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DIVISION 5 - METALS

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SECTION 05502
MISCELLANEOUS METAL MATERIALS AND OTHER ITEMS

PART 1 - GENERAL

1.1 SCOPE. The work covered by this section consists of providing all equipment, materials and labor for fabricating, furnishing, and installing miscellaneous metal materials, and other items.

1.2 QUALITY CONTROL.

1.2.1 General. The Contractor shall establish and maintain quality control for all operations to assure compliance with contract requirements and maintain records of quality control for all operations including but not limited to the following:

(1) Materials.
(2) Fabrication and Workmanship.
(3) Installation.

1.2.2 Reporting. A copy of the records and tests, as well as the records of corrective action taken, shall be furnished to the Government daily.

1.3 APPLICABLE PUBLICATIONS. The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

1.3.1 American National Standards Institute (ASME).

B 18.21.1-99	Lock Washers (Inch Series)
B 18.22.1-65 (R 1990)	Plain Washers

1.3.2 American Society for Testing and Materials (ASTM).

A 36/A 36M-04 (Rev A)	Structural Steel
A 53-02 (Rev A)	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
A 108-03	Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
A 307-03	Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
A 325-04	Structural Bolts, Steel, Heat-Treated, 120/105 ksi Minimum Tensile Strength

A 370-03 (Rev. A)	Mechanical Testing of Steel Products
A 572-04 (Rev B)	High-Strength Low-Alloy Columbium-Vanadium Structural Steel
A 615-04	Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement
A 722-98	Standard Specification for Uncoated High-Strength Steel Bars for Prestressing Concrete
A 786/A 786M-00	Rolled Steel Floor Plates
A 992-04	Standard Specification for Structural Steel Shapes
B 633-98	Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
E 709-01	Standard Guide for Magnetic Particle Examination

1.3.3 American Welding Society (AWS).

D 1.1-02	Structural Welding Code – Steel

1.3.4 Federal Specifications.

QQ-L-171e Lead Pig

1.4 SUBMITTALS. Government approval is required for all submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted to the Contracting Officer in accordance with SECTION 01300 - SUBMITTAL PROCEDURES:

1.4.1 Data. Standard Articles; GA. Manufacturer's specifications, product literature and installation instructions of items specified herein.

1.4.2 Drawings.

1.4.2.1 Shop Fabricated Metal Items; GA. Shop and erection details including members (with their connections) not shown on the contract drawings. Lift gate machinery support frame shop drawings shall be submitted showing all details of the steel frame. The Contractor shall include verification on the steel shop drawings for the machinery support bases that the machinery support frames have been accurately coordinated with the actual size and configuration of the machinery equipment to be provided.

1.4.2.2 Structural Connections; GA. Shop and erection details including members (with their connections) not shown on the contract drawings. Welds shall be indicated by standard welding symbols in accordance with AWS A2.4.

1.4.3 Certificates.

1.4.3.1 Mill Test Reports; FIO. Certified copies of mill test reports for structural steel, structural bolts, nuts, washers and other related structural steel items, including attesting that the structural steel furnished contains no less than 25 percent recycled scrap steel and meets the requirements specified, prior to the installation.

1.4.3.2 Welder Qualifications; GA. Certified copies of welder qualifications test records showing qualification in accordance with AWS D1.1.

1.4.3.3 Welding Inspector; GA. Welding Inspector qualifications.

1.5 STORAGE. Material shall be stored out of contact with the ground in such manner and location as will minimize deterioration.

PART 2 - PRODUCTS

2.1 MISCELLANEOUS METAL MATERIALS AND STANDARD ARTICLES. Materials and standard articles shall conform to the respective specifications and other designated requirements. Sizes shall be as specified or shown on the drawings. Where material requirements are not specified, materials furnished shall be suitable for the intended use and shall be subject to the approval of the Contracting Officer.

2.1.1 Structural Steel. Wide flange shapes shall be ASTM A 992 grade 50. Angle, channel, and S rolled shapes shall be ASTM A 36. Plate steel shall be ASTM A 572, Grade 50. ASTM A 992 and ASTM A 572 structural steel shall conform to the following Charpy V-notch fracture toughness requirements as tested in accordance with ASTM A 370.

Thickness, inches	Fracture Toughness Ft-lbs @ Degrees F
Less than or equal to 2.0	25 @ 70
Greater than 2.0	30 @ 70

2.1.2 Bolts, Nuts, and Washers. Bolts, nuts, and washers shall be of the material, grade, type, class, style, and finish indicated or best suited for intended use.

2.1.2.1 High-Strength Bolts, Nuts and Washers. ASTM A 325

2.1.2.2 Bolts, Nuts, and Washers (Other Than High-Strength).

2.1.2.2.1 Bolts and Nuts. ASTM A 307, Grade A.

2.1.2.2.3 Washers.

2.1.2.2.3.1 Plain Washers. ASME B 18.22.1, Type B.

2.1.2.2.3.2 Lock Washers. ASME B 18.21.1.

2.1.3 Expansion Anchors. Expansion anchors shall be the size and type shown on the drawings and shall be stud type with a single piece three section wedge and zinc plated in accordance with ASTM B 633. Anchors shall be installed per manufacturer's recommendations. Anchors shall be galvanized unless otherwise indicated.

