APPENDIX A

Specifications
SECTION 03600

GROUT

PART 1  GENERAL

1.1  SUMMARY

A.  Section Includes:

1.  Furnishing non-shrink grout under column and beam bearings and under equipment bases.

2.  Furnishing non-shrink grout around handrail posts and base plates of handrail posts.

3.  Furnishing grout topping and fillet grout in bottoms of concrete tanks, and as concrete topping on slabs.

4.  Furnishing grout around tunnel liners and around pipes in tunnels.

B.  Related Work Specified in Other Sections Include, But is Not Limited to, the Following:

1.  Section 03100 - Concrete Formwork
2.  Section 03310 - Cast-In-Place Concrete

1.2  REFERENCES

A.  Codes and Standards Referred to in this Section:

1.  ASTM C 33  - Specifications for Concrete Aggregates


3.  CRD C-619  - Specification for Grout Fluidifier.

4.  CRD C-621  - Specification for Non-Shrink Grout.
1.3 SUBMITTALS

A. Provide all submittals, including the following, as specified in Division 1:

1. Submit notarized certificate of manufacturer as evidence that pre-packaged non-shrink grout conforms to specified requirements. Include manufacturer’s literature.

2. Submit mix design, for each class of grout, as specified in Section 03310 “Cast-In-Place Concrete”.

3. Submit the following test reports:
   
   a. Compression tests on cylinders for grout topping and fillet grout, as specified in Section 03310.3.3 “Concrete Tests”.

   b. Compression tests, on mortar cubes for non-shrink grout and for tunnel liner and pipe grout, as specified in Section 03310.3.3 “Concrete Tests”.

   c. Air content tests, for grout topping and fillet grout, as specified in Section 03310 “Cast-In-Place Concrete”.

   d. Slump tests, for grout topping and fillet grout and for tunnel liner and pipe grout, as specified in Section 03310.3.3 “Concrete Tests”.

4. Test results showing that in projects of similar scope and size, the effective bearing area (EBA) under column bearings, beam bearings and equipment bases is between 95 and 100 percent.

5. Detailed field records for ready-mixed grout as specified in Section 03310.

1.4 QUALITY ASSURANCE

A. Testing Requirements: Testing laboratory provided by OWNER is responsible for conducting tests required in Division 1.

B. Testing Assistance: Cooperate with the laboratory personnel, provide access to Work, and manufacturer’s operations. Provide and deliver to the laboratory adequate quantities of representative samples of materials proposed to be used which require testing.
1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle all products and materials as specified in Division 1, and as follows:

1. Pre-packaged, Non-shrink Grout:

   Deliver in unopened packages. Store in a dry place protected from moisture.

2. Portland Cement, Aggregates:

   Deliver, store and handle as specified in Section 03310.

PART 2 PRODUCTS

2.1 MATERIALS

A. Non-Shrink Grout:

1. Furnish a flowable, pre-packaged non-shrink grout without dependence on gas expansion forces or enlargement of metal particles for its non-shrinkage characteristics and conforming to CRD C-621.

2. Furnish one of the following:

   a. Masterflow 928, as manufactured by BASF Construction Chemicals.
   b. SikaGrout 212, as manufactured by Sika Corporation.
   c. Or ENGINEER approved equal.

B. Grout Fluidifier:

   Furnish grout fluidifier conforming to CRD C-619.

C. Portland Cement, Aggregates, Admixtures.

1. Furnish as specified in Section 03310.

2. Use air-entraining admixture in all grout.
2.2 GROUT MIXES

A. Non-Shrink Grout:

1. Add water to pre-packaged grout material and mix, as recommended by the manufacturer, to produce a flowable, non-shrink grout having a minimum compressive strength of 3000 psi in 24 hours.

2. Provide grout which when exposed to weather will be free of discoloration, without the necessity of special surface treatments.

B. Bonded Grout Topping and Fillet Grout for Tank Bottoms and Concrete Topping Slabs:

1. Grout to be proportioned from cement, fly ash, fine aggregate and ASTM C33, size no. 8 coarse aggregate with a water-reducing admixture.

2. Proportion to provide a grout having the following properties:
   a. A minimum compressive strength of 4000 psi in 28 days.
   b. An average air content of 5 percent $\geq 1.5$ percent.
   c. Minimum and maximum slumps:
      (1) Fillet grout: 2-4 inches.
      (2) Grout topping: 3-5 inches.
   d. A maximum water-cementitious material ratio of 0.45 by weight of the total cementitious material.

3. Prepare design mixes, for each class of grout, as specified in Section 03310 “Cast-In-Place Concrete”.

C. Tunnel Liner and Pipe Grout:

1. Tunnel liner grout:

   Mix grout for backfilling the space between the tunnel liner and tunnel or other locations as specified or directed in the proportion of 1 part Portland cement to 1 part sand by volume.

