AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	1

3

2. AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO. *(If applicable)*
1	9-Jul-2004		

6. ISSUED BY CODE

US Army Corps of Engineers, Kansas City District
760 Federal Building, 601 East 12th Street
Kansas City, Missouri 64106-2896

7. ADMINISTERED BY *(If other than item 6)* CODE

8. NAME AND ADDRESS OF CONTRACTOR *(No.,street, county, State and ZIP Code)*

CODE FACILITY CODE

(x) 9a. AMENDMENT OF SOLICITATION NO.

X W912DQ-04-B-0010

9B. DATED *(SEE ITEM 11)*

6/19/2004

10A. MODIFICATION OF CONTRACT/ORDER NO.

10B. DATED *(SEE ITEM 13)*

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

[X] The above number solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers [ ] is extended, [X] is not extended.

Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitaiton or as amended, by one of the following methods: (a) By completing Items 8 and 15, and 1 copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegraph which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA *(If required)*

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS, IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

(x) A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: *(Specify authority)* THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.

B. THE ABOVE NUMBER CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES *(such as changes in paying office, appropriation date, etc.)* SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF:

C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:

D. OTHER *(Specify type of modification and authority)*

E. IMPORTANT: Contractor [ ] is not, [ ] is required to sign this document and return copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION *(Organized by UCF section headings, including solicitation/contract subject matter where feasible.)*

Missouri River Mitigation Project
Const. Of Pump Station, Columbia Bottoms Conservation Area, St. Louis County, Mo.

1. The Solicitation is amended in accordance with the attached pages.
2. Bid will be received until 2:00 pm, 20 July 2004 in room 748 Federal Building, 601 East 12th Street, Kansas City, Missouri 64106-2896

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER *(Type or print)*		16A. NAME AND TITLE OF CONTRACTING OFFICER *(Type or print)*	
15B. CONTRACTOR/OFFEROR *(Signature of person authorized to sign)*	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA BY *(Signature of Contracting Officer)*	16C. DATE SIGNED

1. SOLICITATION NO. W912DQ-04-B-0010 is amended as follows:

a. SPECIFICATIONS:

(1) Revised Sections: The following sections are deleted and replaced with revised sections. A copy of each revised section accompanies this amendment.

01500A	Temporary Construction Facilities
11310A	Pumps; Sewage and Sludge
15200A	Pipelines, Liquid Process Piping
16261N	Variable Frequency Drive Systems Under 600 Volts

(2) Narrative Change:

BIDDING REQUIREMENTS, CONTRACT FORMS AND CONTRACT DOCUMENTS: BID SCHEDULE:

In Item No. 0001, the Estimated Quantity is changed from “2,800“ to “2,500” Tons.

b. DRAWINGS:

(1) Revised Drawings: The following drawings are deleted and replaced with revised drawings of the same number. The revised drawings are dated 9 July 2004. A copy of each revised drawing accompanies this amendment.

CU301	36” Water Line Plan and Profile
SB101	Base Plan and Upper Plan
S-201	Pump Station Elevations
S-202	Pump Station Elevations
S-502	Pump Station Sections and Details
M-101	Mechanical Plan View: Pump Well
M-102	Mechanical Plan View: Misc. Equipment
M-201	Mechanical Sections
M-202	Mechanical Sections: Compressed Air
M-601	Mechanical Schedule
M-602	Mechanical Schematic: Compressed Air
MS101	Mechanical Site Plan Pump Station Well
EP101	Electrical Power Plan
EP601	Electrical One Line Diagram Panelboard and Feeder Schedule

2. LIST OF QUESTIONS FROM PROSPECTIVE BIDDERS: Questions / Answers that were submitted at the Pre-Bid Meeting and during the Advertising Period are provided for clarification. A copy of the Questions / Answers accompanies this amendment.

3. For convenience, on the revised specification pages, essential changes from the previous issue have been emphasized as follows, however, all portions of the revised specification pages shall apply whether or not changes have been indicated:

Changes within a paragraph are underlined.
New words or sentences, within a paragraph, are underlined.
Paragraphs, containing a word or sentence that was deleted, are underlined.
When an entire paragraph was deleted, the word “Deleted” is underlined and inserted after the paragraph number.

4. Bidders are required to acknowledge receipt of this amendment on the Bid Form, in the space provided, or by separate letter or telegram prior to receipt of bids. Failure to acknowledge all amendments may cause rejection of the bid.