2.1.4 High Strength Concrete Anchor Dowels. Embedded anchor dowels used for anchorage of the downstream lift gate machinery support frame shall be high strength dowels, either 120 ksi or 150 ksi steel dowels, at locations shown on the contract drawings. 120 ksi dowels shall be high strength deformed dowels conforming to ASTM A 108, with U.N. threads as shown on the drawings. 150 ksi dowels shall be high strength deformed dowels conforming to ASTM A 722, with U.N. threads as shown on the drawings. In addition, a section of the bar adjacent to the threaded portion shall be smooth for a length equal to 1.5 bar diameters. 120 ksi and 150 ksi dowels shall be obtained from commercially available sources. Threaded concrete reinforcing bars used for anchor dowels shall be of the size shown on the drawings and conform to ASTM A615 grade 60. Thread lengths are defined on the drawings. In addition, a section of the bar adjacent to the threaded portion shall be smooth for a length equal to 1.5 bar diameters. Threaded concrete reinforcing bars used for anchor dowels shall be obtained from commercially available sources. All high strength concrete anchor dowels and threaded deformed bars shall be grouted using epoxy resin in accordance with the manufacturers recommendations.

2.1.5 Concrete. The manufacture, transportation, placement, finishing, and curing of Portland cement shall conform to the requirements of SECTION 03301 - CONCRETE.

2.1.6 Epoxy Resin Bonding Material. Epoxy resin bonding material shall conform to the requirements of SECTION 03301 - CONCRETE.

2.1.7 Epoxy Resin Grout. Epoxy resin grout shall conform to the requirements of SECTION 03301 - CONCRETE.

2.2 SHOP FABRICATED METAL AND OTHER ITEMS. Shop fabricated metal and other items shall conform to the requirements and details as specified herein and as shown on the drawings.

2.2.1 Counterweight Replacement.

2.2.1.1 Counterweight Dogging Beam. The counterweight dogging support system shown on drawing M-LM-17/S-20 shall be fabricated in the shop as much as practicable and installed as a unit. The dogging hooks and pins shall be fabricated as shown on drawing M-LM-17/S-22. Installation of the dogging support system shall occur after the replacement counterweights and idler support system have been installed. Components of the dogging support system that are to be embedded in concrete shall be free of rust before concrete is cast. Portions that are to be exposed shall be painted in accordance with SECTION 09940 - PAINTING. The support system is leveled with anchor bolts as shown on the drawings. The hole sizes provided in the beams allow for proper

alignment of the hook pin plates. After the support system is level and the adjustment is approved by the contracting officer, and prior to concrete reconstruction, the area adjacent to the anchor bolts and below the beams shall be grouted. Formwork for the concrete reconstruction shall not be supported by the dogging beam system. The welds connecting the hook pin plates to the dogging beams shall be nondestructively tested in accordance with paragraph 3.2.5.

2.2.1.1.1 Pneumatic Cylinders. The dogging hooks shall be actuated by pneumatic cylinders as detailed on drawings M-LM-17/S-36 and S-37. The Contractor shall furnish one pneumatic cylinder for each dogging hook.

2.2.1.2 Idler Sprocket Support System. The idler sprocket support system shown on drawing M-LM-17/S-19 shall be fabricated in the shop as much as practicable and installed as a unit. Installation shall occur after the replacement counterweights have been installed and are temporarily dogged. The idler sprocket support system and the idler sprocket, MK M-29-1, shall be located accurately using surveying equipment before the concrete reconstruction phase. The precise location of the existing idler sprocket and thus the replacement idler sprocket shall be determined before removal. Holes for MK M-29-1 shall not be drilled before the support system has been located. The final location of the idler support system and idler sprocket shall be approved by the contracting officer before concrete reconstruction. Full counterweight loading to the idler support system shall not be applied until concrete has cured for a minimum of seven days. The support system shall be painted as specified in SECTION 09940 - PAINTING.

2.2.1.3 Replacement Counterweight Boxes. The replacement counterweight boxes shall be fabricated as shown on drawings M-LM-17/S-23 and S-24. Dimensional tolerances noted on the drawings shall be maintained. Nondestructive examination of welds shall be in accordance with paragraph 3.2.5. The counterweight boxes shall be completely shop fabricated and painted as specified in SECTION 09940 - PAINTING. The replacement counterweights are installed before the idler sprocket support system and are temporarily dogged using a contractor-designed scheme. A second option is to temporarily place the counterweight boxes at the bottom of the counterweight chase on temporary cribbing. The Contractor shall submit a plan detailing the proposed method for handling the counterweight boxes during idler sprocket support installation. A portion of the existing hoisting chain may be used for installation of the replacement counterweight boxes. If the Contractor elects to handle the counterweights using the dogging pins, only vertical lifting loads may be applied to the dogging pins. The individual lead ballast weights may be installed in the counterweight box either before or after the counterweight is installed in the counterweight chase. It is anticipated that counterweight boxes would be installed using floating plant.