2. Pipe grout:

   Mix lean grout for backfilling the space surrounding the pipe sections in tunnel or other areas as specified or directed in the proportion of 1 part Portland cement to 12 parts sand by volume.
3. Mix grout to a consistency that can be pumped into the space between the tunnel liner or pipe and tunnel. Use a grout fluidifier to reduce water quantity and improve workability.

4. Prepare design mixes, for each class of grout, as specified in Section 03310 “Cast-In-Place Concrete”.

D. Measurement and Mixing

Measure and mix material as specified in Section 03310.

PART 3 EXECUTION

3.1 INSPECTION

A. Substrate Condition:

Examine the substrate and conditions under which grout is to be placed and notify the ENGINEER, in writing, of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the OWNER.

3.2 INSTALLATION

A. General:

1. Place grout as shown and in accordance with the manufacturer’s instructions. Notify the OWNER if manufacturer’s instructions conflict with the Specifications. Do not proceed with installation until directed by the OWNER.

2. Drypacking will not be permitted.

3. Have manufacturers of proprietary products make available upon 72 hours notification the services of a qualified, full time employee to aid in assuring proper use of the product under job conditions. The cost of this service, if any, shall be borne by the Contractor.

4. Conform grout placement to temperature and weather limitations in Section 03310 “Cast-In-Place Concrete”.
B. Columns, Beams and Equipment Bases:

1. After shimming columns, beams and equipment to proper grade, securely tighten anchor bolts. Properly form around the base plates allowing sufficient room around the edges for placing the grout. Adequate depth between the bottom of the base plate and the top of concrete base must be provided to assure that the void is completely filled with the non-shrink grout.

C. Handrails and Railings

1. After posts have been properly inserted into the holes or sleeves, fill the annular space between posts and sleeve with the non-shrink grout. Bevel grout at juncture with post so that moisture flows away from post.

D. Grout Topping and Fillet Grout for Concrete Tanks:

1. Prior to proceeding with Work, ensure that tank equipment has been checked for accurate adjustment.

2. Use a metal screed on the tank mechanism to check the surface elevation of the base slab and to ensure that at least the thickness of grout shown can be placed. If there is insufficient room for this grout, remove the high spots in the concrete or adjust the mechanism, or both, as necessary to provide proper grout thickness and equipment clearance.

3. Prior to placement of grout, remove all laitance, debris and loose and foreign material from the base slab. Use waterblasting, sandblasting or other methods acceptable to the City.

4. Thoroughly wet the base slab at least 24 hours before placing the grout.

5. Roughen the concrete surface to receive the grout with a rolling tamp. Prior to placing the grout, the surface must be wetted and cleaned as described above. Apply a cement water paste to the surface with a stiff broom.

6. Where recommended by manufacturer, use the tank mechanism to screed the grout on the tank floor and sweep grout into fillets as it is placed. Have a representative of the equipment manufacturer be present during the screeding operation, unless otherwise approved. Screed in accordance with manufacturer’s instructions.

7. Cure and protect the grout as specified in Section 03310 “Cast-In-Place Concrete”.

Screening and Grit Facility 03600-6 09/2016
8. Level the grout topping to comply with requirements of Section 03310.

9. Float finish topping as specified in Section 03310.

E. Grout Topping for Concrete Topping Slabs:

1. Prior to placement of grout, remove all laitance, debris and loose and foreign material from the base slab. Use waterblasting, sandblasting or other methods acceptable to the City.

2. Thoroughly wet the base slab at least 24 hours before placing the grout.

3. Roughen the concrete surface to receive the grout with a rolling tamp. Prior to placing the grout, the surface must be wetted and cleaned as described above. Apply a cement water paste to the surface with a stiff broom.

4. Place grout topping per elevations and slopes indicted on drawings, then screed, wood float, steel trowel and chemically harden as specified in Section 03310.

5. Cure and protect the grout as specified in Section 03310.

F. Grout Tunnel Liners and Pipes in Tunnels:

1. Force grout through pipes or holes located in the crown of the liner or pipe every 20 feet, to completely fill all voids between the liner or pipe and tunnel, using such pressure as necessary to ensure that the voids have been completely filled. Drill additional grout holes and grout at additional locations in necessary to facilitate completely filling all voids.

2. Grout tunnel liners immediately after installation of the liner.

3. Grout pipes or holes immediately after installation of the pipe.

3.3 TESTS

A. Sample and test grout for compressive strength, air content and slump as specified in Section 03310 “Cast-In-Place Concrete”, except as follows:

1. Non-shrink grout and tunnel liner and pipe grout: Prepare and test standard 2-inch mortar cubes in accordance with the requirements of ASTM C109. Make a minimum of one set of 6 cubes for each day of work or each 150 cubic yards of grout for each type of grout. Test two cubes for compressive strength at 7 days, one at 14 days and two at 28 days.

