 3.16 of AWWA C500. Contractor shall provide one T-wrench of a length suitable for operation of all buried valves on the project.

c) Buried valves with operating nuts shall have suitable base castings to fit properly over the bonnets of their respective valves and heavy top sections with stay-put covers.

d) Unless otherwise indicated, the direction of rotation of the handwheel or wrench nut to open a valve shall be to the left (counterclockwise). Each valve body or operator shall have cast thereon the word OPEN and an arrow indicating the direction to open.

L. All ferrous valves shall be epoxy coated. The epoxy coating shall be certified for wastewater use.

15126-1.07 GATE VALVES

M. Gate valves for exposed service 3-inches and smaller shall be rated for a minimum of 100 psig working pressure and a minimum 150 psig test pressure and shall conform to ANSI/AWWA C500.

N. Gate valves 3-inch to 16-inch shall be iron body, resilient seat, bronze mounted, flanged ends in accordance with AWWA C509, rated to 200 psi cold water, full port, fusion epoxy-coated inside and outside in accordance with AWWA C550.

O. All gate valves shall be non-rising stem type fitted with "O-Ring" seals, iron body, resilient seated, rubber encapsulated disc, stationary stem type, or equivalent nonferrous material, unless otherwise specified. Operating hand wheels shall be in conformance with ANSI/AWWA C500. Valves shall have factory-applied fusion epoxy coating inside and out if ferrous.

P. Buried valves shall have mechanical joint ends and 2" standard nut adapter for use with a standard T-wrench for opening and closing.

Q. Gate valves shall be mounted for operator access.

R. Gate valves shall be anchored with a thrust-block to prevent damage or distortion of the PVC pipe and pipe joint when opening and closing the valve. Valve installation shall allow for easy removal of the valve from the pipe and the thrust block, requiring only unbolting or disassembly. Cutting of the pipe, or demolition of the concrete shall not be required.

S. Gate valves shall be manufactured by Stockham, Crane, or equal.

15126-1.08 BURIED VALVES, PVC PIPING - 4" AND LARGER

T. This specification applies to valves used on underground piping using PVC piping with "push on" type joints.

U. All manual shutoff valves shall be gate or butterfly type, iron body with epoxy lining, rubber encapsulated disc, non-rising stem, mechanical joint ends, and 2" standard nut adapter for use with a standard T-wrench for opening and closing. Butterfly valves shall be used where shown on the Plans. Valves not otherwise specified on the Plans shall be gate valves.

V. All manual shutoff valves shall be provided with a valve box for operator access.

W. All manual shutoff valves shall be anchored with a thrust-block to prevent damage or distortion of the pipe and pipe joint when opening and closing the valve. Valve installation shall allow for easy removal of the valve from the pipe and the thrust block, requiring only unbolting or disassembly. Cutting of the pipe, or demolition of the concrete, shall not be required.

15126-1.09 BURIED VALVES, PVC PIPING – 3" AND SMALLER

X. This spec applies to valves used on underground piping using PVC piping with solvent welded socket joints.

Y. All manual shutoff valves shall be of the stainless steel ball valve type with brass body and ball and screwed connections. Trim and seals shall be suitable for tight shutoff on cold water service. Valve shall be fitted with a square nut adapter for use with a standard T-wrench for opening and closing. Contractor shall provide one T-wrench suitable to operate all valves on the project. Valves shall be of the 3 piece type for easy disassembly and removal or be of the unibody type and installed with a union.

Z. All manual shutoff valves shall be provided with a valve box for operator access.

AA. All manual shutoff valves shall be anchored with a thrust-block to prevent damage or distortion of the pipe and pipe joint when opening and closing the valve. Valve installation shall allow for easy removal of the valve from the pipe and the thrust block, requiring only unbolting or disassembly. Cutting of the pipe, or demolition of the concrete shall not be required.

15126-1.10 INSTALLATION

BB. Care shall be taken to prevent damage to valves and appurtenances during handling and installation. All materials shall be carefully inspected for defects in workmanship and materials; all debris and foreign material cleaned out of valve openings, etc. All operating mechanisms shall be operated to check their proper functioning, and all nuts and bolts checked for tightness. Valves and other equipment which do not operate as specified, or are otherwise defective, shall be repaired or replaced at no additional cost to the Owner.

1 15126-1.11 INSPECTION AND TESTING

CC. The various pipe lines in which the valves and appurtenances are to be installed are specified to be field pressure tested. During these tests any defective valve or appurtenance shall be adjusted, removed and replaced, or otherwise made acceptable to the Engineer.

DD. After installation, all valves and appurtenances shall be tested at least one hour at 1-1/2 times the working pressure corresponding to the type of pipe, unless a different test pressure is specified. All joints and valves shall be proven drip tight under test pressure. If any joint of the valve or of the appurtenances proves to be defective, it shall be repaired to the satisfaction of the Engineer at the Contractor's expense.

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