2.2.1.3.1 Lead Ballast Units. The lead ballast weights shall be fabricated as detailed on drawing M-LM-17/S-25. Quantities required are specified on the drawing. Lead shall conform to Federal Specification QQ-L-171e, Grade B. Each unit shall bear a mark on the top surface indicating the type of weight, "A", "B", or "C" as defined on the drawing, and the actual weight of the individual unit. Eyebolts as defined on the drawing are used to install the weights, and are removed after installation. The contractor shall

furnish a sufficient number of eyebolts to complete the work. Ballast weights shall be installed after installation of the counterweight boxes but before concrete reconstruction is completed. The number and type of ballast units shall be in accordance with the drawings except that the Contracting Officer may direct the actual number and type installed. The Contractor shall make a final adjustment of the ballast weights if the counterweight boxes do not hang within 1/16" of plumb. Ballast units not utilized are the property of the Government, and shall be delivered to a location as directed by the Contracting Officer. The ballast units are not to be painted.

2.2.1.4 Chain Guard Support Beam. The chain guard support beam and related structural items shall be fabricated as detailed on drawing M-LM-17/S-34 and S-35. Exposed portions of the chain guard support beam and related items shall be painted in accordance with SECTION 09940 - PAINTING.

2.2.1.5 Chain Guide. The chain guide shall be fabricated as detailed on drawing M-LM-17/S-34 and S-35. Exposed portions of the chain guide embedded plate shall be painted in accordance with SECTION 09940 - PAINTING.

2.2.1.6 Lift Gate Machinery Support Frame. Lift gate machinery support frame alterations shall be for the downstream lift gate machinery support frames of the main and auxiliary locks only, at 4 locations, one each in monoliths 2E, 4I, 2I, and 2W. The new downstream lift gate machinery support frame shown on drawing M-LM-17/S-40 through S-42 shall be fabricated in the shop as much as practicable and installed as a unit. The Contractor shall not use the machinery support frame to support the total weight of the machinery for installation handling. The new portion of the support frame shall be used for support of the parallel shaft reducer, the holding brake, and electric drive motor. The Contractor shall be responsible for final coordination of size and location of the machinery support frames with the size and location of actual machinery provided, including machinery bolt down locations, and horizontal and vertical alignments. Prior to fabrication , the Contractor shall be required to submit shop drawings of the machinery support frames. The shop drawings shall, in part, contain written certification that the support frames have been adequately coordinated with the actual machinery to be provided. Portions of the existing support frame will remain and be modified as shown on the drawings and are intended for support of the two sprocket shaft pillow blocks and the one reducer shaft pillow block. Existing portions of the support frame shall be thoroughly cleaned of all dirt, grease, and existing paint, and primed and repainted in accordance with SECTION 09940 - PAINTING. The new fabricated support frame shall also be primed and painted as specified in SECTION 09940 - PAINTING.

2.2.1.7 Counterweight Chase Pump System. The counterweight chase pump system is shown on drawing M-LM-17/S-29. Additional information is contained in paragraph 2.3.

2.2.1.8 Gallery Temporary Watertight Bulkheads. The temporary watertight bulkheads are to be used in the event of a flood emergency during construction. The use of the temporary watertight bulkheads shall be under the direction of the Contracting Officer as specified in SC-23. The Temporary watertight bulkheads shall be designed by the contractor to withstand a service hydrostatic load of 900 pounds per square foot. The temporary

watertight bulkheads shall be positively attached at each of the locations as shown on drawing M-LM-17/S-27, and contain a rubber sealing member to prevent leakage. The contractor shall submit written computations prepared by Registered Professional Engineer for the design of the temporary watertight bulkhead. Fabrication of the temporary watertight bulkheads shall be complete before demolition work at the lock commences. Bulkheads need only be fabricated for use at one lock at a time. The Contractor shall test fit all bulkheads in the presence of the contracting Officer before demolition work at the lock commences.

2.2.1.9 Miscellaneous Metals. Recess frames for chain recess covers and high water dam recesses shall be fabricated of structural shapes of the type shown on the drawings. Corner joints in frames shall be welded and ground smooth. Frames shall be anchored in the manner shown on the drawings. Chain recess covers and associated removable support beams shall be of the material specified and size shown. Sharp edges and burrs shall be removed. Recess frames, chain recess covers, and removable support beams shall be hot-dip galvanized after fabrication.

2.2.1.10 Service Support Beams. New service support beams and associated items shall be fabricated as shown on drawing S-44. The service support beams are used to dog the lift gate while servicing lifting chains and machinery. Lifting chain dogging links are to be fabricated as shown on drawing S-44. Service support beams and associated items, except machined surfaces, shall be painted in accordance with SECTION 09940 - PAINTING.

2.2.2 Structural Steel Fabrication. Structural steel may be cut by mechanically guided or hand-guided torches, provided an accurate profile with a surface that is smooth and free from cracks and notches is obtained. Surfaces and edges to be welded shall be prepared in accordance with AWS D1.1, Subsection 3.2. Where structural steel is not to be welded, chipping or grinding will not be required except as necessary to remove slag and sharp edges of mechanically guided or hand-guided cuts not exposed to view. Hand-guided cuts, which are to be exposed or visible, shall be chipped, ground or machined to sound metal.