END OF SECTION
SECTION 06620

FIBERGLASS GRATED PLATFORM AND STAIRS

PART I  GENERAL

1.1  SUMMARY

A. Section Includes: Fiberglass gratings, plates, stair treads, stair stringers, structural shapes, embedded angles, grating support legs, stringers, fasten devices, and appurtenances for raised walkway in the Classifiers Room.

B. Related Work Specified in Other Sections Includes:

1. Section 05500 - Metal Fabrication

1.2  REFERENCES

A. Codes and standards referred to in this Section are:

1. ASTM D 256 - Impact Resistance of Plastics and Electrical Insulating Materials
3. ASTM D 638 - Test Method for Tensile Properties of Plastics
4. ASTM D 695 - Test Method for Compressive Properties of Rigid Plastics
5. ASTM D 790 - Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
6. ASTM D 792 - Test Method for Specific Gravity (Relative Density) and Density of Plastics by Displacement
7. ASTM D 2583 - Test Method for Indentation Hardness of Rigid Plastic by Means of a Barcol Impressor
8. ASTM D 2584 - Test Method for Ignition Loss of Cured Reinforced Resins

10. ASTM 593 - Stainless Steel Bolts, Hex Cap Screws and Studs

11. ASTM 594 - Stainless Steel Nuts

1.3 SYSTEM DESCRIPTION

A. General: Provide a raised walkway to span over pipes of different diameters. Include railing per specification 05520. Fit walkway with adjustable leg system to span over pipes and flexible enough to miss pipes at support points.

B. Design Requirements: Design grating for a live load of not less than 150 pounds per square foot with the deflection not exceeding 1/360 of the span, but not more than 1/4 inch.

C. Performance Requirements: Meet or exceed the following requirements:

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<thead>
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<th>Test Method</th>
<th>Strength</th>
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Meet ASTM E 84 Class 1 flame spread 0-25.

1.4 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.

1. Submit detailed working drawings of all grating and plate for approval before any fabrication is started.

B. Literature: Submit manufacturer's literature including load, span and deflection tables for floor grating and plate, and field installation instructions.
C. Samples: Submit 12 inch by 12 inch samples of each type of floor grating and plate to be used.

D. Laboratory Certification: Submit reports of compliance with performance requirements. Pull one random sample from each product batch for testing.

1.5 DELIVERY, STORAGE AND HANDLING

A. Delivery, store and handle all products and materials as specified in Division 1 and as follows:
   1. Dumping or dropping from trucks is not permitted. Return all damaged sections and supply a new piece.
   2. Store materials in areas set aside for such use. Store on skids or platforms above ground. Do not permit warping, bending or loads exceeding design capacity.

1.6 WARRANTY

A. Provide warranty as specified in Division 1.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of design manufacturer is listed below, other manufacturers in compliance with requirements may be Acceptable.
   1. Fibergrate Composite Structures Inc., Addison, TX

2.2 TYPE OF GRATINGS AND PLATES

A. Provide type of gratings and stairs as follows:
   1. Pultruded Fiberglass Reinforced Grating
   2. Pultruded Fiberglass Stair Treads

2.3 MATERIALS

A. General:
   1. Form molded grating from bars in a square mesh pattern at least 1-1/2 inches deep on 1-1/2-inch centers.
2. Provide holes where required for the passage of pipes, or for other purposes. Reinforce holes to preserve strength. Band openings and ends of all grating to the full depth of the grating with fiberglass strips bonded to all intersecting members.

3. Provide skid-resistant surface.

4. Provide grating of uniform and constant profile.

5. Provide grating free of warps, twists or other defects which affect appearance or serviceability.

B. Pultruded Reinforcing Grating: Provide pultruded components using a ultraviolet resistant synthetic veil on all exposed surfaces, Type Safe-T-Span System.

1. Provide fire retardant polyester resin system Type VEFR System.

C. Structural Shapes, Embedded Angles and Grating Support Legs: Provide FRP structural shapes, FRP embedded angles, and FRP grating support legs manufactured by the pultrusion process by combining fiberglass and premium grade resins in a polymer matrix, Type VEFR System. Provide poltruded angles with size: 2-inch by 1-1/2-inch and grating support legs using quality thermosetting resins with ultraviolet inhibitors. Provide continuous embedded angles with integral anchors and adjustable grating support legs with base.

D. Molded Stair Treads: Provide FRP grating stair treads with grit of the same resin formulation as the molded grating, and with slip resistance surface, Type Fibertred System.

