

TECHNICAL SPECIFICATIONS

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END OF SECTION

SECTION 03 30 00  
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes cast-in-place concrete for the following:
1. Foundation walls.
  2. Supported slabs.
  3. Slabs on grade.
  4. Control, expansion and contraction joint devices.
  5. Equipment pads.
  6. Thrust blocks.
  7. Manholes.
- B. Related Sections:
1. Section 03 10 00 - Concrete Forming and Accessories: Formwork and accessories.
  2. Section 03 20 00 - Concrete Reinforcing.
  3. Section 03 35 00 - Concrete Finishing.
  4. Section 03 39 00 - Concrete Curing.

1.2 REFERENCES

- A. American Concrete Institute:
1. ACI 301 - Specifications for Structural Concrete.
  2. ACI 305 - Hot Weather Concreting.
  3. ACI 306.1 - Standard Specification for Cold Weather Concreting.
  4. ACI 308.1 - Standard Specification for Curing Concrete.
  5. ACI 318 - Building Code Requirements for Structural Concrete.
  6. ACI 347 - Guide to Formwork for Concrete.
- B. ASTM International:
1. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
  2. ASTM A185 - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
  3. ASTM A496 - Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
  4. ASTM A497 - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
  5. ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
  6. ASTM A704 - Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.
  7. ASTM A706 - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.

8. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
9. ASTM C33 - Standard Specification for Concrete Aggregates.
10. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
11. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
12. ASTM C143 - Standard Test Method for Slump of Hydraulic Cement Concrete.
13. ASTM C150 - Standard Specification for Portland Cement.
14. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.
15. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
16. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
17. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
18. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
19. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
20. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
21. ASTM C1017 - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
22. ASTM C1064 - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
23. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
24. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
25. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
26. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

C. Concrete Reinforcing Steel Institute:

1. CRSI - Manual of Standard Practice.
2. CRSI - Placing Reinforcing Bars.

### 1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Design Data:

1. Submit concrete mix design for each concrete strength. Submit separate mix designs when admixtures are required for the following:
  - a. Hot and cold weather concrete work.
  - b. Air entrained concrete work.
2. Identify mix ingredients and proportions, including admixtures.
3. Identify chloride content of admixtures and whether or not chloride was added during manufacture.
4. Identify minimum and maximum allowable slump for submitted concrete mix design.

- C. Product Data: Submit data on curing compounds, mats, paper, film, compatibilities, and limitations.
- D. Delivery Data: Submit delivery ticket for ready mixed concrete delivered for use in the work. Delivery ticket shall include the concrete mix, batch, volume delivered, admixtures used, batch time and amount of water that can be added within specifications.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Accurately record actual locations of embedded utilities and components concealed from view in finished construction.

#### 1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with ACI 301. Perform curing in accordance with ACI 318.
- B. Conform to ACI 305 when concreting during hot weather.
- C. Conform to ACI 306.1 when concreting during cold weather.
- D. Acquire cement and aggregate from one source for Work.
- E. Fire Rated Floor Construction: Rating as indicated on Drawings.
  - 1. Tested Rating: Determined in accordance with ASTM E119.

#### 1.6 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.
- B. Maintain concrete temperature after installation at minimum 50 degrees F for minimum 7 days.
- C. Maintain high early strength concrete temperature after installation at minimum 50 degrees F for minimum 3 days.

### PART 2 PRODUCTS

#### 2.1 CONCRETE MATERIALS

- A. Cement: ASTM C150, Type I or IA – Normal or Type II or IIA – Moderate, unless otherwise specified in Drawings.
- B. Normal Weight Aggregates: ASTM C33.
  - 1. Coarse Aggregate Maximum Size: In accordance with ACI 318.
- C. Water: ACI 318; potable, without deleterious amounts of chloride ions.

## 2.2 ADMIXTURES

- A. Air Entrainment: ASTM C260.
- B. Chemical: ASTM C494.
  - 1. Type A - Water Reducing.
  - 2. Type B - Retarding.
  - 3. Type C - Accelerating. Chloride-based accelerators are not permitted.
  - 4. Type D - Water Reducing and Retarding.
  - 5. Type E - Water Reducing and Accelerating. Chloride-based accelerators are not permitted.
- C. Fly Ash or Calcined Pozzolan: ASTM C618. Must be used in quantities not to exceed those specified in ACI C318.
- D. Plasticizing: ASTM C1017.
- E. Integral Waterproofing Admixtures: ASTM C494, Type S; complex catalyzed hydrous silicate, water and vapor proofing liquid admixture.
  - 1. Basis of design product: Subject to compliance with requirements, provide Moxie International, Moxie Shield 1800 Admixture, or equal.
  - 2. Properties:
    - a. Water/Cement Ratio: Maximum 0.52.
    - b. Water Vapor Transmission: Less than 0.1 perms.

## 2.3 ACCESSORIES

- A. Bonding Agent: Two component modified epoxy resin, Non-solvent two component polysulfide epoxy, Mineral filled polysulfide polymer epoxy, or Mineral filled polysulfide polymer epoxy resin.
- B. Non-Shrink Grout: ASTM C1107; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days.

## 2.4 JOINT DEVICES AND FILLER MATERIALS

- A. Joint Filler Type A: ASTM D1751; Asphalt impregnated fiberboard or felt, ¼ inch or ½ inch thick; tongue and groove profile.
- B. Expansion and Contraction Joint Devices: ASTM B221 alloy, extruded aluminum; resilient elastomeric filler strip with Shore A hardness of 35 to permit plus or minus 25 percent joint movement with full recovery.
- C. Sealant: ASTM D6690, Type I.

## 2.5 WOOD FORM MATERIALS

- A. Form Materials: At discretion of Contractor.

## 2.6 FORMWORK ACCESSORIES

- A. Spreaders: Standard, non-corrosive metal form clamp assembly, of type acting as spreaders and leaving no metal within 1 inch of concrete face. Wire ties, wood spreaders or through bolts are not permitted.

## 2.7 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615, 60 ksi yield grade, plain or deformed billet bars, uncoated.
- B. Plain Wire: ASTM A82; unfinished.
- C. Welded Plain Wire Fabric: ASTM A185; in flat sheets or coiled rolls; unfinished.

## 2.8 REINFORCEMENT ACCESSORY MATERIALS

- A. Tie Wire: Minimum 16 gage annealed type.
- B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions. Must be manufactured products used as recommended by manufacturer. Stones, rebar pieces or other materials are not acceptable replacements.

## 2.9 CONCRETE MIX

- A. Select proportions for concrete in accordance with ACI 318 trial mixtures.
- B. Provide concrete to the following criteria:

Material and Property	Measurement
Compressive Strength (7 day)	2,500 psi
Compressive Strength (28 day)	4,000 psi
Cement Type	ASTM C150
Aggregate Type	Normal weight
Aggregate Size (maximum)	1/5 of narrowest dimension between forms, or 2/3 of minimum clear spacing between reinforcing bars or between reinforcing bars and forms, whichever is smaller.
Air Content	4.0 percent plus or minus 2.0 percent

- C. Admixtures: Include admixture types and quantities indicated in concrete mix designs only when approved by Engineer.

1. Use accelerating admixtures in cold weather. Use of admixtures will not relax cold weather placement requirements.
2. Do not use calcium chloride nor admixtures containing calcium chloride.
3. Use set retarding admixtures during hot weather.
4. Add air entrainment admixture to concrete mix for work exposed to freezing and thawing.

D. Ready Mixed Concrete: Mix and deliver concrete in accordance with ASTM C94.

E. Site Mixed Concrete: Mix concrete in accordance with ACI 318.

## 2.10 CURING MATERIALS

A. Membrane Curing Compound Type A: ASTM C309, Type 1, Class A.

1. Manufacturers:

B. Non-Membrane Forming Curing Compound Type B: Liquid, penetrating silicate based type; combination curing, hardening and dustproofing compound.

C. Absorptive Mats Type C: ASTM C171, burlap-polyethylene, minimum 9 oz/sq yd bonded to prevent separation during handling and placing.

D. Waterproof Paper Type D: ASTM C171, curing paper treated to prevent separation during handling and placing.

E. Water: Potable, not detrimental to concrete.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify requirements for concrete cover over reinforcement.

C. Verify anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

### 3.2 PREPARATION

A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Remove laitance, coatings, and unsound materials.

B. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

C. Remove debris and ice from formwork, reinforcement, and concrete substrates.

D. Remove water from areas receiving concrete before concrete is placed.

### 3.3 FORMWORK

- A. Earth Forms:
  - 1. Earth forms are not permitted, unless required to ensure native soil bearing on exposed concrete face.
- B. Formwork - General:
  - 1. Construct forms to correct shape and dimensions, mortar-tight, braced, and of sufficient strength to maintain shape and position under imposed loads from construction operations.
  - 2. Camber forms where necessary to produce level finished soffits unless otherwise shown on Drawings.
  - 3. Carefully verify horizontal and vertical positions of forms. Correct misaligned or misplaced forms before placing concrete.
  - 4. Complete wedging and bracing before placing concrete.
- C. Install formed openings for items to be embedded in or passing through concrete work.
- D. Locate and set in place items required to be cast directly into concrete.
- E. Coordinate with Work of other sections in forming and placing openings, slots, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.
- F. Install accessories straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- G. Embedded Items:
  - 1. Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, water stops, and other features.
  - 2. Do not embed wood or uncoated aluminum in concrete.
  - 3. Obtain installation and setting information for embedded items furnished under other Specification sections.
  - 4. Securely anchor embedded items in correct location and alignment prior to placing concrete.
  - 5. Verify conduits and pipes, including those made of coated aluminum, meet requirements of ACI 318 for size and location limitations.
- H. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads and removal has been approved by Engineer.
- I. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

### 3.4 REINFORCEMENT PLACEMENT

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position beyond specified tolerance.
  - 1. Do not weld crossing reinforcement bars for assembly.
- B. Accommodate placement of formed openings.

- C. Space reinforcement bars with minimum clear spacing of one bar diameter, but not less than 1 inch.
1. Where bars are indicated in multiple layers, place upper bars directly above lower bars.
- D. Maintain concrete cover around reinforcement in accordance with ACI 318 as follows:

Reinforcement Location		Minimum Concrete Cover
Footings and Concrete Formed Against Earth		3 inches
Concrete exposed to earth or weather	No. 6 bars and larger	2 inches
	No. 5 bars and smaller	1-1/2 inches

- E. Splice reinforcing in accordance with splicing device manufacturer's instructions.

### 3.5 PLACING CONCRETE

- A. Notify Engineer and testing laboratory minimum 48 hours prior to commencement of operations.
- B. For concrete thrust blocks, use solid, undisturbed earth at the sides and bottom of the trench excavation for bearing concrete thrust blocking. Shape blocking to avoid obstruction of weep holes or access to joints and pipe fittings.
- C. Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints are not disturbed during concrete placement.
- D. Reinforcement bar supports and spacers shall be sized and shaped for strength and support of reinforcement during concrete placement. Must be manufactured products used as recommended by manufacturer. Stones, rebar pieces or other materials are not acceptable replacements.
- E. Separate slabs on grade from vertical surfaces with ½ inch thick joint filler.
- F. Place joint filler in floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
- G. Extend joint filler from bottom of slab to within ¼ inch of finished slab surface.
- H. Install construction joint devices in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
- I. Install joint device anchors. Maintain correct position to allow joint cover to be flush with floor finish.
- J. Install joint covers in longest practical length, when adjacent construction activity is complete.
- K. Deposit concrete at final position. Prevent segregation of mix.

- L. Place concrete in continuous operation for each panel or section determined by predetermined joints.
- M. Consolidate concrete.
- N. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- O. Place concrete continuously between predetermined expansion, control, and construction joints.
- P. Do not interrupt successive placement; do not permit cold joints to occur.
- Q. Screed floors and slabs on grade level, maintaining surface flatness of maximum  $\frac{1}{4}$  inch in 10 ft.

### 3.6 CONCRETE FINISHING

- A. Finish concrete floor surfaces to requirements of Section 03 35 00.
- B. Steel trowel surfaces which are indicated to be exposed.
- C. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at  $\frac{1}{4}$  inch per foot nominal unless otherwise indicated on drawings.

### 3.7 CURING AND PROTECTION

- A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
  - 1. Protect concrete footings from freezing for minimum 5 days.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
- C. Ponding: Maintain 100 percent coverage of water over floor slab areas continuously for 7 days.
- D. Spraying: Spray water over floor slab areas and maintain wet for 7 days.
- E. Absorptive Mat: Spread cotton fabric over floor slab areas. Spray with water until mats are saturated, and maintain in saturated condition for 7 days.
- F. Absorptive Mat: Saturate burlap-polyethylene and place burlap-side down over floor slab areas, lapping ends and sides; maintain in place for 7 days.
- G. Membrane Curing Compound: Apply curing compound in one coat.
- H. Non-Membrane Forming Curing Compound: Apply curing compound in one coat. Scrub compound into surface. Maintain surface wet with curing compound, without ponding for time recommended by manufacturer.
- I. For curing vertical concrete surfaces:

1. Spraying: Spray water over surfaces and maintain wet for 7 days.
2. Membrane Curing Compound: Apply compound in two coats with second coat applied at right angles to first.
3. Non-Membrane Forming Curing Compound: Apply curing compound in one coat. Scrub compound into surface. Maintain surface wet with curing compound, without ponding for time recommended by manufacturer.

### 3.8 FIELD QUALITY CONTROL

- A. Sections 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. If total amount of concrete is less than 5 cubic yards, field and strength testing below may not be required, at the sole discretion of the Engineer.
- C. Submit proposed mix design of each class of concrete to testing firm for review prior to commencement of Work.
- D. Concrete Inspections:
  1. Continuous Placement Inspection: Inspect for proper installation procedures.
  2. Periodic Curing Inspection: Inspect for specified curing temperature and procedures.
- E. Strength Test Samples:
  1. Sampling Procedures: ASTM C172.
  2. Cylinder Molding and Curing Procedures: ASTM C31, cylinder specimens, standard cured.
  3. Sample concrete and make one set of three cylinders for every 150 cu yds or less of each class of concrete placed each day and for every 5,000 sf of surface area for slabs and walls.
  4. When volume of concrete for any class of concrete would provide less than 5 sets of cylinders, take samples from five randomly selected batches, or from every batch when less than 5 batches are used.
  5. Make one additional cylinder during cold weather concreting, and field cure.
- F. Field Testing:
  1. Slump Test Method: ASTM C143.
  2. Air Content Test Method: ASTM C173.
  3. Temperature Test Method: ASTM C1064.
  4. Measure slump and temperature for each compressive strength concrete sample.
  5. Measure air content in air entrained concrete for each compressive strength concrete sample.
- G. Cylinder Compressive Strength Testing:
  1. Test Method: ASTM C39.
  2. Test Acceptance: In accordance with ACI 318.
  3. Test one cylinder at 7 days.
  4. Test one cylinder at 28 days.
  5. Retain one cylinder for 56 days for testing when requested by Engineer.
  6. Dispose remaining cylinders when testing is not required.
- H. Maintain records of concrete placement. Record date, location, quantity, air temperature and test samples taken.

3.9 PATCHING

- A. Allow Engineer to inspect concrete surfaces immediately upon removal of forms.
- B. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Engineer upon discovery.
- C. Patch imperfections in accordance with ACI 301.

3.10 DEFECTIVE CONCRETE

- A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.
- B. Repair or replacement of defective concrete will be determined by Engineer.
- C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Engineer for each individual area.