2.2.3 Concrete and Epoxy Resin Grout Placement. Concrete placement and placement of epoxy resin grout shall be in conformance with all the applicable requirements specified in SECTION 03301 - CONCRETE. Portland cement concrete shall be used for concrete reconstruction, except epoxy resin grout shall be used for filling nut pockets. Drilling and grouting for dowels and anchors shall be in conformance with the requirements specified in SECTION 03301 - CONCRETE.

2.2.3.4. Painting. The exposed surfaces of steel members shall be cleaned, primed and painted in accordance with the requirements of SECTION 09940 - PAINTING.

2.3 PORTABLE UNWATERING PUMPS.

2.3.1 General. The Contractor shall furnish and install 4 heavy-duty submersible wastewater pumps specifically designed for highly contaminated liquid and sludge. Each pump shall include all associated discharge hose, pipe fittings, lifting wire rope, hoists, power and control cables, electrical

controls and associated mounting hardware. Each pump shall have a 3-inch cast-iron discharge connection with anchor bolts, 90 feet of stainless steel lifting wire rope and 150 feet of submersible power/control cable approved and sized according to NEC and the ICEA standards. At the design point, the pump shall be capable of pumping 120 to 140 gallons per minute (gpm) at 68 feet of total dynamic head (tdh) without exceeding the horsepower (hp) rating of the motor. An additional point on the discharge rating curve for the pump shall be 35 to 45 gpm at 82 feet of tdh. Shut off head shall be a minimum of 87 feet of tdh. The pump motors shall be rated 460-volt, 3-phase, 60-hertz service. The motor horsepower shall be adequate to ensure that the pump in non-overloading throughout the entire pump performance curve from shut-off through run-out.

2.3.2 Pump Construction. The pump shall be designed for highly contaminated liquid and sludge. The hydraulic end shall consist of a recessed vortex impeller in a nitrile rubber lined split casing volute. The liners shall be designed for easy removal and replacement, as required. The maximum temperature with an external cooling system shall be 79°C (175°F). A dual function breather valve shall be provided in the cooling jacket to allow bleeding of air from the cooling system on start-up and allow air to circulate through the system during a dry running phase. The pump shall be of aluminum bronze or aluminum magnesium alloy construction.

2.3.2.1 Cooling System. A cooling jacket shall be provided to facilitate heat transfer. A small portion of the pumped liquid shall be circulated around the cooling channel by the pumping action of the impeller back vanes. The passage for the pumped liquid to the cooling channel shall be designed to allow for passage of relatively clean water to minimize clogging. The cooling system shall be readily modifiable to block the internal flow for introduction of external cooling water.

2.3.2.2 Impeller. The impeller shall be a Ni-Hard (abrasive-resistant) or Ni-Resist (corrosive-resistant) material. The impeller shall be of a semi-open, swirl design, recessed in the upper part of the volute, keyed to the drive shaft, and out of the normal flow of the pumped liquid.

2.3.2.3 Volute. The pump shall be equipped with a two-piece volute with replaceable wear inserts of nitrile rubber.

2.3.2.4 Pump Drive Shaft. The pump drive shaft shall be an extension of the submersible motor shaft. Couplings shall not be acceptable. The shaft shall rotate on two permanently lubricated ball bearings. The shaft shall be stainless steel.

2.3.2.5 Pump Shaft Bearings. The pump shaft shall rotate on two bearings. Motor bearings shall be permanently grease lubricated. The upper bearing shall be a single deep groove ball bearing. The lower bearing shall be a two row angular contact bearing to compensate for axial thrust and radial forces. Single row bearings are not acceptable for the lower bearing.

2.3.2.6 Mechanical Shaft Seals. The pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in a lubricant reservoir that

hydrodynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary and one positively driven rotating tungsten-carbide ring. The upper, secondary seal unit, located between the lubricant chamber and the motor housing, shall contain one stationary tungsten-carbide seal ring and on positively driven rotating carbon seal ring. Each seal interface shall be held in contact by its own spring system. The seals shall require no maintenance or adjustment. The seals shall not depend on direction of rotation for sealing. The position of the mechanical seals shall depend on the shaft. Mounting of the lower mechanical seal on the impeller hub shall not be acceptable. The following seal types shall not be considered acceptable: (1) shaft seals without positively driven rotating members, (2) conventional double mechanical seals containing a common single or double spring acting between the upper and lower seal faces, and (3) cartridge type systems. No system requiring a pressure differential to offset pressure and effect sealing shall be permitted. Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and allow lubricant expansion. The drain and inspection plug, with positive anti-leak seal, shall be readily accessible from the outside of the pump case. The seal system shall not rely upon the pumped media for lubrication. The seal lubricant shall be FDA Approved and non-toxic.