E. Pultruded Stair Treads: Provide FRP stair treads manufactured by the pultrusion process using a vinyl ester resin, Type VEFR System.

F. Supports for Raised walkway in the Classifiers Room area: Provide 1-1/2 inch square mesh molded FRP grating panels supported on FRP adjustable legs with screw-leveling feature, FRP nut base and stainless steel Type 316 wire clip. Adjust the height of grating support legs from atop grating. Secure the adjacent panels with “F” type stainless steel Type 316 clips spaced at maximum 48-inches on center.

G. Fasteners and Accessories: Provide stainless steel Type 316 fasteners and anchors as specified in Section 05500.
2.4 FABRICATION

A. Provide floor gratings, plates, stair treads and appurtenances fabricated as follows:

1. Pultruded fiberglass reinforced gratings manufactured from thermally cured pultrude structural load and tie bar components. Form the load bar using continuous strand roving and an outside surface covered with a continuous strand mat and a synthetic surfacing veil.

B. Fabricate gratings and plates accurately, free from warps, twists or other defects which affect the appearance and serviceability of the grating and plates.

C. Provide top surface of gratings and plates with annular abrasive particles (grit) for skid resistance.

D. Seal grating and plate cuts with catalyzed resin capable with resin used in the manufacture of the grating and plates and of equal or superior corrosive resistance.

E. Unless otherwise indicated on the Contract Drawings provide minimum size and thickness of materials as follows:

1. Pultruded FRP grating: 1-1/2 inch deep minimum bearing bars at a 1-inch maximum clear spacing and with a tie bar spacing of 6 inches maximum on center.

2. FRP stair treads: channels with a minimum size of 10 inches deep x 2-3/4 inches wide x 1/2 inch thick.

3. Pultruded grating stair treads: 1 inch wider than tread widths shown on the Contract Drawings but not less than 10-1/2 inches wide and securely fastened to FRP or stainless steel angles or carrier bars fastened to FRP treads. Construct the outer edge or nosing of stair treads to make it distinctly visible and contrasting with other part of the tread. Furnish nosings on all the stair treads and landings.

F. Provide cut-outs in the grating for the passage of pipe, valve stem, columns and similar work. Where more than four (4) bearing bars are included in the cut-out, provide banding bars of the same dimension as the bearing bars around the opening and welded or electric-forged to the component parts of gratings.

PART 3 EXECUTION

3.1 INSTALLATION

A. General: Erect grating in place on embedded angles, with full and uniform bearing on the supports, precluding rocking movement. Do not use wedges or similar
shimming devices. Lock individual grating panels securely in place with approved clamps or devices.

B. Positioning: Install grating sections for ease of removal and replacement. Permit a maximum clearance of 1/4-inch at ends and between sections. Neatly fit adjacent sections so that transverse members form an uninterrupted straight line.

C. Adjust supports spacing and or number to miss pipes passing under walkway and still satisfy design requirements indicated above.

D. Fasteners: Fasten each grating section to the support angles with approved fasteners. Do not permit fasteners to extend above the top plane of the grating.

E. Penetrations: Provide penetrations where required for the passage of pipes, or for other purposes. Reinforce grating where necessary to preserve its strength. Band openings in, and ends of all grating to the full depth of the grating with fiberglass strips bonded to all intersecting members.

F. Cut Ends: Seal all field-cut surfaces in accordance with the grating manufacturer's recommendations or instructions.

END OF SECTION
SECTION 11288
STOP LOGS AND STOP GATES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for furnishing and installing stop logs and stop gates and frames with all necessary parts and accessories for a complete installation. Stop logs and stop gates and frames shall be furnished by the same manufacturer.

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 03150 - Concrete Accessories
2. Section 03310 - Cast-in-Place Concrete
3. Section 03600 - Grout
4. Section 05500 - Metal Fabrications

1.2 REFERENCES

A. Codes and standards referred to in this Section are:

1. AWWA C513 - Open Channel Fabricated Metal Slide Gates

1.3 SYSTEM DESCRIPTION

A. General: Stop log/plate as shown and specified as listed in the stop log/plate schedule herein. Provide all stop gates of the same type from one manufacturer.

B. Design the gate anchorage system shall either be for attachment to existing concrete wall or embedded in new concrete wall as described on the drawings and the Schedule. It is the Contractor’s responsibility to confirm and coordinate all field dimensions, including but not limited to existing thimble flange dimensions, with the manufacturer prior to the submittal of drawings. The new anchorage system shall be designed with this considered.

1.4 SUBMITTALS

A. General: Provide all submittals, including the following, as specified in Division 1.
B. Shop Drawings: Submit shop drawings, including arrangement and erection drawings of the stop gates and frames and structural design data, if requested. Include the following:

1. Certificate of Compliance with the drawings and specifications, noting all deviations from the drawings and specifications.
2. Installation reference list with contact names and numbers for no less than 20 installations of similar size and use.
3. Equipment weights and lifting points.
4. Recommendations for short and long term storage.
5. A copy of the manufacturer’s warranty.