3.11 PROTECTION OF FINISHED WORK

- A. Section 01 70 00 - Execution and Closeout Requirements: Protecting finished Work.
- B. Do not permit traffic over unprotected floor surface.

END OF SECTION

## SECTION 05 31 23

## STEEL ROOF DECKING

## PART 1 GENERAL

## 1.1 SUMMARY

- A. Section Includes:
  - 1. Steel roof deck and accessories.
- B. Related Sections:
  - 1. Section 06 17 53 - Wood Trusses.

## 1.2 REFERENCES

- A. American Society of Civil Engineers:
  - 1. ASCE 3 - Standard Practice for the Construction and Inspection of Composite Slabs.
- B. ASTM International:
  - 1. ASTM A36 - Standard Specification for Carbon Structural Steel.
  - 2. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- C. American Welding Society:
  - 1. AWS D1.1 - Structural Welding Code - Steel.
- D. Steel Deck Institute:
  - 1. SDI 29 - Design Manual for Composite Decks, Form Decks and Roof Decks.
- E. SSPC: The Society for Protective Coatings:
  - 1. SSPC Paint 15 - Steel Joist Shop Paint.

## 1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal requirements.
- B. Shop Drawings: Indicate replacement panels, pertinent details, trim and accessories.
- C. Product Data: Submit deck profile characteristics and dimensions, structural properties and finishes,

## 1.4 QUALIFICATIONS

- A. Installer: Company specializing in performing Work of this section with minimum 3 years' experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.
- B. Store deck on dry wood sleepers; slope for positive drainage.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Manufacturers:
  - 1. Metal Sales Manufacturing Corporation.
  - 2. Model: Image II Integrated Standing Rib Metal Roofing System.
  - 3. Substitutions Permitted: Section 01 60 00 - Product Requirements.
- B. Sheet Steel: 16" Width with Minor Ribs 26 gauge
- C. Color: Sierra Green

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

3.2 INSTALLATION

- A. Replace all damaged panels and accessories according to manufacturer's recommendations

END OF SECTION

## SECTION 22 11 00

## FACILITY WATER DISTRIBUTION

## PART 1 GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Valves.
2. Pipe hangers and supports.
3. Pressure gauges.
4. Pressure gauge taps.
5. Flow control valves.
6. Water pressure reducing valves.
7. Relief valves.
8. Strainers.
9. Hose bibs.
10. Backflow preventers.
11. Pressure booster systems.

## B. Related Sections:

1. Section 03 30 00 - Cast-In-Place Concrete: Execution requirements for placement of concrete housekeeping pads specified by this section.
2. Section 09 90 00 - Painting and Coating: Product and execution requirements for painting specified by this section.
3. Section 22 05 03 - Plumbing Piping: Product and installation requirements for piping materials applying to various system types.
4. Section 22 05 53 - Identification for Plumbing Piping and Equipment: Product requirements for pipe identification and valve tags for placement by this section.
5. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections to equipment specified by this section.
6. Section 31 23 17 - Trenching: Execution requirements for trenching required by this section.
7. Section 33 13 00 - Disinfecting of Water Utility Distribution: Product and execution requirements for disinfection of domestic water piping beyond 5 feet of building.

## 1.2 REFERENCES

## A. American Society of Mechanical Engineers:

1. ASME B40.1 - Gauges - Pressure Indicating Dial Type - Elastic Element.

## B. American Society of Sanitary Engineering:

1. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers.
2. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers.

## C. ASTM International:

1. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.

- D. American Water Works Association:
  - 1. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.
  - 2. AWWA C702 - Cold-Water Meters - Compound Type.
  - 3. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
  - 4. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.
- E. Manufacturers Standardization Society of the Valve and Fittings Industry:
  - 1. MSS SP 67 - Butterfly Valves.
  - 2. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
  - 3. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
  - 4. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
  - 5. MSS SP 85 - Cast Iron Globe & Angle Valves, Flanged and Threaded.
  - 6. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.
- F. National Electrical Manufacturers Association:
  - 1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

### 1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings (pressure booster systems): Indicate layout, general assembly, components, and dimensions.
- C. Product Data:
  - 1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturer's catalog information.
  - 2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
  - 3. Hangers and Supports: Submit manufacturers catalog information including load capacity.
  - 4. Domestic Water Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.
  - 5. Pumps: Submit pump type, capacity, certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.
- D. Manufacturer's Installation Instructions: Submit installation instructions for pumps, valves and accessories.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

### 1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of valves and equipment.

- C. Operation and Maintenance Data: Submit spare parts list, exploded assembly views and recommended maintenance intervals.

#### 1.5 QUALITY ASSURANCE

- A. For drinking water service, provide valves complying with NSF 61.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.
- B. Accept valves and equipment on site in shipping containers with labeling in place. Inspect for damage.
- C. Provide temporary protective coating on cast iron and steel valves.
- D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

#### 1.7 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

#### 1.8 EXTRA MATERIALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish one packing kit for each size valve, two hose end vacuum breakers for hose bibs and two pump seals for each pump model.

### PART 2 PRODUCTS

#### 2.1 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Refer to Section 22 05 03.

#### 2.2 DOMESTIC WATER PIPING, ABOVE GRADE

- A. Refer to Section 22 05 03.

#### 2.3 UNIONS AND FLANGES

- A. Refer to Section 22 05 03.

## 2.4 GATE VALVES

- A. Manufacturers:
  - 1. Milwaukee Valve Company Model Ultra-Pure Lead-Free Valves.
  - 2. NIBCO, Inc. Model CWP Iron Body Gate Valves.
  - 3. Clow Valve Resilient Wedge Valves.
  - 4. Substitutions Permitted: Section 01 60 00 - Product Requirements.
- B. 2 inches and Smaller: MSS SP 80, bronze body, bronze trim, threaded or union bonnet, rising stem, hand-wheel, inside screw, solid wedge disc, solder or threaded ends. Rated for 300 psi unless otherwise specified in Drawings.
- C. 2-1/2 inches and Larger: MSS SP 70, ductile iron body, ductile iron or bronze trim, bolted bonnet, rising stem, hand-wheel, outside screw and yoke, solid wedge disc with seat rings, flanged ends. Rated for 300 psi unless otherwise specified in Drawings.

## 2.5 GLOBE VALVES

- A. Manufacturers:
  - 1. Crane Valve, North America.
  - 2. Milwaukee Valve Company Model Ultra-Pure Lead-Free Valves.
  - 3. Substitutions: Section 01 60 00 - Product Requirements.
- B. 2 inches and Smaller: MSS SP 80, bronze body, bronze trim, threaded or union bonnet, hand wheel, Buna-N composition disc, solder or threaded ends. Rated for 200 psi unless otherwise specified in Drawings.
- C. 2-1/2 inches and Larger: MSS SP 85, cast iron body, bronze trim, hand wheel, outside screw and yoke, flanged ends. Rated for 300 psi unless otherwise specified in Drawings.

## 2.6 BALL VALVES

- A. Manufacturers:
  - 1. Crane Valve, North America Model 9201 or 9202.
  - 2. Substitutions Permitted: Section 01 60 00 - Product Requirements.
- B. 2 inches and Smaller: MSS SP 110, 400 psi WOG, two-piece bronze body, chrome plated brass ball, full port, Teflon seats, blow-out proof stem, solder or threaded ends, lever handle.

## 2.7 BUTTERFLY VALVES

- A. Manufacturers:
  - 1. Crane Valve, North America Model Resilient Seated Butterfly Valves.
  - 2. Milwaukee Valve Company Model Ultra-Pure Lead-Free Valves.
  - 3. NIBCO, Inc. Model Butterfly Valve
  - 4. Substitutions Permitted: Section 01 60 00 - Product Requirements.
- B. 2-1/2 inches and Larger: MSS SP 67, Class 200 unless otherwise shown in Drawings.
  - 1. Body: Cast or ductile iron, lug or grooved ends, stainless steel stem, extended neck.

2. Disc: Aluminum bronze, Elastomer coated ductile iron or stainless steel.
3. Seat: Resilient replaceable EPDM.
4. Handle and Operator: 10 position lever handle.

## 2.8 CHECK VALVES

### A. Horizontal Swing Check Valves:

1. Manufacturers:
  - a. Clow Valve Swing Check Valves
  - b. Substitutions Permitted: Section 01 60 00 - Product Requirements.
2. 2 inches and Larger: MSS SP 71, Class 200 unless otherwise indicated in Drawings, cast iron or bronze body, bolted cap, bronze or cast iron disc, flanged ends.

### B. Spring Loaded Check Valves:

1. Manufacturers:
  - a. Milwaukee Valve Company Model Ultra-Pure Lead-Free Valves.
  - b. Watts LF 600.
  - c. Substitutions Permitted: Section 01 60 00 - Product Requirements.
2. 2 inches and Smaller: MSS SP 80, Class 250, bronze body, in-line spring lift check, silent closing, Buna-N disc, integral seat, solder or threaded ends.

## 2.9 PIPE HANGERS AND SUPPORTS

### A. Manufacturers:

1. Cooper B-Line / TOLCO.
2. Substitutions Permitted: Section 01 60 00 - Product Requirements.

B. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.

C. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.

D. Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.

E. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hooks.

F. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamps.

G. Vertical Support: Steel riser clamp.

H. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

I. Copper Pipe Support: Carbon steel ring, adjustable, copper plate.

## 2.10 PRESSURE GAUGES

- A. Gauge: ASME B40.1, with bourdon tube, rotary brass movement, brass socket, front calibration adjustment, black scale on white background.
  1. Case: Stainless steel.

2. Bourdon Tube: Type 316 stainless steel.
3. Dial Size: 2-1/2 inch diameter, unless otherwise specified in Drawings.
4. Mid-Scale Accuracy: One percent.
5. Scale: PSI. 0 - 150
6. Liquid Filled

#### 2.11 PRESSURE GAUGE TAPS

- A. Needle Valve: Stainless Steel, ¼ inch NPT for minimum 300 psi.
- B. Ball Valve: Brass, ¼ inch NPT for 250 psi.
- C. Pulsation Damper: Pressure snubber, brass with ¼ inch NPT connections.

#### 2.12 FLOW CONTROL VALVES

- A. Construction: Class 150, Stainless steel or bronze body with union on inlet, temperature and pressure test plug on inlet.
- B. Calibration: Control flow within 15 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 5 psi.

#### 2.13 WATER PRESSURE REDUCING VALVES

- A. Manufacturers:
  1. Watts Lead-Free Models (2 inches and smaller).
  2. Cla-Val Model 90 Series (2-1/2 inches and larger).
  3. Substitutions Permitted: Section 01 60 00 - Product Requirements.
- B. 2 inches and Smaller: MSS SP 80, bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded double union ends.
- C. 2 inches and Larger: MSS SP 85, ductile iron body, bronze fitted, elastomeric diaphragm and seat disc, flanged.

#### 2.14 RELIEF VALVES

- A. Manufacturers:
  1. Watts Lead-Free Models (2 inches and smaller).
  2. APCO Model SRA (2-1/2 inches and larger).
  3. Substitutions Permitted: Section 01 60 00 - Product Requirements.
- B. Pressure Relief:
  1. 2 inches and Smaller: bronze body, Teflon or silicone seat, steel stem and springs, automatic, direct pressure actuated.
  2. 2-1/2 inches and Larger: ductile iron body, EPDM disc seat, steel stem and springs, automatic, direct pressure actuated.

## 2.15 STRAINERS

- A. 2 inch and Smaller: Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
- B. 1-1/2 inch to 4 inch: Class 125, flanged iron body, Y pattern with 1/16-inch stainless steel perforated screen.
- C. 5 inch and Larger: Class 125, flanged iron body, basket pattern with 1/8 inch stainless steel perforated screen.

## 2.16 HOSE BIBS

- A. Interior: Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, chrome plated where exposed with hand wheel, vacuum breaker in conformance with ASSE 1011.
- B. Interior Mixing: Bronze or brass, wall mounted, double service faucet with hose thread spout, integral stops, chrome plated where exposed with hand wheels, and vacuum breaker in conformance with ASSE 1011.

## 2.17 BACKFLOW PREVENTERS

- A. Reduced Pressure Backflow Preventers:
  - 1. Comply with ASSE 1013.
  - 2. Bronze body, with bronze internal parts and stainless steel springs.
  - 3. Two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve opening under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.
- B. Double Check Valve Assemblies: Comply with ASSE ASSE 1015 or AWWA C510; Bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.

## 2.18 PRESSURE BOOSTER SYSTEMS

- A. Pumps:
  - 1. Single phase input power converted to 208-230V pump power; soft start; up to 5 Hp; end suction pumps, such as:
    - a. Grundfos Model CR 10-5
    - b. Xylem-Goulds Model 10SV-5
    - c. Or equal
  - 2. Substitutions Permitted: Section 01 60 00 - Product Requirements.
- B. System:
  - 1. "Skid" type system, packaged complete with two pumps, factory assembled, tested, and adjusted; shipped to site as integral unit; consisting of pumps, valves, and galvanized or

- stainless steel piping, with control panel assembled on fabricated steel base with structural steel framework, or on a separate fabricated steel base, or wall mounted.
- a. Grundfos; Hydro MPC-EC Series
  - b. Towle Whitney; TW2018T or TW 2000S Series
  - c. Or equal
2. Substitutions Permitted: Section 01 60 00 - Product Requirements.
- C. Controls and Instruments: Locate in NEMA 250 Type 3R enclosure with main disconnecting switch interlocked with door.
1. Furnish for each motor, fused circuit, magnetic starter with three overloads, control circuit transformer with fuse protection and selector switch for each pump.
  2. Furnish inlet low limit pressure switch (max. 1 psi), low pressure alarm indicator, running indicator, current sensing devices, minimum run timers, manual alternation capacity, suction and discharge pressure gauges, and outlet pump on/off sensor for both analog (4-20mA) floats and pressure sensors up to maximum dynamic head. Install gauge vibration damper (pressure snubber) as necessary –McMaster-Car 3820K28 or approved equal.
- D. System shall include the following features:
1. Dry Running Protection.
  2. Lead Pump Alternation for each pumping cycle.
  3. Changeover after 24 hours continuous run.
  4. Soft Pressure Build-Up.
  5. Pump Run Indicator Lights for each pump.
  6. System Fault Indicator Light.
  7. Individual Pump Fault Indicator Light for each pump.
  8. Surge Arrestor.
  9. Emergency Operation Switch for each pump located on exterior of door.
  10. HOA Switches
  11. Run Time Meter
  12. Cycle Counter
- E. Lead Pump: When lead pump fails to operate, start next pump in sequence automatically.
- F. Time Delay Relay: Prevent lag pumps short cycling on fluctuating demands.
- G. Thermal Bleed Circuit with Solenoid Valve: Prevent overheating during low demand.
- H. Low Pressure Control: Stop pump operation when incoming water pressure approaches atmospheric.
- I. Pump Switch: Permit manual or automatic operation.
- J. Valves: Each pump outlet check valve to maintain constant system pressure. Furnish gate, ball or butterfly valves on suction and discharge of each pump.
- K. Performance:
1. Flow: 55 gpm from each pump
  2. Total Dynamic Head: 182 feet of head to the top of water storage tank

- L. Electrical Characteristics and Components:
  - 1. On-site Power: 230 volts, single phase
  - 2. Disconnect Switch: Factory mount disconnect switch in control panel.
  - 3. Pressure Switch: Pressure from nearby water Distribution System shall be used to automate tank level
    - a. Pressure to stop booster station when tank is full-estimated at 75 PSI (Dynamic)
    - b. Pressure to start booster station with a 3 PSI differential-estimated at 72 PSI (Static)

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

### 3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.

### 3.3 INSTALLATION - GAUGE

- A. Install one pressure gauge for each pump, locate taps on suction and discharge of pump; pipe to gauge.
- B. Install gauge taps in piping.
- C. Install pressure gauges with pulsation dampers. Provide needle valve or ball valve to isolate each gauge.
- D. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- E. Install gauge in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- F. Adjust gauges to final angle, clean windows and lenses, and calibrate to zero.