2.3.3 Motor Construction. The pump motor shall be the induction type with a squirrel-cage rotor, shell-type design, housed in an air-filled, watertight chamber, NEMA B type. The stator windings and stator leads shall be insulated with moisture resistant Class F insulation rated for 155°C (311°F). The stator shall be dipped and baked three times in Class F varnish. The stator shall be heat-shrink fitted into the stator housing. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable. The motor shall be designed for continuous duty handling pumped media of 40°C (104°F). The motor shall be capable of up to 15 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum. Thermal switches, set to open at 125°C (260°F), shall be embedded in the stator lead coils to monitor the temperature of each phase winding. These thermal switches shall be used in conjunction with, and supplemental to, external motor overload protection and shall be connected to the control panel. An elastomeric compression seal shall hermetically seal the junction chamber, containing the terminal board, from the motor. The connection between the cable conductors and stator leads shall be made with threaded compression-type binding posts permanently affixed to a terminal board. Wire nuts or crimping-type connection devices shall not be acceptable. The pump and motor shall be designed and assembled by the same manufacturer. The combined service factor (combined effect of voltage, frequency and specific gravity) shall be a minimum of 1.15. The motor shall have a voltage tolerance of plus or minus ten percent. The motor shall be designed for operation up to 40°C (104°F) ambient with a temperature rise not to exceed 80°C. A performance chart shall be provided, which shows curves for torque, current, power factor, input/output kW, and efficiency. The chart shall include data on starting and no-load characteristics.

2.3.3.1 Power and Control Cables. The power cable shall be sized according to the NEC and ICEA standards. The cable shall be of sufficient

length to reach the junction box of the controller without any splices. The outer jacket of the cable shall be oil resistant chloroprene rubber. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet.

2.3.3.2 Cable Entry Seal. The cable entry seal shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the cable. The assembly shall provide ease of changing the cable when necessary using the same entry seal. The cable entry junction chamber and motor shall be separated by a stator lead sealing gland or terminal board, which shall isolate the interior from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be acceptable.

2.3.4 Pumping Unit Controls. Each pump shall be furnished with all controls required for automatic starting and stopping. The automatic controls shall not use floats or probes to sense water levels. The low level shut-off shall be initiated by sensing the sudden drops in motor current associated with the pump breaking suction (air mixing with the pumping liquid). High level shall be initiated by a solid-state electronic memory, which monitors and recalls each running cycle's duration, and re-adjusts the idle period. Longer running cycles should incur shorter idle periods and vice versa. The automatic controls shall be located in a weatherproof, portable enclosure designed to house the motor starter and controls. The Contractor shall furnish one full voltage combination starter for the pump in the enclosure. Each enclosure shall contain a disconnect switch, hand-off-automatic switch, and all appurtenances required to properly control the pump. The enclosure shall be furnished with a self-supporting pedestal that places the operating switch between 48 and 60 inches above the base of the pedestal.

2.3.5 Discharge Hose and Fittings. The Contractor shall furnish one heavy-duty flat roll PVC discharge hose for each unwatering pump. The hose shall be the same nominal size as the pump discharge outlet diameter. The hose shall be constructed with a PVC inner tube, at least two spiral plies with a single synthetic cord reinforcement, and a PVC cover. The hose shall be rated for a minimum working pressure of 125 psig at 70°F. Each hose assembly shall be a minimum of 125 feet long. Each hose shall be complete with fittings at each end designed to connect to the unwatering pump discharge with a female threaded pipe connection at the opposite end.

2.3.6 Winch. The Contractor shall furnish electric motor operated marine hoisting winch, designed for 115-volt service, for each unwatering pump. Winches shall be rated for at least twice the maximum weight of the pump, lifting cable, hose, and pump platform. The winch shall have a drum, which shall be capable of storing 90 feet of stainless steel lifting wire rope. The winch shall have ball bearings, internal mechanical load brake and a remote, momentary contact (requires continuous pressure to operate) control switch. All materials shall be corrosion resistant, designed for operation in marine environment. The winch mounting shall be designed for connection with

ceiling and wall embedments as shown on the contract drawings.

2.4 COMPRESSED AIR DOGGING SYSTEM.

2.4.1 General. The Contractor shall furnish a complete compressed air dogging system, including pneumatic cylinders, directional control valves, tubing or pipe, supports, and associated fittings, as required to operate the dogging hooks. The Contractor shall furnish air supply lines with standard "quick-disconnect" fittings for connection of Government-furnished air compressor. Each dogging hook shall have a pneumatic cylinder, complete with all clevises, eyes, pins and appurtenances required to connect the cylinder to the hook and cylinder mounting assembly. Each pneumatic cylinder shall have a separate directional valve, which shall be "stack-mounted" or "manifold-mounted" to permit simultaneous actuation of all cylinders on one set of counterweight dogging hooks by a single person. Each pneumatic cylinder will have separate piping from the directional valve to each of its inlet ports with appropriately sized flexible hose to permit angular movement of the cylinder.

2.4.2 Pneumatic Cylinder. Each pneumatic cylinder shall have a nominal bore of 2.5 inches and a nominal stroke of six (6) inches. The cylinder rod shall be 5/8-inches in diameter. The cylinder shall have a 0.25-inch NPTF inlet port at the cap end and the rod end for double-acting operation. The cylinder shall be rated for a normal operating pressure of 200 psig, but shall provide a minimum of 490 pounds of push force and 460 pounds of pull force at 100 psig of air pressure, measured at the inlet ports. Contractor variations, such as metric dimensioned alternatives, shall be approved in writing by the Contracting Officer. Each cylinder shall be provided with nitrile or viton seals and a double-lipped rod wiper. Cylinder tube and end caps shall be aluminum or stainless steel. Cylinder rods shall be stainless steel or hard chrome plated to resist corrosion.