C. Quality Control:

1. Submit manufacturer's certified performance and material specifications, as specified.
2. Submit complete calculations for each size of motor operator indicating the force required to operate the gate, the operator force provided, full load and locked rotor current, and horsepower.

D. Operation and Maintenance Manuals: Submit operation and maintenance manuals for the stop gates and frames.

1.5 DELIVERY, STORAGE AND HANDLING

A. General: Deliver, store and handle all products and materials as specified in Division 1.

1.6 QUALITY ASSURANCE

A. Ensure quality, conformance, and reliability with regard to the manufacturing and production of the stop logs and stop gates and frames described in this section. Meet the requirements listed in this section.

1. Supply equipment from a manufacturer regularly engaged in the manufacturing and production of stop gates and frames for a minimum of five (5) years that has installed and had in satisfactory use in this application a minimum of twenty (20) installations of similar size units to the units specified.
2. Provide equipment that is the manufacturer’s standard product and only modified as necessary to comply with the drawings, specifications, and specified service conditions.

3. Guarantee all equipment against faulty or inadequate design, improper assembly or installation, defective workmanship or materials, and breakage or other failure. Provide materials suitable for the service conditions.

PART 2 PRODUCT

2.1 MANUFACTURERS

A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

1. WACO Products, Inc.
2. Hydro Gate Corporation

2.2 GENERAL

A. Design stop logs and stop gates to meet the requirements of AWWA C513, including but not limited to allowable leakage, head and loading, structural strength, deflection, materials and minimum dimensions.

B. Provide stop logs and gates with structural components designed with a minimum safety factor of 4 with regards to ultimate tensile, compressive and shear strength and a minimum safety factor of 2 as regards tensile, compressive and shear yield strength.

2.3 STOP LOGS/PLATES AND APPURtenANCES

A. Stop Logs and Plates:

1. Provide stop logs that have the characteristics and dimensions as tabulated in the Stop Log Schedule.

2. Fabricate stop gate plates from not less than 1/4-inch thick aluminum alloy 6061-T6 plate, reinforced with aluminum alloy 6061-T6 structural shapes, capable of withstanding the water pressure in either direction with the water level at maximum operating level.

3. Deflection under full design head will be no more than 1/360 of the span width of the gate.

4. Fabricate stop gate plates so that plates will be interchangeable for all channels of equal width with the same frame type.
5. Fabricate stop gate plates with slots for lifting purposes. Stop gate plates wider than 3 feet in width shall incorporate dual slots. All slots shall have welded reinforcing plates on both sides of the slot unless otherwise indicated and suitable for lifting with crane hooks or slings.

6. Seals:
   a. Provide frames with self-adjusting ultra high molecular weight polyethylene (UHMW) seat seals on both sides of the stop plate to reduce leakage, friction and wear between the plate and frame. UHMW seat seals shall self-adjust by means of a nitrile compression cord fit into an integral extruded slot in the UHMW. Minimum seal seating surface width shall be ¾ inches.
   b. Bearing bars shall be extruded from virgin UHMW ultraviolet resistant polymer and shall be held within the guide frame by integral retaining slots in the guide extrusion. Bearing bars or seals that are glued or mechanically fastened to the frame or plate shall not be accepted.
   c. Seals shall be replaceable without special tools and without removing the frame from its installed position.

7. Leakage:
   a. Manufacture the stop logs to withstand the differential heads as shown in the stop log schedule with a leakage no greater than 0.1 GPM per linear foot of seal length regardless of the order in which the logs are installed.

8. Provide all stop logs for a particular location of identical construction and capable of being installed in any order.

B. Stop Log Grooves

1. Fabricate the guide frame from minimum ¼-inch thickness 6061-T6 aluminum extrusions and structural members to resist loads imposed by the design head. Side frame extrusions shall have a minimum weight of 4 pounds per foot. Provide frame with factory welded mitered corners where the side and invert frames meet. Guide frames constructed of plate or structural shapes shall not be accepted.

2. Provide frames with a factory applied coating of bituminous paint on all surfaces to be in contact with concrete or grout.
   a. Design embedded frames to allow for a flush bottom installation. Flush bottom frames shall incorporate a countersunk invert seat.
Formed concrete inverts and stop plate mounted seals shall not be accepted. Embedded frames shall be grouted in place within a blockout or embedded at the time of the channel concrete pour with adequate blocking installed by the CONTRACTOR to prevent distortion of the frame during installation.