### 3.4 INSTALLATION - HANGERS AND SUPPORTS

- A. Inserts:
  - 1. Provide inserts for placement in concrete forms.
  - 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
  - 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.
  - 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
  - 5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

- B. Pipe Hangers and Supports:
  - 1. Install in accordance with ASTM F708.
  - 2. Support horizontal piping as schedule.
  - 3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
  - 4. Place hangers within 12 inches of each horizontal elbow.
  - 5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
  - 6. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
  - 7. Prime coat exposed steel hangers and supports. Refer to Section 09 90 00. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

### 3.5 INSTALLATION - ABOVE GROUND PIPING

- A. Install valves with stems upright or horizontal, not inverted.
- B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
- C. Install gate, ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- D. Install globe, ball or butterfly valves for throttling, bypass, or manual flow control services.
- E. Provide lug end butterfly valves adjacent to equipment when functioning to isolate equipment.
- F. Provide spring loaded check valves on discharge of water pumps.
- G. Provide flow controls in water circulating systems as indicated on Drawings.
- H. Install potable water protection devices on plumbing lines where contamination of domestic water may occur; on flush valves, interior and exterior hose bibs.
- I. Pipe relief from valves, back-flow preventers and drains to nearest floor drain.

### 3.6 INSTALLATION - PUMPS

- A. Provide pumps to operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.
- B. Install long radius reducing elbows or reducers between pump and piping. Support piping adjacent to pump so no weight is carried on pump casings. For close coupled or base mounted pumps, install supports under elbows on pump suction and discharge line sizes 4 inches and over.
- C. Install pumps on vibration isolators.
- D. Install flexible connectors at or near pumps where piping configuration does not absorb vibration.

- E. Provide line sized shut-off valve and pump suction fitting on pump suction, and line sized combination pump discharge valve on pump discharge.
- F. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump so no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 4 inches and larger.
- G. Provide air cock and drain connection on horizontal pump casings.
- H. Provide drains for bases and seals.
- I. Check, align, and certify alignment of base mounted pumps prior to start-up.
- J. Install base mounted pumps on concrete housekeeping base, with anchor bolts, set and level, and grout in place. Refer to Section 03 30 00.
- K. Lubricate pumps before start-up.

### 3.7 CLEANING

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.
- B. Disinfect water distribution system in accordance with Section 33 13 00.

END OF SECTION

## SECTION 26 05 19

## ELECTRICAL CONDUCTORS AND CABLES

## PART 1 GENERAL

## 1.1 SUMMARY

- A. Section includes building wire and cable; direct burial cable; service entrance cable; armored cable; metal clad cable; and wiring connectors and connections.
- B. Related Sections:
  - 1. Section 26 05 03 - Equipment Wiring Connections.
  - 2. Section 26 05 33 - Conduit and Boxes for Electrical Systems.
  - 3. Section 26 05 53 - Identification for Electrical Systems: Product requirements for wire identification.
  - 4. Section 31 23 17 - Trenching: Execution requirements for trenching required by this section.
  - 5. Section 31 23 23 - Fill: Requirements for backfill to be placed by this section.

## 1.2 REFERENCES

- A. International Electrical Testing Association:
  - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- B. National Fire Protection Association:
  - 1. NFPA 70 - National Electrical Code.
  - 2. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.
- C. Underwriters Laboratories, Inc.:
  - 1. UL 1277 - Standard for Safety for Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.

## 1.3 SYSTEM DESCRIPTION

- A. Product Requirements: Provide products as follows:
  - 1. Stranded conductor for feeders and branch circuits 10 AWG and smaller.
  - 2. Stranded conductors for control circuits.
  - 3. Conductor not smaller than 12 AWG for power and lighting circuits.
  - 4. Conductor not smaller than 16 AWG for control circuits.
  - 5. Increase wire size in branch circuits to limit voltage drop to a maximum of 5 percent.
- B. Wiring Methods: Provide the following wiring methods:
  - 1. Wet or Damp Interior Locations: Use only building wire, Type THHN/THWN or Type XHHW-2 insulation, in raceway.
  - 2. Exterior Locations: Use only building wire, Type XHHW-2 insulation, in raceway.
  - 3. Underground Locations: Use only building wire, Type XHHW-2 insulation, in raceway.

#### 1.4 DESIGN REQUIREMENTS

- A. Conductor sizes are based on copper unless indicated as aluminum or "AL".
- B. When aluminum conductor is substituted for copper conductor, size to match circuit requirements, terminations, conductor ampacity and voltage drop.

#### 1.5 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit for building wire and all buried or submersible cable.
- C. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors.
- D. Test Reports: Indicate procedures and values obtained.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of components and circuits.

#### 1.7 QUALITY ASSURANCE

- A. Perform Work in accordance with NFPA 70.

#### 1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.

#### 1.9 FIELD MEASUREMENTS

- A. Verify field measurements are as indicated on Drawings.

#### 1.10 COORDINATION

- A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.
- B. Where wire and cable destination is indicated and routing is not shown, determine routing and lengths required.

### PART 2 PRODUCTS

#### 2.1 BUILDING WIRE

- A. Product Description: Single conductor insulated wire.

- B. Conductor: Copper.
- C. Insulation Voltage Rating: 600 volts.
- D. Insulation Temperature Rating: 90 degrees C.

## 2.2 SERVICE ENTRANCE CABLE

- A. Conductor: Copper.
- B. Insulation Voltage Rating: 600 volts.
- C. Insulation: Type USE-2, XHHW-2, or RHW-2.

## 2.3 TERMINATIONS

- A. Terminal Lugs for Wires 6 AWG and Smaller: Solderless, compression type copper.
- B. Lugs for Wires 4 AWG and Larger: Color keyed, compression type copper, with insulating sealing collars.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify interior of building has been protected from weather.
- C. Verify mechanical work likely to damage wire and cable has been completed.
- D. Verify raceway installation is complete and supported.

### 3.2 EXISTING WORK

- A. Ensure all wire is de-energized prior to work.
- B. Remove exposed abandoned wire and cable. Patch surfaces where removed cables pass through building finishes.
- C. Disconnect abandoned circuits and remove circuit wire and cable. Remove abandoned boxes when wire and cable servicing boxes is abandoned and removed. Install blank cover for abandoned boxes not removed.
- D. Provide access to existing wiring connections remaining active and requiring access. Modify installation or install access panel.
- E. Extend existing circuits using materials and methods compatible with existing electrical installations, or as specified.

- F. Clean and repair existing wire and cable remaining or wire and cable to be reinstalled.

### 3.3 INSTALLATION

- A. Route wire and cable to meet Project conditions.
- B. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- C. Special Techniques--Building Wire in Raceway:
  - 1. Pull conductors into raceway at same time.
  - 2. Install building wire 4 AWG and larger with pulling equipment.
- D. Special Techniques - Cable:
  - 1. Protect exposed cable from damage.
  - 2. Support cables above accessible ceiling, using spring metal clips or metal cable ties to support cables from structure. Do not rest cable on ceiling panels.
  - 3. Use suitable cable fittings and connectors.
- E. Special Techniques - Wiring Connections:
  - 1. Clean conductor surfaces before installing lugs and connectors.
  - 2. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
  - 3. Make all splices, taps, terminations and connections in accessible junction boxes or accessible equipment. No connections are to be made, then covered up or pulled into raceways.
  - 4. Tape uninsulated conductors and connectors with electrical tape to 150 percent of insulation rating of conductor.
  - 5. Install split bolt connectors for copper conductor splices and taps, 6 AWG and larger.
  - 6. Install solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
  - 7. Install insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
- F. Install stranded conductors for branch circuits 10 AWG and smaller. Install crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under screws.
- G. Install terminal lugs on ends of 600 volt wires unless lugs are furnished on connected device, such as circuit breakers.
- H. Size lugs in accordance with manufacturer's recommendations terminating wire sizes. Install 2-hole type lugs to connect wires 4 AWG and larger to copper bus bars.
- I. For terminal lugs fastened together such as on motors, transformers, and other apparatus, or when space between studs is small enough that lugs can turn and touch each other, insulate for dielectric strength of 2-1/2 times normal potential of circuit.

### 3.4 WIRE COLOR

- A. General:
  - 1. For wire sizes 10 AWG and smaller, install wire colors in accordance with the following:

- a. Black and red for single phase circuits at 120/240 volts.
  - b. Black, red, and blue for circuits at 120/208 volts single or three phase.
  - c. Orange, brown, and yellow for circuits at 277/480 volts single or three phase.
2. For wire sizes 8 AWG and larger, identify wire with colored tape at terminals, splices and boxes. Colors are as follows:
- a. Black and red for single phase circuits at 120/240 volts.
  - b. Black, red, and blue for circuits at 120/208 volts single or three phase.
  - c. Orange, brown, and yellow for circuits at 277/480 volts single or three phase.
- B. Neutral Conductors: White. When two or more neutrals are located in one conduit, individually identify each with proper circuit number.
- C. Branch Circuit Conductors: Install three or four wire home runs with each phase uniquely color coded.
- D. Feeder Circuit Conductors: Uniquely color code each phase.
- E. Ground Conductors:
1. For 6 AWG and smaller: Green.
  2. For 4 AWG and larger: Identify with green tape at both ends and visible points including junction boxes.

### 3.5 FIELD QUALITY CONTROL

- A. Sections 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.3.1.

END OF SECTION

SECTION 31 10 00

SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Removing surface debris.
  - 2. Removing designated paving and curbs.
  - 3. Removing designated trees, shrubs, and other plant life.
  - 4. Removing abandoned utilities.
  - 5. Excavating topsoil.
  
- B. Related Sections:
  - 1. Section 02 41 16 - Structure Demolition: Removing underground storage tanks and designated utilities.
  - 2. Section 31 22 13 - Rough Grading.
  - 3. Section 31 23 18 - Rock Removal.

1.2 QUALITY ASSURANCE

- A. Perform cutting and removal of paving and curbs in accordance with California Department of Transportation (Caltrans) standards.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.
  
- B. Verify existing plant life designated to remain is tagged or identified.

3.2 PREPARATION

- A. Call California Dig Alert at 811 not less than three working days before performing Work. Contact Owner for information about utilities not identifiable by California Dig Alert.
  - 1. Request underground utilities to be located and marked within and surrounding construction areas.

### 3.3 PROTECTION

- A. Locate, identify, and protect utilities indicated to remain, from damage.
- B. Protect trees, plant growth, and features designated to remain, as final landscaping.
- C. Protect bench marks, survey control points, and existing structures from damage or displacement.

### 3.4 CLEARING

- A. Clear areas required for access to site and execution of Work to minimum depth of 3 inches.
- B. Remove trees and shrubs within marked areas. Remove stumps, root system to depth of 12 inches, and surface rock.
- C. Clear undergrowth and deadwood, without disturbing subsoil.

### 3.5 REMOVAL

- A. Remove debris, rock, and extracted plant life from site.
- B. Partially remove paving and curbs as indicated on Drawings. Neatly saw cut edges at right angle to surface.
- C. Remove abandoned utilities. Indicated removal termination point for underground utilities on Record Documents.
- D. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on site.
- E. Do not burn or bury materials on site. Leave site in clean condition.

### 3.6 TOPSOIL AND SUBSOIL EXCAVATION

- A. Excavate topsoil and subsoil from areas to be further excavated or regraded, without mixing with foreign materials for use in finish grading.
- B. Do not excavate wet topsoil or subsoil
- C. Stockpile in area designated on site to height not exceeding 8 feet and protect from erosion.
- D. When excavating through roots, perform Work by hand and cut roots with sharp axe.
- E. Coordinate with Engineer for local placement of excess topsoil.

END OF SECTION

## SECTION 31 23 16

### EXCAVATION

#### PART 1 GENERAL

##### 1.1 SUMMARY

- A. Section Includes:
  - 1. Excavating for building foundations.
  - 2. Excavating for paving and roads.
  - 3. Excavating for slabs-on-grade.
  - 4. Excavating for site structures.
  
- B. Related Sections:
  - 1. Section 31 22 13 - Rough Grading: Topsoil and subsoil removal from site surface.
  - 2. Section 31 23 17 - Trenching: Excavating for utility trenches.
  - 3. Section 31 23 18 - Rock Removal: Removal of rock during excavating.
  - 4. Section 33 36 00 - Utility Septic Tanks.

##### 1.2 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
  
- B. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan. Identify name and contact information for Competent Person.

#### PART 2 PRODUCTS

NOT USED

#### PART 3 EXECUTION

##### 3.1 PREPARATION

- A. Call California Dig Alert at 811 not less than three working days before performing Work. Contact Owner for information about utilities not identifiable by California Dig Alert.
  - 1. Request underground utilities to be located and marked within construction areas.
  
- B. Identify required lines, levels, contours, and datum.
  
- C. Protect utilities indicated to remain from damage.
  
- D. Protect plant life, lawns, and other features remaining as portion of final landscaping.

- E. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

### 3.2 EXCAVATION

- A. Underpin adjacent structures which may be damaged by excavation work.
- B. Excavate subsoil to accommodate building foundations, slabs-on-grade, paving, site structures, and construction operations.
- C. Compact disturbed load bearing soil in direct contact with foundations to original bearing capacity; perform compaction in accordance with Section 31 23 17.
- D. Slope banks with machine to angle of repose or less until shored.
- E. Do not interfere with 45 degree bearing splay of foundations.
- F. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- G. Trim excavation. Remove loose matter.
- H. Notify Engineer of unexpected subsurface conditions.
- I. Correct areas over excavated with structural fill Type specified in Section 31 23 17.
- J. Remove excess and unsuitable material from site.
- K. Repair or replace items indicated to remain that are damaged by excavation.

### 3.3 BACKFILLING

- A. Place structure fill material in uniform layers on all sides of the structure 6 inches thick.
- B. Do not fill structure material until the structure footing or other portions of the structure have been inspected.
- C. Compact to 95% of maximum density for bedding under structures. Compact to 90% in other circumstances.
- D. Use excavated soil as final backfill material unless Engineer determines it is unsuitable. Unsuitable final backfill material is solid or loose rock larger than 6 inches or lumps larger than 3 inches. Do not use organic matter or debris.

### 3.4 PROTECTION

- A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.
- B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

- C. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

### 3.5 RESTORATION

- A. Restore sidewalks, curbs, and gutters to their original condition. Comply with the standards and construction requirements of Caltrans or other local authority.
- B. Machine compact backfill under the sidewalk as follows:
  - 1. Cut the existing curb or sidewalk to a neat line.
  - 2. Match the depth of base course material with that present under adjacent curbs or sidewalks.
  - 3. Match the existing concrete sidewalk in width, thickness, slope and finish, but not less than 4 inches in thickness.
  - 4. Use wire mesh reinforcement, 6 inch by 6 inch, mid depth in concrete.