2.4.3 Directional Control Valve. Each directional control valve shall be a 4-way, 3-position valve with a spring return, blocked center position, rated for 150 psig service. Each valve shall be furnished with 0.25-inch NPTF inlet and outlet ports. Valve bodies, and spools, shall be aluminum or stainless steel, for corrosion resistance. All seals shall be nitrile or viton. Each valve shall have a manual hand lever operator, which shall be arranged to permit a full range of operation from a safe location within the counterweight room. Directional valves shall be "stack-mounted" or "manifold-mounted" to permit the manual levers for two hooks (upstream leaf counterweights), or four hooks (downstream leaf counterweights) to be operated by a single person. There shall be only one compressed air connection required to provide supply air to all directional valves needed to operate the dogging hooks for a single counterweight assembly.

2.4.4 Pipe, Tubing, Hose and Fittings. All piping, tubing, manifolds and associated fittings shall be stainless steel or other compatible corrosion-resistant material, as approved by the Contracting Officer. Piping or tubing shall be minimum 0.25-inch diameter, with threads or fittings to match the mating valves, cylinders or manifolds. Hose shall be similar to SAE J1402, Table A/B, size 0.25-inch inside diameter, with appropriate fittings

for connection to the cylinder and the piping. "Stack-mounted" valves shall be furnished with all adapter pieces required to mount the valves and distribute the compressed air to the system. The air supply connection to the valve assemblies shall be compatible with the existing compressed air "quick-disconnect" assembly used by the Government.

2.4.5 Supports and Piping Hangers. The Contractor shall provide compatible supports and hangers for the valves, manifolds, "stack-mount" accessories, piping or tubing, and appurtenances, to complete the installation as shown schematically on the contract drawings. All supports shall be furnished with anchorage devices and fasteners, as required for complete installation.

PART 3 - EXECUTION

3.1 REMOVAL AND DISPOSAL OF EXISTING ITEMS.

3.1.1 Removal of Existing Counterweight. Demolition of concrete necessary for counterweight removal shall be as shown on the drawings and conform to the requirements of SECTION 02050 - DEMOLITION. The existing counterweights shall be removed in one piece using the existing lug. The Contractor shall design a scheme to temporarily dog the existing counterweight during the period the service hoisting chain is removed but before the removal crane is attached. After the existing counterweight is removed, the Contractor shall pump any accumulated water or sludge from the bottom of the counterweight chase, and clear the existing drain at the bottom of the counterweight chase. The Contractor shall inspect the existing counterweight guides shown on reference drawing M-L27-20/65.1 and advise the Contracting officer of any existing damage.

3.1.2. Removal of Existing Idler Sprocket Support. Demolition and removal of the Existing Idler Sprocket Support shall be as shown on the drawings and conform to the requirements of SECTION 02050 - DEMOLITION.

3.1.3 Removal of Existing Machinery Support Frame. Demolition and removal of portions of the existing machinery support frame shall be as shown on the drawings and conform to the requirements of SECTION 02050 - DEMOLITION.

3.1.4 Removal of Counterweight Chase Ladder. The counterweight chase ladder shall be removed and discarded as shown on the drawings before the Counterweight chase pump system may be installed.

3.1.5 Disposition of Removed Items. All items, designated to be discarded under this contract, shall be removed and disposed off site in accordance with all Federal, State and Local regulations.

3.1.5.1 Salvage of Old Bulkheads. Of the 24 old bulkheads stored at Locks 27, 23 shall become the property of the Contractor. One old bulkhead will be retained by the Government. The Contractor shall dispose of the old bulkheads in a safe and legal manner. The approximate weight of each bulkhead is 60,000 lbs. The old bulkheads are painted with a vinyl system which does not contain lead.

3.2 WELDING OF STRUCTURAL STEEL. Unless otherwise authorized or specified, welding of structural steel shall be accomplished by an electric arc welding process, using a method, which excludes the atmosphere from the molten metal. Welding, unless specified otherwise, shall conform to the applicable provisions of AWS D 1.1.

3.2.1 Welding Equipment. Welding equipment shall conform to the requirements of AWS D 1.1.

3.2.2 Filler Metal. The electrode, electrode-flux combination, and grade of weld metal shall conform to the appropriate AWS specification for the base metal and welding process being used. Only low hydrogen electrodes shall be used for manual shielded metal-arc welding regardless of the thickness of the steel. The AWS designation of the electrodes to be used shall be included in the schedule of welding procedure to be furnished by the Contractor. To maintain low moisture of low hydrogen electrodes, a controlled temperature storage oven shall be use at the job site as prescribed by AWS D 1.1.