C. Stop Log Lifter

1. Provide a stop log lifting device for each stop log size furnished by the stop log manufacturer.
   a. Lifting Device: Type 304L stainless steel
   b. Lifting cable and hardware: Type 316L stainless steel

2. Lifting device to be portable and match the channel width of the stop logs provided. Provide lifters for each width of stop logs in accordance with the Stop Log Schedule on the Contract Drawings.

3. Each lifting device to include lifting cable and an eye or shackle.

4. Provide lifter with a latch, and unlatching lines operated from above, to engage or disengage one stop log at a time.

5. Provide Lifting device to grab the log automatically when lowered into the stop log groove.

6. Lifting devices to be rated to handle five times the stop log weight.

D. Stop Log Storage Rack

1. Provide a Type 316 stainless steel stop log storage rack to house stop logs and lifting devices while not in use.

2. Design, fabricate and furnish the stop log storage rack in accordance with Division 5 - Metals.

3. Design the stop log storage frame to avoid damage to the stop log seals.

E. Provide an aluminum platform cart to carry and transport nominal size 6-ft stop logs and stop log lifter. Provide the cart of heavy duty hot-dipped galvanized construction with a load capacity of not less than 200 pounds, and with platform dimensions of not less than 60” x 30”. Provide two rigid wheels and two swivel casters mounted in a diamond pattern. Provide removable hot dipped galvanized stakes at each corner, and provide rigidly attached blocking recommended by the stop log manufacturer to hold the load of a stop log and stop log lifter in place during transport of the load.
2.4 STOP GATE PLATE FRAMES

A. Stop Gate Guide Frames:

1. Fabricate the guide frame from minimum ¼-inch thickness aluminum structural members to resist loads imposed by the design head. Side frame fabrications shall have a minimum weight of 4 pounds per foot. Provide frame with factory welded mitered corners where the side and invert frames meet.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install stop gates and frames in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Division 1.

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Services:

1. Furnish the services of a qualified representative of the manufacturer to provide instruction on proper installation of the equipment, inspect the completed installation, make any necessary adjustments, and participate in the field testing of the equipment, as specified in Division 1.

2. Furnish the services of a qualified representative of the manufacture to demonstrate the proper lifting and instruct the plant personnel in the equipment's maintenance, as specified in Division 1.

B. Tests:

1. After installation of the stop gates and all appurtenances, subject the gates to a field running test, as specified in Division 1, under actual operating conditions.

2. Test stop gates and frames for leakage and strength against the maximum heads practicable to obtain under operating conditions. Verify that leakage does not exceed that specified in AWWA C-513 and repair, re-install or replace as necessary to meet this specification.
3.3 SCHEDULE

A. Abbreviations used in the schedule are as follows:

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<th>Frame Types</th>
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Note: Stop log groove imbedded channel shall an “A” dimension of 8 inches, a “B” dimension of 4 inches, and a “C” dimension if ½ inch.

END OF SECTION

Screenings and Grit Facility 11288-7 10/2018
<table>
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<th>Service</th>
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<th>Pipe Material</th>
<th>Protective Coatings</th>
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</table>

1 Measure the test pressures shown in the schedule at the centerline of the pipeline’s low point. Adjust test pressures measured at other locations accordingly.

2 Do not insulate sections of pipe that pass through or are within structures containing water.
PART 1   GENERAL

1.1   SUMMARY

A. Section Includes: Short circuit and coordination study for the entire power distribution system pertaining to the Screenings and Grit Removal Facilities.

B. Related Work Specified in Other Sections Includes, But is Not Limited to, the Following:

1. Section 16080 - Electrical Testing Requirements
2. Section 16220 - Electric Motors
3. Section 16266 - Adjustable Frequency Drives
4. Section 16273 - Pad-Mounted Transformers
5. Section 16443 - Panelboards
6. Section 16445 - Motor Control Centers

C. The electrical contractor shall retain the services of an independent third party firm, or the equipment manufacturer’s technical services group, to perform a short circuit/coordination study and arc flash risk assessment as described herein.

D. Preliminary studies shall be submitted to the Engineer prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment for manufacture to ensure the characteristics and ratings of the proposed overcurrent devices will be satisfactory. The final submittal shall capture any changes in circuit lengths, wire sizes, additional loads, etc. that may occur during the construction project.

E. The studies shall include all portions of the electrical distribution system from the normal power source or sources relative to the Screenings and Grit Facility project, down to and including the smallest circuit breaker in the distribution system (for short circuit calculations). Normal system connections and those which result in maximum fault conditions shall be adequately covered in the study.

F. The firm should be currently involved in medium- and low-voltage power system evaluation. The study shall be performed, stamped and signed by a registered professional engineer in the State of Virginia. Credentials of the individual(s) performing the study and background of the firm shall be submitted to the Engineer for approval prior to start of the work. A minimum of five (5) years’ experience in power system analysis is required for the individual in charge of the project.
G. The firm performing the study should demonstrate capability and experience to provide assistance during start up as required.