END OF SECTION

## SECTION 31 23 17

## TRENCHING

## PART 1 GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Excavating trenches for utilities from 5 feet outside building.
2. Compacted fill from top of utility bedding.
3. Backfilling and compaction.

## B. Related Sections:

1. Section 03 30 00 - Cast-In-Place Concrete: Concrete materials.
2. Section 31 22 13 - Rough Grading: Topsoil and subsoil removal from site surface.
3. Section 31 23 16 - Excavation: General building excavation.
4. Section 31 23 18 - Rock Removal: Removal of rock during excavating.
5. Section 31 37 00 - Riprap.
6. Section 33 11 13 - Water Mains: Water piping and bedding.
7. Section 33 11 16 - Water Distribution Valves and Hydrants.
8. Section 33 12 13 - Water Service Connections: Water piping and bedding from building to utility service.
9. Section 33 31 00 - Individual Sewerage Piping: Sanitary sewer piping and bedding from building to utility service.
10. Section 33 31 13 - Community Sewerage Piping: Sanitary sewer piping and bedding.
11. Section 33 36 00 - Utility Septic Tanks.

## 1.2 REFERENCES

## A. ASTM International:

1. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
2. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
3. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

## B. California Department of Transportation:

1. California Test Method 216 – Relative Compaction of Untreated and Treated Soils and Aggregates.
2. California Test Method 217 – Method of Test for Sand Equivalent.
3. California Test Method 229 – Method of Test for Durability Index
4. California Test Method 301 – Method of Test for Determining the “R” Value of Treated and Untreated Bases, Subbases, and Basement Soils by the Stabilometer.

1.3 DEFINITIONS

- A. Utility: Any buried pipe, duct, conduit, or cable.

1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan. Identify name and contact information for Competent Person.
- C. Product materials for pipe embedment, structural fill or cement slurry mix.
- D. Obtain Engineer approval prior to using any locally procured material as backfill.

PART 2 PRODUCTS

2.1 FILL MATERIALS

- A. Imported Pipe Embedment: Angular crushed stone or gravel; free of shale, clay, friable material and debris; graded in accordance with ASTM D2321, Class 1B soils, within the following limits:

Sieve Size	Percent Passing
1 ½ inch	100
3/8 inch	90 to 100
No. 4	5 to 50
No. 200	0 to 5

- B. Imported Structural Fill: Complies with requirements of Caltrans Class 3 Aggregate Subbase:

Sieve Size	Percent Passing
3 inches	100
2 inches	87 to 100
No. 4	45 to 100
No. 200	0 to 34
Resistance (R-value)	40 minimum

- C. Cement Slurry Fill: Per Caltrans Standard Specifications, current edition.
  1. Fluid workable mixture of aggregate, cement and water that will flow without segregation of the aggregate while being placed.
  2. Water shall be free from oil, salts and other impurities that would have an adverse effect.
  3. Proportion cement slurry fill by weight or volume: Not less than 188 lbs of cement shall be used for each cubic yard of material produced.

- 4. Aggregate must be one of the following:
  - a. Commercial quality concrete sand.
  - b. Excavated or imported material, free of organic material and other deleterious substances, and complying with grading requirements in the following table

Sieve Size	Percent Passing
1 ½ inches	100
1 inch	80 to 100
¾ inches	60 to 100
3/8 inches	50 to 100
No. 4	40 to 80
No. 100	10 to 40

PART 3 EXECUTION

3.1 LINES AND GRADES

- A. Lay pipes to lines and grades indicated on Drawings.
  - 1. Owner reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.
- B. Use calibrated equipment with qualified operator to establish lines and grades.

3.2 PREPARATION

- A. Call California Dig Alert at 811 not less than three working days before performing Work. Contact Owner for information about utilities not identifiable by California Dig Alert.
  - 1. Request underground utilities to be located and marked within and surrounding construction areas.
- B. Identify required lines, levels, contours, and datum locations.
- C. Protect plant life, lawns, and other features remaining as portion of final landscaping.
- D. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- E. Maintain and protect above and below grade utilities indicated to remain.
- F. Establish temporary traffic control when trenching is performed in public right-of-way. Relocate controls as required during progress of Work.

### 3.3 TRENCHING

- A. Remove boulders and rock up of 1 cubic yard, measured by volume. Remove larger material as specified in Section 31 23 18.
- B. Cut trenches sufficiently wide to enable installation and allow inspection. Remove water or materials that interfere with Work.
- C. Excavate bottom of trenches between 12 and 24 inches wider than outside diameter of pipe.
- D. Excavate trenches to depth indicated on Drawings. Provide uniform and continuous bearing and support for bedding material and pipe utilities.
- E. Do not interfere with 45 degree bearing splay of foundations.
- F. Perform work in accordance with excavation plan. If no excavation plan has been submitted and approved, slope or bench side walls of excavation starting 3 feet above top of pipe. When side walls cannot be sloped, provide sheeting and shoring to protect excavation as specified in this section.
- G. When subsurface materials at bottom of trench are loose or soft. Excavate to greater depth as directed by Engineer. Backfill with imported pipe embedment. Remove large rock, boulders, and large stones to provide 3 inches of soil cushion on all sides of the pipe and pipe accessories.
- H. Cut out soft areas of subgrade not capable of compaction in place. Excavate to greater depth as directed by Engineer. Backfill with imported structural fill and compact to density equal to or greater than requirements for subsequent backfill material.
- I. Trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.
- J. Correct over excavated areas with compacted backfill as specified for authorized excavation or replace with cement slurry fill as directed by Engineer.
- K. Remove excess subsoil not intended for reuse, from site.

### 3.4 STOCKPILING OF IMPORTED MATERIALS

- A. Stockpile materials on site at locations designated by Engineer.
- B. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.
- C. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.
- D. Control erosion from stockpiles in accordance with Section 31 25 13 and approved Storm Water Pollution Prevention Plan (SWPPP), where required.

### 3.5 STOCKPILE CLEANUP

- A. Leave unused materials in neat, compact stockpile.

- B. When borrow area is indicated, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

### 3.6 SHEETING AND SHORING

- A. Conform to approved excavation plan, where applicable.
- B. Sheet, shore, and brace excavations to prevent danger to persons, structures and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.
- C. Support trenches more than 5 feet deep excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.
- D. Design sheeting and shoring to be removed at completion of excavation work.
- E. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.
- F. Repair damage to new and existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

### 3.7 BACKFILLING

- A. Use excavated soil as pipe embedment unless Engineer determines it is unsuitable. Unsuitable material is defined as incapable of being compacted to specified density with optimum moisture content, solid or loose rock, lump material larger than 1-inch, organic matter, or debris.
- B. Use excavated soil as final pipe backfill or as structural fill unless Engineer determines it is unsuitable. Unsuitable final pipe backfill or structural fill is solid or loose rock larger than 6-inches or lumps larger than 3-inches. Do not use organic matter or debris.
- C. Backfill trenches to contours and elevations with unfrozen fill materials.
- D. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
- E. Place material in continuous layers as follows:
  - 1. All Backfill within Roadway and Shoulder: Maximum 6 inches compacted depth.
  - 2. Structural Fill: Maximum 6 inches compacted depth.
  - 3. Pipe Embedment and Haunching: Maximum 6 inches compacted depth.
  - 4. Final Backfill in Unimproved Areas: Maximum 12 inches compacted depth.
- F. Employ placement method that does not disturb or damage foundation perimeter drainage and utilities in trench.
- G. Maintain optimum moisture content of fill materials to attain required compaction density.
- H. Do not leave trench open at end of working day. If required, protect open trench to prevent danger to the public.

3.8 CEMENT SLURRY BACKFILLING

- A. Maintain a minimum 6-inches clear distance between outside of pipe and side of the excavation.
- B. Compacted earth plugs or other suitable system shall be placed at the ends of the trench to receive slurry backfill to completely contain the slurry in the trench.
- C. Place in a uniform manner that will prevent voids in, or segregation of, the backfill, and will not float or shift the pipe.
- D. Backfilling over or placing any material over the cement slurry backfill shall not commence until 4 hours after the slurry has been placed.
- E. Cement slurry backfill shall not be used where it would be in contact with aluminum or aluminum coated materials.

3.9 COMPACTION

- A. Compact backfill to percentage of maximum density determined by ASTM D1557 unless otherwise specified by permit or authority:

Percent of Maximum Density

<u>Location</u>	<u>Bedding &amp; Haunching</u>	<u>Initial &amp; Final Backfill</u>
Roadways, Improved Surfaces	95	95
Roadway Rights-of-Way, Outside of Roadway Prism	90	90
Backfill Around Structures	95	95
Unimproved Surfaces, Fields, Etc	90	80

3.10 FIELD QUALITY CONTROL

- A. Sections 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Perform laboratory material tests in accordance with ASTM D1557.
- C. Perform in place compaction tests in accordance with the following:
  - 1. Density Tests: ASTM D1556 or ASTM D6938.
  - 2. Moisture Tests: ASTM D6938.
- D. When tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.

- E. Frequency and Location of Tests: as directed by Engineer, typically not to exceed one location every 500 linear feet for pipe installations or every 1,000 square feet for structures. Multiple tests of different lifts at a single location may be required as directed by Engineer.

### 3.11 REMOVAL OF NUISANCE WATER

- A. Control site drainage, springs and runoff, and prevent water from adversely affecting trenching locations.
- B. Remove nuisance water entering the trenches. Water that can be removed through the use of sump or transfer pumps will not be considered dewatering for payment purposes.
- C. Keep trenches free from standing water until the facilities are in place, open ends plugged against the entrance of water, and backfill has been placed and compacted.

### 3.12 PROTECTION OF FINISHED WORK

- A. Section 01 70 00 - Execution and Closeout Requirements: Protecting finished work.
- B. Reshape and re-compact fills subjected to vehicular traffic during construction.

END OF SECTION

## SECTION 32 31 13

## CHAIN LINK FENCES AND GATES

## PART 1 GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Fence framework, fabric, and accessories.
2. Excavation for post bases.
3. Concrete foundation for posts and center drop for gates.
4. Manual gates and related hardware.

## B. Related Sections:

1. Section 03 30 00 – Cast-in-Place Concrete: Concrete anchorage for posts.

## 1.2 REFERENCES

## A. ASTM International:

1. ASTM A121 - Standard Specification for Metallic-Coated Carbon Steel Barbed Wire.
2. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
4. ASTM A392 - Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
5. ASTM A824 - Standard Specification for Metallic-Coated Steel Marcellled Tension Wire for Use with Chain Link Fence.
6. ASTM F567 - Standard Practice for Installation of Chain-Link Fence.
7. ASTM F626 - Standard Specification for Fence Fittings.
8. ASTM F900 - Standard Specification for Industrial and Commercial Swing Gates.
9. ASTM F1043 - Standard Specification for Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework.
10. ASTM F1083 - Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
11. ASTM F1184 - Standard Specification for Industrial and Commercial Horizontal Slide Gates.

## B. Chain Link Fence Manufacturers Institute:

1. CLFMI - Product Manual.

## 1.3 SYSTEM DESCRIPTION

- A. Fence Height: 6 feet nominal height, unless otherwise indicated on Drawings.
- B. Line Post Spacing: At intervals not exceeding 10 feet.
- C. Fence Post and Rail Strength: Conform to ASTM F1043 Light Industrial Fence quality.

- D. Barbed Wire: Conform to ASTM A121, 3 strands of wire, twisted with four point barbs.

#### 1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates, and schedule of components.
- C. Product Data: Submit data on fabric, posts, accessories, fittings and hardware.

#### 1.5 QUALITY ASSURANCE

- A. Supply material in accordance with CLFMI - Product Manual.
- B. Perform installation in accordance with ASTM F567.

#### 1.6 DELIVERY, STORAGE AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Deliver fence fabric and accessories in packed cartons or firmly tied rolls.
- C. Identify each package with manufacturer's name. Store fence fabric and accessories in secure and dry place.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers:
  - 1. Master Halco Galvanized Steel Fabric, Posts, and Hardware.
  - 2. Builders Fence Company Galvanized Steel Fabric, Posts, and Hardware.
  - 3. Substitutions Permitted: Section 01 60 00 - Product Requirements.

#### 2.2 MATERIALS AND COMPONENTS

- A. Materials and Components: Conform to CLFMI Product Manual and ASTM F1043 Light Industrial / Commercial Fence Framework.
- B. Steel Chain Link Fabric: 2 inch mesh, 9 gauge.
  - 1. Zinc-Coated Steel Fabric: ASTM A392 hot dipped galvanized before or after weaving.
    - a. Class 1: 1.2 ounce per square foot
  - 2. Fabric selvage: Twisted top selvage, knuckled bottom selvage.

- C. Steel Fence Framework: Round steel pipe and rail: ASTM F1043, Group IC-L Light Industrial / Commercial Fence Framework, schedule 40 galvanized pipe per ASTM F1083. Exterior hot dipped zinc coating minimum average 1.8 ounce per square foot. Regular Grade, Type I round.
  - 1. Line post: 1.90 inch OD, 2.28 pounds per foot.
  - 2. End, Corner, Pull, Terminal and Swing Gate post (up to 4 foot width): 2.375 inch OD, 3.12 pounds per foot.
  - 3. Swing Gate post (over 4 foot width) and Sliding Gate post (up to 10 foot width): 2.875 inch OD, 4.64 pounds per foot.
  - 4. Sliding Gate post (over 10 foot width): 4.00 inch OD, 6.56 pounds per foot.
  - 5. Top, brace, bottom and intermediate rails: 1.66 inch OD, 1.84 pounds per foot.
- D. Metallic Coated Steel Marcellled Tension Wire: 7 gauge marcellled wire complying with ASTM A824. Match coating type to that of the chain link fabric.
  - 1. Type II Zinc Coated Class 4 – 1.2 ounce per square foot.
- E. Metallic Coated Steel Barbed Wire: Comply with ASTM A121, Design Number 12-4-5-14R, double 12 ½ gauge twisted strand wire, with 4 point 14 gauge round barbs spaced 5 inches on center. Match coating type to that of the chain link fabric.

### 2.3 ACCESSORIES

- A. Tension and Brace Bands: Galvanized pressed steel complying with ASTM F626, minimum steel thickness of 12 gauge, minimum width of ¾ inch and minimum zinc coating of 1.20 ounce per square foot.
- B. Terminal Post Caps, Line Post Loop Tops, Rail and Brace Ends, Boulevard Clamps and Rail Sleeves: In compliance with ASTM F626, pressed steel galvanized after fabrication having a minimum zinc coating of 1.20 ounce per square foot.
- C. Truss Rod Assembly: In compliance with ASTM F626, 3/8 inch diameter steel truss rod with a pressed steel tightener, minimum zinc coating of 1.2 ounce per square foot, assembly capable of withstanding a tension of 2,000 pounds.
- D. Tension Bars: In compliance with ASTM F626. Galvanized steel one-piece length 2 inch less than fabric height, minimum zinc coating of 1.2 ounce per square foot.
  - 1. Bars for 2 inch mesh shall have a minimum cross section of 3/16 inch by ¾ inch.
- E. Barbed Wire Arms: In compliance with ASTM F626, pressed steel galvanized after fabrication, minimum zinc coating of 1.2 ounce per square foot, capable of supporting a vertical load of 250 pounds.
  - 1. Sloped to 45 degrees, double arm, manufactured to accommodate 3 strands of barbed wire.
- F. Gate Hardware: Fork latch with gravity drop, Center gate stop and drop rod (where indicated in drawings); 180 degree gate hinges for each leaf and hardware for padlock keyed to match hardware.
  - 1. Gate latch fabricated of 5/16 inch thick by 1 ¾ inch pressed steel galvanized after fabrication.
  - 2. Galvanized malleable iron or heavy gauge pressed steel post and frame hinges.