3.2.3 Qualification of Welders and Welding Operators. Welding operators, welders, and tack welders shall be qualified and, as necessary, re-qualified for the particular type of work to be performed. Qualification shall be in accordance with AWS D 1.1. The Contractor shall certify by name to the Contracting Officer the welders and welding operators so qualified, including the date of qualification and code and procedures under which qualified. Prior qualification may be accepted provided the welder has performed satisfactory work under the code for which qualified within the preceding three months. The Contractor shall require the welder or welding operator to repeat the qualifying tests when, in the opinion of the Contracting Officer, a reasonable doubt as to the welder's proficiency is indicated by performance of the work. In such cases, the welder shall be recertified as above, if the retest is successfully completed; otherwise, the welder shall be disqualified until a retest has been successfully completed. All expenses in connection with qualification and re-qualification shall be borne by the Contractor.

3.2.4 Workmanship Requirements.

3.2.4.1 Welding Procedure. The Contractor shall prepare for submission to the Contracting Officer a complete schedule of welding procedures which shall consist of detailed procedure specifications for each structure to be welded and tables or diagrams showing the procedure to be used for each required joint. The schedule shall conform to the provisions of AWS D 1.1, include filler metal, preheat, interpass temperature and stress relief heat treatment requirements, and show the types and locations of welds designated on the drawings and/or in the specifications to receive nondestructive examination. The procedures shall be such as to minimize residual stresses and distortion of the completed weldment. Procedures shall be prequalified or qualified by tests as required and prescribed in AWS D 1.1. Properly documented evidence of compliance with all requirements of these specifications for previous qualification tests will establish the joint welding procedure as prequalified. Each procedure shall be clearly identified as being either prequalified or qualified by tests. The test welding and specimen testing must be witnessed and the test report document signed by a

representative of the Contracting Officer. The Contractor will be directed or authorized to make any changes in previously approved welding procedures that are deemed necessary or desirable by the Contracting Officer. Approval of any procedure, however, will not relieve the Contractor of the responsibility for producing a finished structure meeting all requirements of these specifications. Joints subject to submergence shall be continuous seal welded, unless otherwise noted on the drawings. Existing steel shall be sandblasted in advance of welding or flame cutting in accordance with the provisions of AWS D1.1 for a distance of twelve inches on either side of weld or flame cut lines.

3.2.4.2 Stress Relief Heat Treatment. Where stress relief heat treatment is specified or required on the drawings, it shall be in accordance with the requirements of AWS D 1.1, unless otherwise authorized or directed by the Contracting Officer.

3.2.4.3 Preheat and Interpass Temperature. Preheating shall be performed as required by AWS D 1.1, or as otherwise specified, except that the temperature of the base metal shall be at least 70°F. The weldments to be preheated shall be slowly and uniformly heated by approved means to the prescribed temperature, held at that temperature until the welding is completed, and then permitted to cool slowly in still air. Preheat and interpass temperature requirements shall apply to flame cutting for existing component removal.

3.2.4.4 Temporary Welds. Temporary welds required for fabrication and erection shall be made under the controlled conditions prescribed herein for permanent work. Temporary welds shall be made using low-hydrogen welding electrodes and by welders qualified for permanent work as specified elsewhere in these specifications. Preheating for temporary welds shall be as required by AWS D 1.1 for permanent welds, except that the minimum temperature shall be 70°F any case. In making temporary welds, arcs shall not be struck in other than weld locations. Each temporary weld shall be removed after serving its purpose and ground flush with adjacent surfaces.

3.2.4.5 Tack Welds. Tack welds that are to be incorporated into the permanent work shall be subject to the same quality requirements as the permanent welds and shall be cleaned and fused thoroughly with the permanent welds. Preheating shall be performed as specified above for temporary welds. Multiple-pass tack welds shall have cascaded ends. Defective tack welds shall be removed before permanent welding.

3.2.5 Inspection.

3.2.5.1 General. Welding shall be subject to inspection by Government Inspectors to determine conformance with the requirements of AWS D 1.1, the approved welding procedures, and provisions stated elsewhere in these specifications. The Contracting Officer will require nondestructive inspection of designated welds and may require supplemental examination of any joint or coupons to be cut from any location in any joint. The Contractor shall maintain an adequate inspection system and perform the necessary inspections in accordance with the Contract Clause entitled "Inspection of Construction".

3.2.5.2 Visual Examination. Prior to any welding, the Contractor shall visually inspect the preparation of material for welding to assure compliance with AWS D 1.1. All completed welds shall be cleaned and examined carefully by the Contractor for insufficient throat or leg sizes, cracks, undercutting, overlap, excessive convexity or reinforcement, and other surface defects to ensure compliance with the requirements of AWS D 1.1. Defects shall be corrected as provided in AWS D1.1.

3.2.5.3 Nondestructive Examination. The Contractor shall perform nondestructive examination of shop and field welds as designated on the drawings and/or described in these specifications.

3.2.5.3.1 Testing Agency. Nondestructive examination of welds and evaluation of the tests or inspections as to the acceptability of the welds shall be performed by a testing agency adequately equipped and competent to perform such services or by the Contractor if suitable equipment and qualified personnel are employed. In either case, written approval by the Contracting Officer shall be required and such tests or inspections shall be made in the presence of the Contracting Officer. The evaluation of the tests or inspections shall be subject to the approval of the Contracting Officer and all records shall become the property of the Government.