H. The study and assessment shall be performed on SKM Dapper, Captor and PowerTool software or EasyPower product suite software.

1.2 REFERENCES

A. Codes and standards referred to in this Section are:


1.3 DATA FOR THE STUDY

A. Requirements:

1. The contractor shall provide the required data for preparation of the studies. The engineer performing the system studies shall furnish the contractor with a listing of the required data immediately afterward of the contract.

2. The contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to release of the equipment for manufacture.

1.4 SUBMITTALS

A. Third Part Qualifications:

1. Submit qualifications of individual(s) who will perform the work to the Engineer for approval prior to commencement of the studies.

B. Preliminary Report:

1. Submit a draft of the studies to the Engineer for review prior to delivery of the final study to the Owner. Make all additions or changes as required by the reviewer.

C. Final Study Report:

1. Provide studies in conjunction with equipment submittals to verify equipment ratings required.

2. The results of the power system studies shall be summarized in a final report and provided in the following formats. Provide (2) bound hard copies of the final report. Provide (2) electronic copies (on CD) of the final report and
one-line diagrams in PDF format. Provide (2) electronic copies (on CD) of the final report in MS Word format and the one-line diagrams in CAD format.

3. Also provide (2) electronic copies (on CD) of all files generated by the SKM or EasyPower software for all scenarios evaluated in the studies. The files shall permit the studies to be opened, reviewed or updated by any user of the analysis software used for the studies.

4. The report shall typically include the following sections:

   a. Overview

   b. Short Circuit Study

      SC-1 Purpose
      SC-2 Explanation of Data
      SC-3 Assumptions
      SC-4 Analysis of Results
      SC-5 Recommendations
      SC-6 Fault Analysis Input Report from Software Program
      SC-7 Fault Contribution Report

   c. Protective Device Coordination Study

      PDC-1 Purpose
      PDC-2 Explanation of Data
      PDC-3 Assumptions
      PDC-4 Analysis of Results
      PDC-5 Recommendations (Including NEC 700-27 Requirement)
      PDC-6 Results from Software Program
      PDC-7 Example Drawings

   d. Arc Flash Study

      ARC-1 Purpose
      ARC-2 Explanation of Data
      ARC-3 Assumptions
      ARC-4 Analysis of Results
      ARC-5 Recommendations
      ARC-6 Arc Flash Evaluation Report from Software Program

   e. Prioritized Recommendations And Conclusions
5. The above sections shall include the following items in detail:

   a. Obtain available fault current from the local utility company.

   b. Short circuit studies shall evaluate the available fault current at each bus (each change of impedance), including all three-phase motors.

   c. Coordination study recommendations for relay settings, breaker settings, and motor protection settings.

   d. Recommendations for improving the coordination and/or load distribution, as well as ground fault requirements.

   e. Worst case Arc Flash values (highest incident energy) for project specific scenarios (low short circuit and high short circuit for each possible power supply source).

   f. Arc flash values for two maintenance cases, which define the arc flash values available at the equipment that would be available if the instantaneous trip of the upstream circuit breaker is set at a minimum value. This is recommended if someone has to work on live equipment.

   g. IEEE standard one-line diagram with equipment evaluation and circuit breaker settings that clearly define the system data and are easy to interpret. The diagrams should include the bus names and references used in the studies.

   h. Recommendations to reduce the arc flash incident energy in all areas that are subject to 8 calories per square centimeter or greater of available incident energy.

   i. Condition of Maintenance information for any existing equipment included in the study.

   j. Prioritized report summarizing all recommendations from this study. This shall include observed NEC code violations and their corrective action.
PART 2  PRODUCTS

Not Used

PART 3  EXECUTION

3.1  SHORT CIRCUIT AND COORDINATION STUDY

A. The short circuit, coordination, and arc flash hazard studies shall be performed using SKM Dapper, Captor and PowerTool for Windows software or EasyPower product suite Windows based software packages. In the short circuit study, provide calculation methods and assumptions, the base per unit quantities selected, one-line diagrams, source impedance data including power company system characteristics, typical calculations, and recommendations. Calculate short circuit interrupting and momentary (when applicable) duties for an assumed 3-phase bolted fault at each supply switchgear lineup, unit substation primary and secondary terminals, low voltage switchgear lineup, switchboard, motor control center, distribution panelboard, pertinent branch circuit panelboard, and other significant locations throughout the system. Provide a ground fault current study for the same system areas, including the associated zero sequence impedance data. Include in tabulations fault impedance, X to R ratios, asymmetry factors, motor contribution, short circuit KVA, and symmetrical and asymmetrical fault currents.