## 2.4 GATES

### A. General:

1. Gate Types, Opening Widths and Directions of Operation: As indicated on Drawings.
2. Design gates for operation by one person.

### B. Swing Gates:

1. Fabricate gates to permit 180 degree swing.
2. Gates Construction: Galvanized steel welded fabrication in compliance with ASTM F900 with welded corners. Gate frame members 1.90 inch OD.
3. Frame members spaced no greater than 8 feet apart vertically and horizontally.
4. Match gate fabric to that of the fence system.

### C. Sliding Gates:

1. Framing and Posts: ASTM F1184, Class 2 for internal rollers.
2. Gate framing to be of welded construction, minimum 1.90 inch OD pipe members.
3. Frame members spaced no greater than 8 feet apart vertically and horizontally.
4. Match gate fabric to that of the fence system.
5. Rollers for overhead and cantilever sliding gates: Bearing type. Furnish non-sealed bearings with grease fitting for periodic maintenance.
6. Secure rollers to post or frame without welding.

## 2.5 FINISHES

- A. Components and Fabric: Galvanized to ASTM A123 for components; ASTM A153 for hardware; ASTM A392 for fabric.
- B. Accessories: Same finish as framing.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install framework, fabric, accessories and gates in accordance with ASTM F567.
- B. Set intermediate, terminal, and gate posts plumb, in concrete footings with top of footing 2 inches above finish grade. Slope top of concrete for water runoff.
- C. Line Post Footing Depth Below Finish Grade: 3 feet.
- D. Corner, Gate and Terminal Post Footing Depth Below Finish Grade: 3 feet.
- E. Brace each gate and corner post to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail one bay from end and gate posts.
- F. Install top rail through line post tops and splice with 6 inch long rail sleeves.
- G. Install center brace rail on corner gate leaves.

- H. Place fabric on outside of posts and rails.
- I. Do not stretch fabric until concrete foundation has cured 7 days.
- J. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is less.
- K. Position bottom of fabric 2 inches above finished grade.
- L. Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 15 inches on centers.
- M. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.
- N. Install bottom tension wire stretched taut between terminal posts.
- O. Install support arms sloped outward and attach barbed wire; tension and secure.
- P. Support gates from gate posts. Do not attach hinged side of gate from building wall.
- Q. Install gate with fabric and barbed wire overhang to match fence. Install three hinges on each gate leaf, latch, catches, drop bolt, retainer and locking clamp.
- R. Where indicated on drawings, provide concrete center drop to footing depth and drop rod retainers at center of double gate openings.
- S. Connect to existing fence at existing terminal post.
- T. Install posts with 6 inches maximum clear opening from end posts to buildings, fences and other structures.
- U. Excavate holes for posts to diameter and spacing indicated on Drawings without disturbing underlying materials.
- V. Center and align posts. Place concrete around posts, and vibrate or tamp for consolidation. Verify vertical and top alignment of posts and make necessary corrections.

### 3.2 ERECTION TOLERANCES

- A. Section 01 40 00 - Quality Requirements: Tolerances.
- B. Maximum Variation From Plumb: ¼ inch.
- C. Maximum Offset From Indicated Position: 1 inch.

END OF SECTION

## SECTION 33 11 13

## WATER DISTRIBUTION MAINS

## PART 1 GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Pipe and fittings for public water line including potable water line and fire water line.
2. Tapping Sleeves and Valves.
3. Underground pipe markers.

## B. Related Requirements:

1. Section 03 30 00 - Cast-In-Place Concrete: Concrete for thrust restraints.
2. Section 31 23 17 - Trenching: Execution requirements for trenching required by this section.
3. Section 33 05 17 - Precast Concrete Valve Vaults and Meter Boxes.
4. Section 33 05 23 - Trenchless Utility Installation: Waterline installation under roadways and other obstructions.
5. Section 33 11 16 - Water Distribution Valves and Hydrants.
6. Section 33 12 13 - Water Service Connections: Backflow prevention at water main.
7. Section 33 13 00 - Disinfecting of Water Utility Distribution: Disinfection of water piping.

## 1.2 REFERENCE STANDARDS

## A. ASTM International:

1. ASTM A36 - Standard Specification for Carbon Structural Steel.
2. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
4. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
5. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
6. ASTM F2164 - Standard Practice for Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure.
7. ASTM F2620 - Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings.

## B. American Water Works Association:

1. AWWA C104 - ANSI Standard for Cement Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. AWWA C105 - ANSI Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. AWWA C110 - ANSI Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (76 mm Through 1,219 mm), for Water.
4. AWWA C111 - ANSI Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

5. AWWA C115 - ANSI Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
6. AWWA C151 - ANSI Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids.
7. AWWA C153 - ANSI Standard for Ductile-Iron Compact Fittings for Water Service.
8. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
9. AWWA C605 - Water Treatment - Underground Installation of Polyvinyl Chloride PVC Pressure Pipe and Fittings for Water.
10. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. through 12 In. (100 mm Through 300 mm), for Water Distribution.
11. AWWA C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 36 In. (350 mm Through 1,200 mm), for Water Transmission and Distribution.
12. AWWA C906 - Polyethylene (PE) Pressure Pipe and Fittings, 4 in. Through 65 in., for Waterworks.
13. AWWA M55 - PE Pipe – Design and Installation.

### 1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit data on pipe materials, pipe fittings, valves and accessories.

### 1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.
- C. Certification of pressure testing and bacteriological testing to verify proper disinfection of pipe.

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Block individual and stockpiled pipe lengths to prevent moving.
- C. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.
- D. Store PVC materials out of sunlight as much as practicable.
- E. Ship and deliver polyethylene pipe and fittings from manufacturer with dust plugs on pipe ends and fitting ends.
- F. Do not use chains, wire rope, forklifts or other methods or equipment that may gouge or damage polyethylene pipe.

## 1.6 EXISTING CONDITIONS

- A. Verify field measurements prior to fabrication. Indicate field measurements on shop drawings.

## PART 2 PRODUCTS

## 2.1 WATER PIPING

- A. Ductile Iron Pipe:
  - 1. Pipe Class: AWWA C151, for nominal thickness, rated water working pressure and maximum depth of cover.
  - 2. Fittings: Ductile iron, AWWA C110. Compact fittings AWWA C153.
    - a. Coating and Lining:
      - 1) Bituminous Coating: AWWA C110.
      - 2) Cement Mortar Lining: AWWA C104, double thickness.
  - 3. Joints:
    - a. Mechanical and Push-On Joints: AWWA C111.
    - b. Flanged Joints: AWWA C115.
    - c. Restrained Joints (where indicated on drawings): Boltless, push-on type, joint restraint independent of joint seal.
  - 4. Jackets: AWWA C105 polyethylene jacket: Double layer, half lapped, 10 mil polyethylene tape. Required at all fittings and flanged joints.
- B. Polyvinyl Chloride (PVC): AWWA C900 and AWWA C905, Class 165, or as indicated on drawing:
  - 1. Fittings: PVC AWWA C900/AWWA C905, or ductile iron AWWA C153, or cast iron AWWA C111.
  - 2. Joints: ASTM D3139, PVC flexible elastomeric seals. Solvent-cement couplings are not permitted.
- C. Polyvinyl Chloride (PVC) with internal restrained joints: AWWA C900, Class 235:
  - 1. Fittings: PVC AWWA C900/AWWA C905, or ductile iron AWWA C153, or cast iron AWWA C111.
  - 2. Joints: ASTM D3139, PVC flexible elastomeric seals. Solvent-cement couplings are not permitted.
- D. Polyvinyl Chloride (PVC): ASTM D1785 Schedule 40 or 80, as indicated in Drawings:
  - 1. Fittings: PVC AWWA C900/AWWA C905, or ductile iron AWWA C153, or cast iron AWWA C111.
  - 2. Joints: ASTM D3139, PVC flexible elastomeric seals. Solvent-cement couplings are not permitted.
- E. High Density Polyethylene Pipe: AWWA C906, made from PE4710 resin unless otherwise indicated in Drawings, Dimension Ratio (DR) as specified in Bid Schedule:
  - 1. Fittings: AWWA C906, molded or fabricated.
  - 2. Joints: ASTM F2620, butt fusion.

## 2.2 TAPPING SLEEVES AND VALVES

- A. Tapping Sleeves:
  - 1. Manufacturer List:
    - a. Kennedy Valve Co.
    - b. Mueller Co.
    - c. ROMAC Industries, Inc.
    - d. Substitutions Permitted: Section 01 60 00 - Product Requirements: Requirements for substitutions for other manufacturers and products.
- B. Tapping Valves:
  - 1. Manufacturer List:
    - a. Kennedy Valve Co.
    - b. Mueller Co.
    - c. U.S. Pipe
    - d. Substitutions Permitted: Section 01 60 00 - Product Requirements: Requirements for substitutions for other manufacturers and products.

## 2.3 VALVES AND FIRE HYDRANTS

- A. Valves: Conform to Section 33 11 16.
- B. Fire Hydrants: Conform to Section 33 11 16

## 2.4 UNDERGROUND PIPE MARKERS

- A. Description: Plastic Ribbon Tape: Bright colored, continuously printed "WATER", minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.
- B. Trace Wire: Electronic detection materials for non-conductive piping products.
  - 1. Unshielded 10 AWG THWN insulated copper wire.
  - 2. Conductive tape.

## 2.5 FINISHES

- A. Steel: Galvanizing, ASTM A123; hot dip galvanize after fabrication.

## 2.6 ACCESSORIES

- A. Concrete for Thrust Restraints: Conform to Section 03 30 00.
- B. Steel rods, bolt, lugs and brackets: ASTM A36 Grade A carbon steel.
- C. Protective Coating: Bituminous coating.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.
- B. Verify existing utility water main size, location, and invert are as indicated on Drawings.

#### 3.2 PREPARATION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation preparation.
- B. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs. Use only equipment specifically designed for pipe cutting. The use of chisels or hand saws will not be permitted. Grind edges smooth with beveled end for push-on connections.
- C. Remove scale and dirt on inside and outside before assembly.
- D. Prepare pipe connections to equipment with flanges or unions.

#### 3.3 BEDDING

- A. Excavate pipe trench in accordance with Section 31 23 17 for Work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated on Drawings.
- B. Dewater excavations to maintain dry conditions and preserve final grades at bottom of excavation.
- C. Provide sheeting and shoring in accordance with Section 31 23 17.
- D. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 6 inches compacted depth; compact to 95 percent.

#### 3.4 INSTALLATION – PIPE

- A. Install ductile iron piping and fittings to AWWA C600.
- B. Install PVC pipe in accordance with AWWA C605.
- C. Handle and assemble pipe in accordance with manufacturer's instructions and as indicated on Drawings.
- D. Steel Rods, Bolt, Lugs, and Brackets: Coat buried steel with one coat of coal tar coating before backfilling.
- E. Maintain minimum 10 ft parallel horizontal separation of water main from sewer piping.

- F. Maintain minimum 25 ft horizontal separation of water main from septic tank, septic drainfield or pressure-dosed mound.
- G. Water mains shall be no less than 45 degrees to and at least one foot above sanitary sewer and storm drain lines where those lines must cross. All portions of the water main within 10 horizontal feet of the sewer line shall be encased in a continuous sleeve or cement slurry fill.
- H. Install pipe to indicated elevation to within tolerance of 1 inch.
- I. Route pipe in straight line. Re-lay pipe that is out of alignment or grade.
- J. Install pipe with no high points. If unforeseen field conditions arise which necessitate high points, install air release valves as directed by Engineer.
- K. Install pipe to have bearing along entire length of pipe. Do not lay pipe in wet or frozen trench.
- L. Prevent foreign material from entering pipe during placement.
- M. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- N. Close pipe openings with watertight plugs during work stoppages.
- O. Install access fittings to permit disinfection of water system performed under Section 33 13 00.
- P. Establish elevations of buried piping with not less than 2.5 feet of cover, unless otherwise specified in drawings. Measure depth of cover from final surface grade to top of pipe barrel.
- Q. Install plastic ribbon tape continuous buried 12 inches below finish grade, above pipe line; coordinate with Section 31 23 17.

### 3.5 INSTALLATION – POLYETHYLENE PIPE

- A. Install HDPE pipe and fittings in accordance with ASTM D2321 and AWWA M55.
- B. Bending radius of polyethylene pipe shall be not less than 50 feet if not near a fitting or a joint.
- C. Bending radius of polyethylene pipe shall be not less than 100 feet when near a fitting or a joint.
- D. For all Polyethylene pipe, wait a minimum of 24 hours after burial before initiating pressure testing or installing in-line anchoring.
- E. For all connections of polyethylene pipe to PVC or to Ductile Iron pipe:
  - 1. Restrained joints shall be used at all such connections.
  - 2. Thrust anchors shall be installed at all such connections as well. These anchors may be comprised of either:
    - a. A suitable number of restrained joints on the PVC or Ductile Iron pipe, as submitted by the Contractor, or
    - b. Thrust blocks on the PVC or Ductile Iron pipe, if feasible, or
    - c. In-line anchoring of Polyethylene pipe near the connection.

### 3.6 TRACE WIRE INSTALLATION

- A. Install trace wire continuous over top of pipe; coordinate with Section 31 23 17.
- B. Provide attachments to the pipe with plastic zip ties or duct tape a minimum of every 10 feet.
- C. Avoid underground splices, but where necessary, make splices with an underground, waterproof splice kit.
- D. Provide riser boxes at each gate valve location.
  - 1. Install an independent tracer wire line between each gate valve box in each direction of pipe.
  - 2. Bring tracer wire a minimum of 18 inches of slack wire above gate valve riser using box construction specified.
  - 3. Install box to elevation that will not interfere with operation and maintenance of the valve.
- E. Test tracer wire for proper functioning using a conductive/inductive type locator in the presence of the Engineer or a designated representative.
- F. Repair and retest, at no cost, any section of trace wire that does not function properly.

### 3.7 INSTALLATION - VALVES AND HYDRANTS

- A. Install valves and hydrants in accordance with Section 33 11 16.

### 3.8 INSTALLATION - TAPPING SLEEVES AND VALVES

- A. Install tapping sleeves and valves in accordance with Drawings and in accordance with manufacturer's instructions.

### 3.9 THRUST RESTRAINT

- A. Provide valves, tees, bends, caps, and plugs with concrete thrust blocks. Pour concrete thrust blocks against undisturbed earth. Locate thrust blocks at each elbow or change of pipe direction to resist resultant force and so pipe and fitting joints will be accessible for repair. Provide thrust restraint bearing on subsoil as shown in Drawings and in compliance with AWWA standards.
- B. Install tie rods, clamps, set screw retainer glands, or restrained joints. Protect metal restrained joint components against corrosion by applying a bituminous coating. Do not encase pipe and fitting joints to flanges.
- C. Install thrust blocks, tie rods, and/or joint restraint at dead ends of water main.

### 3.10 CONNECTION TO EXISTING WATER MAINS

- A. Shut off of water mains will not be permitted overnight, on weekends, or on federal, state, or tribal holidays. Water shut-off is limited to 4 hours maximum, and only after public notification.