3.2.5.3.2 Procedure.

3.2.5.3.2.1 Magnetic Particle Inspection. The procedure for making magnetic particle inspection shall conform to the applicable provisions of ASTM E 709.

3.2.5.3.2.2 Ultrasonic Testing. The procedure for making, evaluating and reporting the ultrasonic testing of the welds shall conform to the requirements of AWS D1.1, Section 6, Part C.

3.2.5.3.2 Acceptability of Welds. Welds shall be unacceptable if shown to have defects prohibited by AWS D 1.1, Subsection 9.25, or shown to possess any degree of incomplete fusion, inadequate penetration, or undercutting.

3.2.5.3.3 Welds Subject to Nondestructive Examination:

Type Of NDT	Item	Dwg. No. M-LM-17/
	DOGGING SUPPORT SYSTEM	
Ultrasonic	Counterweight pin plates	S-21
	COUNTERWEIGHT BOXES	
Mag Particle	As shown on drawings	S-23 S-24
	CHAIN GUARD SUPPORT BEAM	
Mag Particle	As shown on drawings	S-34

3.2.5.4 Test Coupons. The Government reserves the right to require the Contractor to remove coupons from completed work when doubt as to soundness cannot be resolved by nondestructive examination. Should tests of any two coupons cut from the work of any welder show strengths less than that specified for the base metal, it will be considered evidence of negligence or incompetence, and such welder shall be removed from the work. When coupons are removed from any part of a structure, the members cut shall be repaired in a neat workmanlike manner with joints of proper type to develop the full strength of the members, with peening as approved or directed to relieve residual stress. The expense for removal and testing of the coupons, repair of the cut members, and the performance of nondestructive examination of repairs shall be borne by the Government or the Contractor in accordance with the "Inspection of Construction" paragraph of the Contract Clauses of the contract.

3.2.5.5 Supplemental Examination. Before final acceptance, the Government reserves the right to perform supplemental nondestructive examinations when the soundness of any weld is suspected of being deficient due to faulty workmanship or stresses that might occur during shipment or erection. The cost of such inspection will be borne by the Government.

3.2.6 Repairs. Defective welds shall be repaired in compliance with AWS D 1.1. The Contractor shall submit a welding repair plan for approval before repairs are made. Defective weld metal shall be removed to sound metal by use of air carbon-arc or oxygen gouging. The surfaces shall be thoroughly cleaned before welding. Welds that have been repaired shall be retested by the same methods used in the original inspection. Except for repair of members cut to remove test coupons, which were found to contain acceptable welds, costs of repairs and retesting shall be borne by the Contractor.

3.3 INSTALLATION OF PORTABLE UNWATERING PUMPS. Each portable unwatering pump shall be mounted securely to a structural steel platform, as shown on the contract drawings. The Contractor shall install a stainless steel guide system, anchored at the top and bottom, to direct the lowering and raising of the pump/platform assembly. The guide system shall have a positive means of adjustment, as shown on the contract drawings. The Contractor shall install the stainless steel lifting cable to the pump lifting lug and the manual hoisting winch. The Contractor shall mount the manual hoisting winch to an embedded anchorage in the ceiling of the counterweight pit. The Contractor shall secure any parts, such as a detachable operating handle, to the winch to prevent accidental loss into the pit.

3.4 INSTALLATION OF MACHINERY SUPPORT FRAMES. Concrete removal and preparation shall be in accordance with SECTION 03301 – CONCRETE. The anchor dowels shall be accurately positioned using a template of the new machinery support frame. All drilling shall be done prior to installation of the anchor dowels and shall be in accordance with SECTION 02210 – CONCRETE DRILLING. The Contractor shall immediately notify the Government if reinforcing, electrical conduits, or other embedments are encountered during drilling. The anchor dowel epoxy shall develop full strength prior to pull testing and setting the machinery. Prior to setting the machinery, the anchor dowels shall be pull

tested to 20,000 lbs. Using the anchor dowels, with upper and lower nuts, the machinery platform shall be adjusted to obtain accurate alignment and elevation. The Contractor shall demonstrate to the satisfaction of the Contracting Officer that the machinery is accurately positioned prior to grouting beneath the machinery support frame. After adjusting the machinery and prior to grouting, the Contractor shall torque the top nuts on the anchor dowels to 120 ft-lbs. Following completion of the initial anchor dowel tightening, the Contractor shall apply non-shrink grout beneath the machinery support frame except as noted herein. Areas of the support frame as required for access to the lower nuts of the anchor dowels shall not be grouted until the primary grout has cured for a minimum of 12 hours. After this curing period the lower nuts on the anchor dowels shall be loosened. The Contractor shall apply non-shrink grout to the remaining areas around the anchor dowel locations to complete the secondary grouting operation. After the secondary grout has cured for a minimum of 24 hours, the Contractor shall check the machinery arrangement for proper alignment. The Contractor shall correct any misalignment prior to final anchor bolt tightening. The Contractor shall tighten all upper nuts of the anchor dowels to 240 ft-lbs.

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