B. In the protective device coordination study, provide time-current curves graphically indicating the coordination proposed for the system, centered on conventional, full-size, log-log forms. Include with each curve sheet a complete title and one-line diagram with legend identifying the specific portion of the system covered by that particular curve sheet. Include a detailed description of each protective device identifying its type, function, manufacturer, and time-current characteristics. Tabulate recommended device tap, time dial, pickup, instantaneous, and time delay settings.

C. Include on the curve sheets power company relay and fuse characteristics, system medium-voltage equipment relay and fuse characteristics, low-voltage equipment circuit breaker trip device characteristics, pertinent transformer characteristics, pertinent transformer characteristics, pertinent motor and generator characteristics, and characteristics of other system load protective devices. Include at least all devices down to largest branch circuit and largest feeder circuit breaker in each motor control center, and main breaker in branch panelboards.

D. Include all adjustable settings for ground fault protective devices. Include manufacturing tolerance and damage bands in plotted fuse characteristics. Show transformer full load and 150, 400, or 600 percent currents, transformer magnetizing inrush, ANSI transformer withstand parameters, and significant symmetrical and asymmetrical fault currents. Terminate device characteristic
curves at a point reflecting the maximum symmetrical or asymmetrical fault current to which the device is exposed.

E. Select each primary protective device required for a delta-wye connected transformer so that its characteristic or operating band is within the transformer characteristics, including a point equal to 58 percent of the ANSI withstand point to provide secondary line-to-ground fault protection. Where the primary device characteristic is not within the transformer characteristics, show a transformer damage curve. Separate transformer primary protective device characteristic curves from associated secondary device characteristics by a 16 percent current margin to provide proper coordination and protection in the event of secondary line-to-line faults. Separate medium-voltage relay characteristic curves from curves for other devices by at least a 0.4-second time margin.

F. Include complete fault calculations as specified herein for each proposed and ultimate source combination. Note that source combinations may include present and future supply circuits, large motors, or generators as noted on drawing one-lines.

G. Utilize equipment load data for the study obtained by the Contractor from contract documents, including contract addendums issued prior to bid openings.

H. Include fault contribution of all motors in the study. Notify the Engineer in writing of circuit protective devices not properly rated for fault conditions.

I. Provide settings for the chiller motor starters or obtain from the mechanical contractor, include in the study package, and comment.

J. Evaluate proper operation of the ground relays in 4-wire distributions with more than one main service circuit breaker, or when generators are provided, and discuss the neutral grounds and ground fault current flows during a neutral to ground fault.

K. For motor control circuits, show the MCC full-load current plus symmetrical and asymmetrical of the largest motor starting current to ensure protective devices will not trip major or group operation.

3.2 FIELD SETTINGS

A. The contractor shall perform field adjustments of the protective devices as required to place the equipment in final operating condition. The settings shall be in accordance with the approved short circuit study, protective device coordination study and arc flash risk assessment.

B. Necessary field settings and adjustments of devices and minor modifications to equipment to accomplish conformance with the approved short circuit and protective device coordination study shall be carried out by the Contractor at no additional cost to the owner.
3.3 ARC FLASH RISK ASSESSMENT

AS PART OF THE SHORT CIRCUIT AND COORDINATION STUDY, ARC FLASH RISK ASSESSMENT SHALL BE INCLUDED. THE STUDY SHALL INCLUDE THE FOLLOWING:

A. Determine and document all possible utility and generator/emergency sources that are capable of being connected to each piece of electrical gear. Calculations shall be based on highest possible source connection.

B. Calculations to conform to National Fire Protection Association (NFPA) 70E recognized means of calculation standards. All incident energy units shall be calculated in calories per square centimeter.

C. Provide recommended boundary zones and personal protective equipment (PPE) based on the calculated incident energy and requirements of NFPA 70E for each piece of electrical gear.

D. Contractor to provide a spreadsheet either hard copy or electronic so Engineer can provide new naming criteria for electrical equipment.

E. Upon acceptance of Item D above the Electrical Contractor shall provide warning labels as required by OSHA based upon the results of the arc flash risk assessment.

F. At a minimum, the labeling shall contain the following information: nominal system voltage, arc flash boundary, limited approach boundary, restricted approach boundary, available incident energy and the corresponding working distance or the arc flash PPE category, minimum arc rating of clothing, and the study date. Label shall also include the name and logo and the telephone number of the company performing the study.

G. Arc flash warning labels shall be affixed to all electrical equipment that is likely to require examination, adjustment, servicing or maintenance while energized. This includes, but is not limited to, medium-voltage switchgear, transformers, switchgear, panel boards, three-phase disconnects switches, motor control centers, motor controllers.

END OF SECTION