- B. Make the necessary arrangements with the owner of the existing utility prior to any connections to any water mains. Residents shall be notified at least two working days in advance of water shut-off.
- C. Do not start work until all the materials, equipment, and labor have been assembled on the site. When work is started on a connection, proceed continuously without interruption, and as rapidly as possible, until completed.
- D. Make connections to existing water mains in a neat, workmanlike manner to suite actual conditions encountered at the existing water main. Adhere to manufacturer's recommendations to avoid damage to pipe coating when wet or dry tapping.
- E. Prevent the existing water main from being contaminated when making the connection. Take all action necessary to prevent trench water, mud or other contaminants from entering the connection line or main at any time.

### 3.11 SERVICE CONNECTIONS

- A. Install service connections in accordance with Section 33 12 13.

### 3.12 DISINFECTION OF POTABLE WATER PIPING SYSTEM

- A. Flush and disinfect system in accordance with Section 33 13 00.

### 3.13 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Requirements for inspecting, testing.
- B. Pressure test system in accordance with AWWA C600 (ductile iron), AWWA C605 (PVC), ASTM F2164 (HDPE) and the following:
  - 1. Pressure testing shall not be allowed prior to 7 days after pouring any concrete thrust blocks or restraints, to allow proper curing time.
  - 2. Test Pressure: Not less than 200 psi or 50 psi in excess of maximum static pressure, whichever is greater.
  - 3. Conduct hydrostatic test for at least two-hour duration.
  - 4. Fill section to be tested with water slowly, expel air from piping at high points. Install corporation stops at high points. Close air vents and corporation stops after air is expelled. Raise pressure to specified test pressure.
  - 5. Observe joints, fittings and valves under test. Remove and renew cracked pipe, joints, fittings, and valves showing visible leakage. Retest.
  - 6. Correct visible deficiencies and continue testing at same test pressure for additional 2 hours to determine leakage rate. Maintain pressure within plus or minus 5.0 psig of test pressure. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of test.
  - 7. Compute maximum allowable leakage by the following formula:

$L = (SD\sqrt{P})/C$
L = testing allowance, in gallons per hour
S = length of pipe tested, in feet
D = nominal diameter of pipe, in inches
P = average test pressure during hydrostatic test, in psig
C = 148,000
When pipe under test contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each size.

8. When test of pipe indicates leakage greater than allowed, locate source of leakage, make corrections and retest until leakage is within allowable limits. Correct visible leaks regardless of quantity of leakage. If no visible leaks are apparent, verify all air is removed from system and retest. If retest fails, locate source of leakage and make corrections.
- C. Compaction Testing for Bedding: In accordance with Section 31 23 17.
- D. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- E. Frequency of Compaction Tests: At least once for every 1,000 linear feet of pipe installed, minimum one test required for any installation over 500 linear feet.

END OF SECTION

## SECTION 33 11 16

## WATER DISTRIBUTION VALVES AND HYDRANTS

## PART 1 GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Pipe and fittings for site water line including domestic water line and fire water line.
2. Valves.
3. Pressure reducing valves.
4. Hydrants.
5. Underground pipe markers.
6. Precast concrete vault.

## B. Related Requirements:

1. Section 03 30 00 - Cast-In-Place Concrete: Concrete for thrust restraints.
2. Section 31 23 16 - Excavation: Product and execution requirements for excavation and backfill required by this section.
3. Section 31 23 17 - Trenching: Execution requirements for trenching required by this section.
4. Section 33 11 13 - Water Distribution Mains.
5. Section 33 12 13 - Water Service Connections.
6. Section 33 13 00 - Disinfecting of Water Utility Distribution: Disinfection of site service utility water piping.

## 1.2 REFERENCE STANDARDS

## A. ASTM International:

1. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).

## B. American Water Works Association:

1. AWWA C502 - Dry-Barrel Fire Hydrants.
2. AWWA C503 - Wet-Barrel Fire Hydrants.
3. AWWA C504 - Rubber-Sealed Butterfly Valves.
4. AWWA C508 - Swing-Check Valves for Waterworks Service, 2 in. (50 mm) Through 24 in. (600 mm) NPS.
5. AWWA C509 - Resilient-Seated Gate Valves for Water-Supply Service.
6. AWWA C515 - Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service.
7. AWWA C550 - Protecting Epoxy Interior Coating for Valves and Hydrants.
8. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.

## C. National Sanitation Foundation:

1. NSF 61 - Drinking Water System Components - Health Effects

## D. National Fire Protection Association:

1. NFPA 281 - Recommended Practice for Fire Flow Testing and Marking of Hydrants

### 1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit data on pipe materials, pipe fittings, valves and accessories.

### 1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.

### 1.5 QUALITY ASSURANCE

- A. Valves: Manufacturer's name and pressure rating marked on valve body.

### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Deliver and store valves in shipping containers with labeling in place.

## PART 2 PRODUCTS

### 2.1 GATE VALVES

- A. Manufacturer List:
  - 1. Clow Valve Co.
  - 2. Mueller Co.
  - 3. Waterous Co.
  - 4. Kennedy Valve Co.
  - 5. Substitutions Permitted: Section 01 60 00 - Product Requirements: Requirements for substitutions for other manufacturers and products.
- B. 2-1/2 inches and Smaller: Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, IPS ends, with control rod, post indicator, extension box and valve key.
- C. 3 inches and Larger: AWWA C509 or AWWA C515; iron body, bronze or ductile iron; including the manufacturer's name, pressure rating, and year of fabrication cast into valve body.
  - 1. Resilient seats.
  - 2. Stem: Non-rising bronze stem.
  - 3. Operating Nut: Square; open counterclockwise unless otherwise indicated.
  - 4. Ends: Flanged, mechanical joint or bell end connections.
  - 5. Coating: AWWA C550; interior/exterior.
  - 6. Sizes 12 inch diameter and smaller: 200 psig, or as indicated in Drawings.
  - 7. Sizes 16 inch diameter and larger: 150 psig, or as indicated in Drawings.

## 2.2 VALVE BOXES

- A. 12 inch diameter Valves and Smaller: Domestic cast iron, two-piece, screw or sliding type, with minimum inside shaft diameter of 5 ¼ inches.
- B. Valves Larger than 12 inch diameter: Domestic cast iron, three-piece, screw or sliding type, round base, with minimum inside shaft diameter of 5 ¼ inches.
- C. PVC C900 DR 18 riser pipe in lieu of cast iron telescoping riser may be allowable with approval of Engineer.
- D. Cast iron lid, marked "WATER" or "RAW WATER" as appropriate.

## 2.3 BALL VALVES

- A. 2 inches and Smaller: Brass body, full port, teflon coated brass ball, rubber seats and stem seals, Tee stem pre-drilled for control rod, IPS inlet end, IPS outlet, with control rod, extension box and valve key.

## 2.4 COMBINATION AIR VALVES

- A. Manufacturer List:
  - 1. Val-Matic.
  - 2. Apco Valve.
  - 3. Cla-Val.
  - 4. Substitutions Permitted: Section 01 60 00 - Product Requirements: Requirements for substitutions for other manufacturers and products.
- B. Description: Cast Iron Body, stainless steel float. Combines both functions of air release and vacuum release. Low pressure components shall be included where applicable.
- C. Valve Box: Cylindrical steel enclosure, set on concrete base with anchor. The exterior of steel enclosure shall be field painted with two coats of yellow reflectorized paint.

## 2.5 SWING CHECK VALVES

- A. Manufacturer and Product List:
  - 1. Flomatic Model 745.
  - 2. Apco Model CVS-6000.
  - 3. Mueller Swing Check Valve.
  - 4. Substitutions Permitted: Section 01 60 00 - Product Requirements: Requirements for substitutions for other manufacturers and products
- B. 2 inches to 24 inches: AWWA C508, iron body, bronze trim, 45 degree swing disc, renewable disc and seat, flanged ends.

## 2.6 PRESSURE REDUCING VALVE STATIONS

- A. Manufacturer List:

1. Cla-Val
2. Flomatic
3. OCV Control Valves
4. Substitutions Permitted: Section 01 60 00 - Product Requirements: Requirements for substitutions for other manufacturers and products

B. Product Info: Ductile Iron body and cover, sized as shown in Drawings, pressure settings as shown in Drawings.

C. Enclosure: Fiberglass enclosure, continuous stainless steel hinge on one side, lockable on opposite side. Sized to accommodate inlet and outlet piping, and all piping, valves, and accessories for entire pressure reducing station as shown in Drawings. 1" of urethane foam insulation on interior of enclosure.

## 2.7 BUTTERFLY VALVES

A. 2 inches to 24 inches: AWWA C504, iron body, bronze disc, resilient replaceable seat, water or lug ends, infinite position lever handle.

## 2.8 BLOW OFF HYDRANT

A. Manufacturer List:

1. Kupferle Foundry Company Model Mainguart #78.
2. Substitutions Permitted: Section 01 60 00 - Product Requirements: Requirements for substitutions for other manufacturers and products.

B. Description: Blow-off hydrant shall be non-freezing, self draining type. All working parts shall be bronze design with aluminum plunger and serviceable from above grade with no digging. Shall be lockable to prevent unauthorized use. Outlet shall be bronze, 2 ½ inch diameter.

C. Accessories: Meter box per Section 33 05 17.

## 2.9 FIRE HYDRANT

A. Manufacturer List:

1. Clow Valve Co.
2. Mueller Co.
3. American Darling
4. Substitutions Permitted: Section 01 60 00 - Product Requirements: Requirements for substitutions for other manufacturers and products.

B. Dry-barrel Break-away Type: AWWA C502; cast-iron body, compression type valve.

1. Bury Depth: As indicated on the Drawings.
2. Inlet Connection: 6 inches.
3. Valve Opening: 4 1/2 inches diameter.
4. Ends: Flange, Mechanical Joint or Bell End.
5. Bolts and Nuts: Stainless steel or Bronze.
6. Coating: AWWA C550; interior.
7. Direction of Opening: Counterclockwise unless otherwise indicated.

- C. Wet-Barrel Type: AWWA C503; cast-iron body.
  - 1. Valve Openings: Individual for pumper and hose nozzles.
  - 2. Ends: Mechanical joint or bell end.
  - 3. Bolts and Nuts: Stainless steel or Bronze.
  - 4. Coating: AWWA C550; interior.
  - 5. Check Valve: Break-off type, compatible with hydrant.
- D. Hydrant Extensions: Fabricate in multiples of 6 inches with rod and coupling or flange to increase barrel length.
- E. Hose and Streamer Connection: Match sizes and type of thread with utility company and fire department, two hose nozzles (2 ½ inch), one pumper nozzle (4 ½ inch).
- F. Finish: Primer and two coats of enamel in traffic or safety yellow color, in accordance with NFPA 281 requirements.
- G. Hydrant Wrench: Furnish one hydrant wrench per contract as applicable.

#### 2.10 FLUSH HYDRANT

- A. Manufacturer List:
  - 1. James Jones J-342, J-344, J-344HP or equal.
  - 2. Substitutions Permitted: Section 01 60 00 - Product Requirements: Requirements for substitutions for other manufacturers and products.
- B. Hydrant: AWWA C503, wet barrel type, with minimum 2 inch diameter valve seat opening.
- C. Hydrant Extensions: Galvanized steel with PVC based tape wrap on all exposed surfaces (3M Scotchrap, 20 mil thickness, or equal).
- D. Hose and Streamer Connection: One hose nozzle (2 inch, 2 ½ inch, or 4 inch, as indicated in Drawings).
- E. Finish: Primer and two coats of enamel in traffic or safety yellow color.
- F. Hydrant Wrench: Furnish one hydrant wrench per contract as applicable.

#### 2.11 ACCESSORIES

- A. Concrete for Thrust Restraints: Concrete type specified in Section 03 30 00.
- B. Protection Posts: black iron or galvanized steel, 4 in diameter, 6 ft long, buried 3 ft deep (3 ft exposed). Paint post with 2 coats of yellow reflectorized paint. Cap with concrete or stampable aluminum cap as required in Drawings.
- C. Gravel for weep hole or drainage: 3/8 inch washed pea gravel.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.
- B. Verify building service connection and municipal utility water main size, location, and invert are as indicated on Drawings.

### 3.2 PREPARATION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation preparation.
- B. Locate, identify, and protect utilities to remain from damage.
- C. Do not interrupt existing utilities without permission and without making arrangements to provide temporary utility services.
  - 1. Notify Engineer not less than 3 days in advance of proposed utility interruption.
  - 2. Do not proceed without permission from the Owner.
- D. Perform trench excavation, backfilling and compaction in accordance with Section 31 23 17.

### 3.3 BEDDING

- A. Excavate trench in accordance with Section 31 23 17 for Work of this Section.
- B. Form and place concrete for pipe thrust restraints at change of pipe direction. Place concrete to permit full access to pipe and pipe accessories. Place thrust restraint bearing on subsoil.
  - 1. Where native subsoil is not suitable, place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 6 inches compacted depth; compact to 95 percent. Imported pipe embedment only to be used with Engineer approval in advance.
  - 2. Backfill around sides and to top of thrust restraint with cover fill, tamp in place and compact to 95 percent.

### 3.4 INSTALLATION - VALVES AND HYDRANTS

- A. Set valves on compacted soil or compacted fill material, with thrust block or thrust restraint as shown in Drawings.
- B. Pour concrete pads around valves and hydrants per Drawings. Coordinate with Section 03 30 00. No not encase break-off check valves or other accessories in concrete pad.
- C. Center and plumb valve box over valve. Set valve box cover flush with finished grade in paved streets. Set valve box cover 2 inches above finished grade in dirt streets, shoulders or unimproved areas.
- D. Set hydrants plumb; locate pumper nozzle perpendicular to and facing roadway.

- E. Set hydrants to grade, with nozzles at least 20 inches above finished grade and safety flange not more than 6 inches, nor less than 2 inches above grade or concrete pad.
- F. For dry barrel hydrants, provide drainage pit filled with 3 cubic feet of pea gravel. Encase elbow of hydrant in gravel to 6 inches above drain opening. Do not connect drain opening to sewer.

3.5 INSTALLATION – PRESSURE REDUCING VALVE STATION

- A. Field set pressure to settings as shown in Drawings.
- B. Concrete installation: Refer to Sections 03 10 00, 03 20 00, and 03 30 00.
- C. Anchor the enclosure base to the concrete slab as shown in Drawings.
- D. Use galvanized steel or stainless steel for all nuts and bolts.
- E. Use caulking between enclosure base and the concrete slab.

3.6 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Flush and disinfect system in accordance with Section 33 13 00.

3.7 FIELD QUALITY CONTROL

- A. Pressure test system in accordance with AWWA C600 and the following:
  - 1. Test Pressure: Not less than 200 psi or 50 psi in excess of maximum static pressure, whichever is greater.
  - 2. Conduct hydrostatic test for at least two-hour duration.
  - 3. Fill section to be tested with water slowly, expel air from piping at high points. Install corporation cocks at high points. Close air vents and corporation cocks after air is expelled. Raise pressure to specified test pressure.
  - 4. Observe joints, fittings and valves under test. Remove and renew cracked pipe, joints, fittings, and valves showing visible leakage. Retest.
  - 5. Correct visible deficiencies and continue testing at same test pressure for additional 2 hours to determine leakage rate. Maintain pressure within plus or minus 5.0 psig of test pressure. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of test.
  - 6. Compute maximum allowable leakage by the following formula:

$L = (SD\sqrt{P})/C$
L = testing allowance, in gallons per hour
S = length of pipe tested, in feet
D = nominal diameter of pipe, in inches
P = average test pressure during hydrostatic test, in psig
C = 148,000

When pipe under test contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each size.