5. Bids will be received until 2:00 p.m. local time at place of receipt of offers, 20 July 2004 in Room 757, Federal Building, 601 E. 12th Street, Kansas City, Missouri 64106-2896.

3 Encls
1. Spec pages as listed
2. Drawings as listed
3. Questions from Prospective Bidders

SECTION 01500A

TEMPORARY CONSTRUCTION FACILITIES
02/97

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1.1.1 Site Plan

The Contractor shall prepare a site plan indicating the proposed location and dimensions of any area to be fenced and used by the Contractor, the number of trailers to be used, avenues of ingress/egress to the fenced area and details of the fence installation. Any areas which may have to be graveled to prevent the tracking of mud shall also be identified. The Contractor shall also indicate if the use of a supplemental or other staging area is desired.

1.2 BULLETIN BOARD, PROJECT SIGN, AND PROJECT SAFETY SIGN

1.2.1 Bulletin Board

Immediately upon beginning of work, the Contractor shall provide a weatherproof glass-covered bulletin board not less than 36 by 48 inches in size for displaying the Equal Employment Opportunity poster, a copy of the wage decision contained in the contract, Wage Rate Information poster, and other information approved by the Contracting Officer. The bulletin board shall be located at the project site in a conspicuous place easily accessible to all employees, as approved by the Contracting Officer. Legible copies of the aforementioned data shall be displayed until work is completed. Upon completion of work the bulletin board shall be removed by and remain the property of the Contractor.

1.2.2 Project and Safety Signs

The requirements for the signs and their content shall be as shown on the drawings attached to this section. The signs shall be erected within 15 days after receipt of the notice to proceed. The data required by the safety sign shall be corrected daily, with light colored metallic or non-metallic numerals. Upon completion of the project, the signs shall be removed from the site.

1.3 HAUL ROADS AND BARRICADES

1.3.1 Haul Roads

The Contractor shall, at its own expense, construct access and haul roads necessary for proper prosecution of the work under this contract. Haul roads shall be constructed with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic shall be avoided. The Contractor shall provide necessary lighting, signs, barricades, and distinctive markings for the safe movement of traffic. The method of dust control, although optional, shall be adequate to ensure safe operation at all times. Location, grade, width, and alignment of construction and hauling roads shall be subject to approval by the Contracting Officer. Lighting shall be adequate to assure full and clear visibility for full width of haul road and work areas during any night work operations. Upon completion of the work, haul roads designated by the Contracting Officer shall be removed.

1.3.2 Barricades

The Contractor shall erect and maintain temporary barricades to limit public access to hazardous areas. Such barricades shall be required whenever safe public access is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic. Barricades shall

be securely placed, clearly visible with adequate illumination to provide sufficient visual warning of the hazard during both day and night.

1.4 GOVERNMENT FIELD OFFICE

1.4.1 Resident Engineer's Office

The Contractor shall provide the Government Resident Engineer with an office, approximately 200 square feet in floor area, located where directed and providing space heat, electric light and power. The Contractor shall furnish bottled drinking water, thermostatically controlled space heat, ventiliation and air conditioning, electric light (suitable for an office environment), sufficient power and two phone lines. The Contractor is also responsible for the first $75.00 per month of long distance telephone charges from the telephone or fax machine inside the Corps trailer in addition to the normal monthly telephone charges. The Contractor is also responsible for installation of and payment for all utilities consumed by the Corps trailer. The office should also contain two desks, two office desk chairs, tow four drawer lockable legal size file cabinets, one telephone, one plain paper fax machine, and one table large enough to accomodate full scale drawings. The steps and landing at the doors shall be well built and substantial. The Corps trailer will be located inside the fenced area near the maintenance buildling. The Contractor shall also provide a Port-A-Pot for the use of the Government and shall clean maintain it weekly A mail slot in the door or a lockable mail box mounted on the surface of the door shall be provided. At completion of the project, the office and Port-A-Pot shall remain the property of the Contractor and shall be removed from the site.

1.4.2 Trailer-Type Mobile Office

The Contractor may, at its option, furnish and maintain a trailer-type mobile office acceptable to the Contracting Officer and providing as a minimum the facilities specified above. The trailer shall be securely anchored to the ground at all four corners to guard against movement during high winds.