7. When test of pipe indicates leakage greater than allowed, locate source of leakage, make corrections and retest until leakage is within allowable limits. Correct visible leaks regardless of quantity of leakage.
- B. Compaction Testing for Bedding: In accordance with Section 31 23 17.
- C. When tests indicate Work does not meet specified requirements, remove Work, replace and retest at Contractor's expense.

END OF SECTION

## SECTION 33 12 13

## WATER SERVICE CONNECTIONS

## PART 1 GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Pipe and fittings for domestic water service connections to buildings.
2. Corporation stop assembly.
3. Curb stop assembly.
4. Meter setting equipment.
5. Water meters.
6. Backflow preventers.
7. Underground pipe markers.
8. Precast concrete vault.
9. Bedding and cover materials.

## B. Related Requirements:

1. Section 03 30 00 - Cast-In-Place Concrete.
2. Section 31 23 17 - Trenching.
3. Section 33 05 13 - Manholes and Structures.
4. Section 33 11 13 - Water Distribution Mains.
5. Section 33 13 00 - Disinfecting of Water Utility Distribution

## 1.2 REFERENCE STANDARDS

## A. American Society of Mechanical Engineers:

1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

## B. American Society of Sanitary Engineering:

1. ASSE 1012 - Backflow Preventer with Intermediate Atmospheric Vent.
2. ASSE 1013 - Reduced Pressure Principle Backflow Preventers.

## C. ASTM International:

1. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.
2. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
4. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
5. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.

## D. American Welding Society:

1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

- E. American Water Works Association:
  - 1. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
  - 2. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
  - 3. AWWA C800 - Underground Service Line Valves and Fittings.
  - 4. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. through 3 in., for Water Service.
  - 5. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

### 1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit data on pipe materials, pipe fittings, corporation stop assemblies, curb stop assemblies, meters, meter setting equipment, service saddles and accessories.

### 1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of piping mains, curb stops, connections and thrust restraints.

### 1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with utility company standards.

### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. During loading, transporting, and unloading of materials and products, exercise care to prevent any damage.
- C. Store products and materials off ground and under protective coverings and custody and in manner to keep these clean and in good condition until used.
- D. Exercise care in handling precast concrete products to avoid chipping, cracking, and breakage.

## PART 2 PRODUCTS

### 2.1 WATER PIPING AND FITTINGS

- A. Copper Tubing: ASTM B88, Type K, annealed:
  - 1. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper.
  - 2. Joints: Compression connection or AWS A5.8, BCuP silver braze.
- B. PVC Pipe: ASTM D1785, Schedule 40 or 80, as indicated in Drawings:

1. Fittings: ASTM D2466, PVC.
2. Joints: ASTM D2855, solvent weld.

C. Polyethylene Pipe: AWWA C901:

1. Fittings: AWWA C901, molded or fabricated.
2. Joints: Butt fusion or compression.

## 2.2 CORPORATION STOP ASSEMBLY

A. Manufacturer List:

1. Mueller Co.
2. A.Y. McDonald Co.
3. Ford Meter Box Co.
4. Substitutions Permitted: Section 01 60 00 - Product Requirements: Requirements for substitutions for other manufacturers and products.

B. Corporation Stops:

1. Brass or red brass alloy body conforming to ASTM B62.
2. Inlet end threaded for tapping according to AWWA C800.
3. Outlet end suitable for service pipe specified.

C. Service Saddles:

1. Double strap type, bronze construction, designed to hold pressures in excess of pipe working pressure.

## 2.3 CURB STOP ASSEMBLY

A. Manufacturer and Product List:

1. Mueller Co. 300 Series.
2. A.Y. McDonald Co. 76000 Series.
3. Ford Meter Box Co. "B" Series.
4. Substitutions Permitted: Section 01 60 00 - Product Requirements: Requirements for substitutions for other manufacturers and products.

B. Curb Stops:

1. Brass or red brass alloy body conforming to ASTM B62.
2. Plug type valve.
3. Positive pressure sealing.

C. Curb Boxes and Covers:

1. Cast iron body, Extension Type or Buffalo Type.
2. Minneapolis or Arch Pattern Base.
3. Lid with inscription WATER, with Pentagon Plug.

## 2.4 METER SETTING EQUIPMENT

A. Manufacturer and Product List:

1. Mueller Company Copper Meter Yokes
2. A.Y. McDonald 700 Series.

3. Ford Meter Box Co. 70 Series.
4. Substitutions Permitted: Section 01 60 00 - Product Requirements: Requirements for substitutions for other manufacturers and products.

B. Outside Meter Setting:

1. Meter Yokes: Copper or iron, riser type assembly with bronze inlet inverted key angle valve expansion type outlet connection and ell fitting; flared copper tubing connections both ends.
2. Meter Yokes: Copper or iron, inlet and outlet horizontal or vertical setting with matching couplings, fittings and stops.
3. Accessories: Dual check valve, shut off valve, and test valve/drain.

## 2.5 WATER METERS

A. Manufacturer and Product List:

1. Badger Meter, Inc. Recordall Series.
2. Neptune Technology Group Model T-10.
3. Rockwell/Sensus Model SR II.
4. Substitutions Permitted: Section 01 60 00 - Product Requirements: Requirements for substitutions for other manufacturers and products.

B. Where indicated, furnish materials in accordance with manufacturer and model indicated on drawings. No substitutions permitted.

C. AWWA C710, positive displacement disc type suitable for fluid with bronze case and cast iron bottom cap, hermetically sealed register, remote reading to AWWA C706 where indicated.

D. Meter: Brass body turbine meter with magnetic drive register.

1. Service: Cold water, 122 degrees F.
2. Maximum Flow: 20 gpm.
3. Maximum Operating Pressure: up to 150 psi.
4. Accuracy: 1-1/2 percent.
5. Nominal Size: 5/8 inch x 3/4 inch, unless otherwise noted.

## 2.6 BALL VALVES

A. 2 inches and Smaller: Brass body, lead free, full port, teflon coated brass ball, rubber seats and stem seals, Tee stem pre-drilled for control rod, IPS inlet end, IPS outlet, with control rod, extension box and valve key.

## 2.7 INDIVIDUAL PRESSURE REDUCING VALVES

A. 1 inch and Smaller: Lead free, brass body, integral strainer, maximum working pressure 300 psi or higher, adjustable reduce pressure setting between 25 and 75 psi.

## 2.8 UNDERGROUND PIPE MARKERS

A. Plastic Ribbon Tape: Bright colored, continuously printed "WATER", minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

## 2.9 PRECAST CONCRETE VAULTS AND METER BOXES

- A. Precast Concrete Valve Vaults and Meter Boxes: Conform to Section 33 05 17.

## 2.10 ACCESSORIES

- A. Concrete for Thrust Restraints: Concrete type specified in Section 03 30 00.

# PART 3 EXECUTION

## 3.1 EXAMINATION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.
- B. Verify building service connection and municipal utility water main size, location, and invert are as indicated on Drawings.

## 3.2 PREPARATION

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation preparation.
- B. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.
- C. Remove scale and dirt on inside and outside before assembly.
- D. Prepare pipe connections to equipment with flanges or unions.

## 3.3 INSTALLATION - CORPORATION STOP ASSEMBLY

- A. Make connection for each different kind of water main using suitable materials, equipment and methods approved by the Architect/Engineer.
- B. Provide service saddles for mains other than of cast iron or ductile iron mains.
- C. Attach corporation stops using service saddles at 10 and 2 o'clock position on main's circumference; locate corporation stops at least 12 inches apart longitudinally and staggered.
- D. For plastic pipe water mains, provide full support for service clamp for full circumference of pipe, with minimum 2 inches width of bearing area; exercise care against crushing or causing other damage to water mains at time of tapping or installing service clamp or corporation stop.
- E. Use proper seals or other devices so no leaks are left in water mains at points of tapping; do not backfill and cover service connection until approved by the Architect/Engineer.

## 3.4 BEDDING

- A. Excavate pipe trench in accordance with Section 31 23 17 for Work of this Section.

- B. Where native subsoil is not suitable, place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 6 inches compacted depth; compact in accordance with Section 31 23 17. Pipe embedment only to be used with Engineer approval in advance.
- C. Backfill around sides and to top of pipe, tamp in place and compact in accordance with Section 31 23 17.

### 3.5 INSTALLATION - PIPE AND FITTINGS

- A. Maintain minimum 10 ft parallel horizontal separation of water service line from sewer piping.
- B. Maintain minimum 25 ft horizontal separation of water service line from septic tank, septic drainfield or pressure-dosed mound.
- C. Water service lines shall be no less than 45 degrees to and at least one foot above sanitary sewer and storm drain lines where those lines must cross. All portions of the water service line within 10 horizontal feet of the sewer line shall be encased in a continuous sleeve or cement slurry fill.
- D. Group piping with other site piping work whenever practical.
- E. Install pipe to indicated elevation to within tolerance of 1 inch.
- F. Route pipe in straight line.
- G. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- H. Install access fittings to permit disinfection of water system performed under Section 33 13 00.
- I. Form and place concrete for thrust restraints at each elbow or change of direction of pipe main.
- J. Establish elevations of buried piping with not less than 2.5 feet of cover.
- K. Install plastic ribbon tape continuous buried 12 inches below finish grade, above pipe line; coordinate with Section 31 23 17.
- L. Backfill trench in accordance with Section 31 23 17.

### 3.6 INSTALLATION - CURB STOP ASSEMBLY

- A. Set curb stops on solid bearing or compacted soil.
- B. Center and plumb curb box over curb stops. Set box cover flush with finished grade.

### 3.7 INSTALLATION - WATER METERS

- A. Install positive displacement meters in accordance with AWWA M6, with isolating valve on inlet.

3.8 INSTALLATION - BACKFLOW PREVENTERS

- A. Install backflow preventer where indicated on the Contract Drawings and in accordance with manufacturer's instructions.
- B. Comply with local water company requirements and plumbing codes in regards to testing and installation requirements.

3.9 SERVICE CONNECTIONS

- A. Install water service in accordance with utility company requirements with double check valve backflow preventer.
- B. Install water meter and backflow preventer in concrete vault located on site. Refer to Section 33 05 17.
- C. Install water service to 5 feet of building. Connect to building water service. Provide isolation ball valve and hose bib.
- D. Install individual pressure reducing valve, where required, upstream of any hose bib and house connection.

3.10 PRECAST CONCRETE VAULT

- A. Conform to Section 33 05 17.

3.11 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Flush and disinfect system in accordance with Section 33 13 00.

END OF SECTION

## SECTION 33 13 00

## DISINFECTING OF WATER DISTRIBUTION

## PART 1 GENERAL

## 1.1 SUMMARY

- A. Section includes disinfection of potable water distribution system; and testing and reporting results.
- B. Related Sections:
  - 1. Section 33 11 13 - Water Distribution Mains.
  - 2. Section 33 11 16 - Water Distribution Valves and Hydrants: Product and Execution requirements for installation, testing, of site domestic water distribution piping.
  - 3. Section 33 12 13 -Water Service Connections
  - 4. Section 33 21 00 - Individual Water Supply Wells: Product and Execution requirements for installation, testing, and disinfection of water wells.
  - 5. Section 33 21 13 - Community Water Supply Wells: Product and Execution requirements for installation, testing, and disinfection of water wells.

## 1.2 REFERENCES

- A. American Water Works Association:
  - 1. AWWA B300 - Hypochlorites.
  - 2. AWWA B301 - Liquid Chlorine.
  - 3. AWWA C651 - Disinfecting Water Mains.

## 1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit procedures, proposed chemicals, and treatment levels for review.
- C. Test Reports: Indicate results comparative to specified requirements.
- D. Certificate: Certify cleanliness of water distribution system meets or exceeds specified requirements.

## 1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.
- B. Disinfection Report:
  - 1. Type and form of disinfectant used.
  - 2. Date and time of disinfectant injection start and time of completion.
  - 3. Test locations.
  - 4. Name of person collecting samples.

5. For community water system, initial and 24 hour disinfectant residuals in treated water in ppm for each outlet tested.
6. For individual water system, initial and 3 hour disinfectant residuals in treated water in ppm for each outlet tested.
7. Date and time of flushing start and completion.
8. Disinfectant residual after flushing in ppm for each outlet tested.

C. Bacteriological Report:

1. Date issued, project name, and testing laboratory name, address, and telephone number.
2. Time and date of water sample collection.
3. Name of person collecting samples.
4. Test locations.
5. For community water system or well, initial and 24 hour disinfectant residuals in ppm for each outlet tested.
6. For individual water system or well, initial and 3 hour disinfectant residuals in ppm for each outlet tested.
7. Coliform bacteria test results for each outlet tested.
8. Certify water conforms, or fails to conform, to bacterial standards of Environmental Protection Agency.

- D. Water Quality Certificate: Certify water conforms to quality standards of Environmental Protection Agency, suitable for human consumption.

## 1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with AWWA C651.

## PART 2 PRODUCTS

### 2.1 DISINFECTION CHEMICALS

- A. Chemicals: AWWA B300, Hypochlorite and AWWA B301, Liquid Chlorine.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify piping system has been cleaned and inspected.
- C. Perform scheduling and disinfecting activity with start-up, water pressure testing, adjusting and balancing, demonstration procedures, including coordination with related systems.

### 3.2 INSTALLATION

- A. Provide and attach required equipment to perform the Work of this section.
- B. Perform disinfection of water distribution system and installation of system and pressure testing. Refer to Section 33 11 13 for pressure testing requirements.
- C. Inject or input treatment disinfectant into piping system to chlorine dose of no less than 25 milligrams per liter, in accordance with AWWA C651.
- D. Maintain disinfectant in system for 24 hours, or as required by AWWA C651.
- E. Flush, circulate, and clean until required cleanliness is achieved; use municipal domestic water. Dechlorinate before disposal if there is no place to safely dispose of high chlorine water. Take water samples for total and fecal coliform testing after chlorine is flushed from system.
- F. Replace permanent system devices removed for disinfection.

### 3.3 FIELD QUALITY CONTROL

- A. Sections 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Disinfection, Flushing, and Sampling:
  - 1. Disinfect pipeline installation in accordance with AWWA C651.
  - 2. Upon completion of retention period required for disinfection, flush pipeline until chlorine concentration in water leaving pipeline is no higher than that generally prevailing in existing system or is acceptable for domestic use. Test for fecal and total coliforms. If water indicates presence of coliforms, disinfection needs to be completed again.
  - 3. Legally dispose of chlorinated water. When chlorinated discharge may cause damage to environment, apply neutralizing chemical to chlorinated water to neutralize chlorine residual remaining in water.
  - 4. After final flushing and before pipeline is connected to existing system, or placed in service, employ an approved independent testing laboratory to sample, test and certify water quality suitable for human consumption.
  - 5. If test fails, Contractor shall repeat disinfection and testing process in accordance with AWWA until test is successful. All repeat testing shall be done at Contractor's expense.

END OF SECTION

## SECTION 33 13 13

## WATER STORAGE TANK DISINFECTION

## PART 1 GENERAL

## 1.1 SUMMARY

- A. Section Includes:
  - 1. Water tank disinfection.
  - 2. Bacteriological testing.
- B. Related Sections:
  - 1. Section 09 97 14 - Steel Water Storage Tank Painting.
  - 2. Section 09 97 24 - Concrete Water Storage Tank Painting.
  - 3. Section 33 16 13 - Prestressed Concrete Water Storage Tanks.
  - 4. Section 33 16 19 - Welded Steel Water Storage Tanks.

## 1.2 REFERENCES

- A. American Water Works Association:
  - 1. AWWA B300 - Hypochlorites.
  - 2. AWWA B301 - Liquid Chlorine.
  - 3. AWWA C652 - Disinfection of Water Storage Facilities.

## 1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Disinfection Procedure: Submit procedure description including type of disinfectant to and calculations indicating quantities of disinfectants required to produce specified chlorine concentration in accordance with Section 3 and 4 of AWWA C652. Plan shall include plans to dechlorinate effluent after testing if discharge will be released to the environment.
- C. Test Reports: Indicate results of bacteriological and residual chlorine laboratory test reports.

## 1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with AWWA C652.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Store disinfectants in cool, dry place away from combustibles such as wood, rags, oils and grease.

- C. Handle disinfectants with caution; protect skin and eyes from contact; avoid breathing vapors; wear gloves, aprons, goggles, and vapor masks.

## 1.6 ENVIRONMENTAL REQUIREMENTS

- A. Furnish personnel working inside tank during disinfection with equipment to comply with Federal and State regulations for work conducted in hazardous atmosphere.
- B. Neutralize disinfectant solution before disposal.
- C. Legally dispose of disinfection solution off Project site.
- D. Repair damage caused by disinfectant solution and disinfection procedures.

## PART 2 PRODUCTS

### 2.1 DISINFECTANTS

- A. Chlorine Forms: In accordance with AWWA C652, Section 3.
  - 1. Liquid chlorine conforming to AWWA B301.
  - 2. Sodium hypochlorite conforming to AWWA B300.
  - 3. Calcium hypochlorite conforming to AWWA B300.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Conduct inspection of tank interior before beginning disinfection.
  - 1. Verify tank is clean and free of polluting materials.
  - 2. Verify tank pipe and vent connections are properly made and clear of obstructions.
  - 3. Verify paint is thoroughly cured in accordance with paint manufacturer's instructions and all painter's holidays have been identified and repaired.

### 3.2 PREPARATION

- A. Protect aquatic life and vegetation from damage from disinfectant solution purged from tank.

### 3.3 APPLICATION

- A. Use any one or a combination of the three methods for disinfecting tank specified in Section 4 of AWWA C652:
  - 1. Chlorination Method 1: Water storage facility is filled to overflow level with chlorinated water with free chlorine residual of not less than 10 mg/L at the end of 24 hour period. See AWWA C652 for full instructions.

2. Chlorination Method 2: A solution of at least 200 mg/L free chlorine is applied to surface of the water storage tank that would be in contact with water when facility is full to the overflow elevation. See AWWA C652 for full instructions.
3. Chlorination Method 3: Water and chlorine added to result in a solution with at least 50 mg/L free chlorine filling 5% of total storage volume. After a period of not less than 6 hours, storage tank is filled to overflow level with potable water. Resulting chlorinated water is held for a period not less than 24 hours after filling is complete. See AWWA C652 for full instructions.

### 3.4 FIELD QUALITY CONTROL

- A. Sections 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Collect samples of water from filled tank for bacteriological analysis in accordance with Section 4.4 of AWWA C652; take inlet and outlet water samples.
- C. Test water samples for bacterial contamination and residual chlorine in accordance with Federal EPA standards for potable water. Water samples must be taken when chlorine residual is at or below system levels, typically less than 1.0 mg/L.
- D. When water samples fail to meet Federal EPA standards for potable water perform the following corrective measures until water quality conforms to Federal EPA standards:
  1. Inlet and Outlet Water Sample Failure: Eliminate source of contamination in water supply, repeat disinfection, and retest water quality.
  2. Outlet Water Sample Failure: Repeat disinfection, and retest water quality.

END OF SECTION

## SECTION 33 16 21

## HDPE WATER STORAGE TANKS

## PART 1 GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. HDPE elevated water tank.
2. Tank foundation.

## B. Related Sections:

1. Section 31 23 16 - Excavation.
2. Section 31 23 17 - Trenching.
3. Section 33 11 13 - Water Distribution Mains.
4. Section 33 11 16 - Water Distribution Valves and Hydrants.
5. Section 33 13 13 - Water Storage Tank Disinfection.

## 1.2 REFERENCES

## A. NSF International

1. NSF/ANSI 61 – Drinking Water System Components – Health Effects.

## 1.3 DEFINITIONS

A. PURCHASER used in AWWA D103 means Owner.

## 1.4 DESIGN REQUIREMENTS

1. Compliance with NSF/ANSI 61 is required.
2. Dimensions and Capacity:
  - a. Minimum usable tank capacity and height as indicated on Drawings
  - b. Diameter as indicated on Drawings
  - c. Height as indicated on Drawings
  - d. Overflow Weir Height as indicated on Drawings and shall ensure that free board is in accordance with most recent and pertinent AWWA standards while maintaining minimum usable capacity.
3. Location of Site: As indicated on Drawings.

## 1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

## B. Product Data:

1. Submit data for tank, gravel ring, pipe protection tape, ball valves, pipe support, and other pipe specialty fittings.

## 1.6 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual location layout and final configuration of tank and accessories.

## 1.7 QUALIFICATIONS

- A. Fabricator: Company specializing in performing work of this section with minimum five years documented experience.
- B. Installer: Company specializing in performing work of this section with minimum five years documented experience.

## PART 2 PRODUCTS

### 2.1 HDPE WATER TANK

- A. Manufacturers:
  - 1. Norwesco 10000WG 41379: 10,000-gal Vertical Water Tank customized with bulkhead fittings
    - a. Website: <https://www.agspray.com/tanks-tank-accessories/water-waste-management-tanks/above-ground-tanks/vertical-storage-tanks/pid13641/10-000-gallon-vertical-green-water-tank/>
    - b. Substitutions Permitted

### 2.2 FOUNDATION

- A. RINGWALL
  - 1. Manufacturers: Wright Tank and Steel Fabrication or Approved Equal
    - a. Width: 12-inch Galvanized
    - b. Thickness: 14-Guage Steel
    - c. Website: <https://wrighttank.com/water-tank-gravel-rings/>

### 2.3 PIPE PROTECTION TAPE

- A. PASCO Pipe protection tape system or approved equal
  - 1. Part Number: 9052-R
  - 2. Description: 2-inch wide, 10-millimeter thick "All Weather" PVC Plastic Tape
  - 3. Website: [https://www.pascospecialty.com/catalog/PASCO\\_CATALOG\\_E.pdf](https://www.pascospecialty.com/catalog/PASCO_CATALOG_E.pdf)

### 2.4 EXPANSION JOINT

- A. Ultraspool expansion Joint or approved equal
  - 1. Rubber Material: EPDM
  - 2. Ret Ring Material: Galv Carbon Steel

3. Website:  
[https://www.flexicraft.com/Rubber\\_Expansion\\_Joints/Ultraspool\\_Single\\_Rubber\\_Expansion\\_Joint/](https://www.flexicraft.com/Rubber_Expansion_Joints/Ultraspool_Single_Rubber_Expansion_Joint/)

## 2.5 AIR VENT

- A. Special Vent Required for Screening of Tank Vent: AWWA D103, Section 7.7.2 - Vent. Provide total free open vent area based on design flow. Provide 24 mesh stainless steel, aluminum or bronze insect screen. Frost proof.
  1. Manufacturer: Gizmo Engineering or approved equal
  2. Size: 3-inch
  3. Type: Threaded fitting
  4. Contact: <https://gizmo-engineering.com/products/vent-caps/plastic-vent-caps-with-screen/>
    - a. Type 24 mesh size must be specified when ordering

## 2.6 CATCH BASIN

- A. NDS 24 in. Square Catch Basin Kit with Grate or approved equal
  1. Pipe Size: 4-inch
  2. Website: <https://www.homedepot.com/p/NDS-24-in-Square-Catch-Basin-Kit-with-Black-Grate-2400BLKIT/320078020>

## 2.7 TANK CONSTRUCTION

- A. In conformance with requirements listed in AWWA D103, Paragraph III, supplemented, or modified below:
  1. Compliance with NSF/ANSI 61 is required.
  2. Pipe and Fittings for Fluid Conductors: AWWA D103, Section 4.9 – Pipe and Fittings for Fluid Conductors
  3. Pipe and Pipe Connections:
    - a. AWWA D103, Section 7.2 - Pipe Connections:
      - 1) Provide inlet and outlet pipe at diameter shown in Drawings.
    - b. Provide other accessories as indicated on Drawings.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify elevations and grading for elevated tank and location of elevated tank.
- C. Refer to Section 31 23 16 for excavation and Section 31 23 17 for backfill requirements.

### 3.2 INSTALLATION

- A. Install in accordance with Planset Drawings and Manufacturers Recommendations

### 3.3 FIELD QUALITY CONTROL

A. Sections 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspection and Testing:

1. Hydrostatic Testing:

- a. Test completed and cleaned tank for liquid tightness by filling tank to its overflow elevation with water provided by Owner. Note: in some circumstances, this may take a week or more. Understand locally available water sources and pumping rates.
- b. Correct leaks disclosed by this test.
- c. Contractor shall correct all deficiencies and repeat the test at Contractor's expense.

### 3.4 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning. Clean interior and exterior of tank to remove debris, construction items, and equipment. Disinfect tank in accordance with Section 33 13 13.

END OF SECTION

## SECTION 33 21 13

## COMMUNITY WATER SUPPLY WELLS

## PART 1 GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Pump and controller.
2. Water and system testing and certification.

## B. Related Sections:

1. Section 03 30 00 - Cast-In-Place Concrete
2. Section 22 05 03 - Plumbing Piping
3. Section 26 05 03 - Equipment Wiring Connections
4. Section 26 05 19 - Electrical conductors and Cables
5. Section 26 05 26 - Grounding for Electrical Systems
6. Section 26 05 33 - Conduit and Boxes for Electrical Systems
7. Section 31 23 17 - Trenching: Excavating and Backfilling for conduit and pipe from well head to building.
8. Section 33 11 13 – Water Distribution Mains.
9. Section 33 13 00 - Disinfecting of Water Utility Distribution

## 1.2 REFERENCES

## A. ASTM International:

1. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM C150 - Standard Specification for Portland Cement.

## B. American Water Works Association:

1. AWWA A100 - Standard for Water Wells.

## C. California Department of Water Resources

1. Bulletins 74-81 and 74-90 Combined: Water Well Standards.

## D. National Electrical Manufacturers Association:

1. NEMA MG 1 - Motors and Generators.
2. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

## 1.3 EXISTING SYSTEM DESCRIPTION

1. Steel Casing Size: 8-inch nominal diameter, ~28 feet deep.
2. Production: 60 gallons per minute at 107 feet max total dynamic head

#### 1.4 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: pump, motor, and all accessories. Include data indicating rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.
- C. Submit proof of California C-57 license to perform this work.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.
- B. Submit executed certification of well pump after performance testing.
- C. Operation and Maintenance Data: Submit equipment manuals.
- D. Provide minimum 5 year written warranty for submersible pump.

#### 1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with AWWA A100 and State of California Water Well Standards.

#### 1.7 QUALIFICATIONS

- A. Drilling/pump installation firm: Company specializing in performing Work of this section with minimum 5 years documented experience and licensed in State of California

### PART 2 PRODUCTS

#### 2.1 MATERIALS

- A. Pump:
  - 1. Manufacturers:
    - a. Franklin Electric, Model 50FH15S6-PE or approved equal
    - b. Substitutions Permitted: Section 01 60 00 - Product Requirements.
  - 2. Motor: NEMA MG 1, submersible type:
    - a. Characteristics: 1.5 hp; three phase 60 Hertz.
  - 3. Pump: Submersible type for deep well pump, water lubricated:
    - a. Operating Performance (head upper limit: 107 ft; lower limit 60 ft):
      - 1) 60 gpm at 60 ft of total dynamic head with VFD
      - 2) 60 gpm at 107 feet total dynamic head with VFD
    - b. Pump and motor are separate, replaceable units.
  - 4. Operation
    - a. Pumps will be automated by 10,000-gal HDPE water tank via tank floats and existing low water shut-off in raw water wet well.
    - b. Bottom float in HDPE tank will call for pump to turn on
    - c. Middle float in HDPE tank will call for pump to turn off

- d. Top float in HDPE tank will act as a fail-safe for emergency cutoff
- B. VFD:
1. Manufacturers:
    - a. Yaskawa or Approved Equal
      - 1) Model: GA500 AC Drive, 240 V, 1 PH
      - 2) Part #: YASGA50UB12ABA
    - b. YAS URX000315 AC Input Reactor
      - 1) Part # YASURX000315
  - OR
  - c. Model: FP6506 Pump Drive - 5hp 240V drive
  - d. YAS URX00319 AC Input Reactor
    - 1) Part #: YASURX000319
2. Distributor/Subcontractor information: North Valley Distributing \*installer of original equipment
    - a. Contact: Bryan Carr
      - 1) Address: 3081 Crossroads Drive, Redding CA, 96003
      - 2) Phone: 530-222-1500
      - 3) Email: [bcarr@northvalleydistributing.com](mailto:bcarr@northvalleydistributing.com)
      - 4) Quote Number: S1365256
- C. Float Switch
1. Manufacturers: SJE RHOMBUS or approved equal
  2. Model: SJE MegaMaster™ Signal-Duty Float Switches
  3. Switch type: NO/NC
  4. Cable Length: 100'
  5. Mounting: Suspended, Internal Weight
  6. Website: <https://catalog.usabluebook.com/C132-Catalog-v2/830/#>
    - a. Stock #: 34902
  7. Floats will be used by the existing PLC to automate ON, OFF, and HIGH LEVEL ALARM CUT-OFF functions
  8. Control wires will be routed to PLC as indicated in drawings

## 2.2 ELECTRICAL WIRE AND CONDUIT

- A. Refer to Sections 26 05 19, and 26 05 33.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify site conditions are capable of supporting equipment for performing operations and testing.

### 3.2 PREPARATION

- A. Protect structures near well from damage.
- B. Disinfect all tools and equipment prior to lowering into well to prevent contamination.
- C. Do not set drilling rod, drop pipe, submersible cable, or any other items to go down the hole on the ground.

### 3.3 DISINFECTION

- A. Well disinfection shall comply with California Department of Water Resources Bulletin 74-81, Water Well Standards.
- B. Inject and circulate a chlorine solution into well so that the chlorine concentration is at least 50 ppm. Do not use granulated HTH for disinfection.
- C. Maintain disinfectant in well for minimum 24 hours.
- D. Positive bacteriological results require repeated well disinfection and samples retaken until negative results are obtained. Contractor shall notify Engineer of positive bacteriological results within 24 hours.

### 3.4 WATER QUALITY TESTING

- A. Collect water samples for bacteriological testing and submit them to an EPA certified laboratory.
- B. Take two (2) samples a minimum of 30 minutes apart.
- C. Record date, time and temperature of each sample.
- D. Conform to all lab-sampling requirements.
- E. Contractor will furnish sample containers.

### 3.5 INSTALLATION –

- A. PUMP
  - 1. Install according to manufacturer's instructions.
  - 2. Set pump intake to depth of existing pump.
- B. VFD
  - 1. Install according to manufacturer's instructions.
  - 2. Install and program VFD to work as designed with pumps and existing programmable logic controller. Contractor shall possess a California Type C-10 Electrical Contractor license (or employ as a subcontractor one with this license)

3.6 TESTS

- A. Submersible Cable: Test for leakage or shorts with a megohmmeter. Readings shall be 2 megohms or greater.

END OF SECTION