1.5 CLEANUP

Construction debris, waste materials, packaging material and the like shall be removed from the work site daily. Any dirt or mud which is tracked onto paved or surfaced roadways shall be cleaned away. Materials resulting from demolition activities which are salvageable shall be stored within the fenced area described above or at the supplemental storage area. Stored material not in trailers, whether new or salvaged, shall be neatly stacked when stored.

1.6 RESTORATION OF STORAGE AREA

Upon completion of the project and after removal of trailers, materials, and equipment from within the fenced area, the fence shall be removed and will become the property of the Contractor. Areas used by the Contractor for the storage of equipment or material, or other use, shall be restored to the original or better condition. Gravel used to traverse grassed areas shall be removed and the area restored to its original condition, including top soil and seeding as necessary.

-- End of Section --

SECTION 11310A

PUMPS; SEWAGE AND SLUDGE
11/90

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

ABMA 9	(1990; R 2000) Load Ratings and Fatigue Life for Ball Bearings
ABMA 11	(1990; R 1999) Load Ratings and Fatigue Life for Roller Bearings

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 153/A 153M	(1998) Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASME INTERNATIONAL (ASME)

ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 1	(1993) Industrial Controls and Systems
NEMA MG 1	(1993; Rev 1; Rev 2; Rev 3; Rev 4) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1999) National Electrical Code

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Equipment Installation; G, DF

Drawings containing complete wiring and schematic diagrams and any other details required to demonstrate that the system has been

coordinated and will properly function as a unit. Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.

SD-03 Product Data

Sewage and Sludge Pump System; G, DF

Pump characteristic curves showing capacity in gpm, net positive suction head (NPSH), head, efficiency, and pumping horsepower from 0 gpm to 110 percent. A complete list of equipment and material, including manufacturer's descriptive data and technical literature, performance charts and curves, catalog cuts, and installation instructions.

Spare Parts; G, DF

Spare parts data for each different item of material and equipment specified, after approval of the related submittals, and not later than two months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies. This complete list of parts and supplies shall be shown in the O & M manual. Provide one set of mechanical seals and one set of O-rings and gaskets.

Sewage and Sludge Pump System; G, DF

Diagrams, instructions, and other sheets proposed for posting.

SD-06 Test Reports

Field Testing and Adjusting Equipment; G, DF

Performance test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall indicate the final position of controls.

SD-06 Factory Witness Test

Factory Witness Test; G, DF

A factory witness test by the Onwer's Engineer shall be provided. All results of the factory witness test shall be submitted.

SD-10 Operation and Maintenance Data

Sewage and Sludge Pump System; G, DF

Six copies of operation and six copies of maintenance manuals for the equipment furnished. One complete set prior to performance testing and the remainder upon acceptance. Operation manuals shall detail the step-by-step procedures required for system startup, operation, and shutdown. Operation manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. Maintenance manuals shall list routine maintenance

procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include piping and equipment layout and simplified wiring and control diagrams of the system as installed. Manuals shall be approved prior to the field training course. Spare parts list shall be included in the O & M manual.

1.3 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be stored with protection from the weather, excessive humidity and excessive temperature variation; and dirt, dust, or other contaminants.

1.4 FIELD MEASUREMENTS

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

PART 2 PRODUCTS

2.1 GENERAL MATERIAL AND EQUIPMENT REQUIREMENTS

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 10 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site. Pump casings shall be constructed of cast iron of uniform quality and free from blow holes, porosity, hard spots, shrinkage defects, cracks, and other injurious defects. Impellers shall be cast iron unless otherwise specified for rotors.

2.1.1 Nameplates

Each major item of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.

2.1.2 Equipment Guards

Belts, pulleys, chains, gears, projecting setscrews, keys, and other rotating parts so located that any person may come in close proximity thereto shall be enclosed or guarded.

2.1.3 Electric Motors

Motors shall conform to NEMA MG 1.

2.1.4 Motor Controls

Controls shall conform to NEMA ICS 1. Motor shall have Class F insulation, NEMA B. Refer to electrical specification 16415 for additional motor requiremnts.

2.1.5 Bolts, Nuts, Anchors, and Washers

Bolts, nuts, anchors, and washers shall be corrosion resisting steel; galvanized in accordance with ASTM A 153/A 153M. Stainless steel cap screws shall conform to ASTM A 276, Type 316 Ti. 305 and 316 stainless

steel fastners are acceptable.

2.1.6 Pressure Gauges

Diaphram pressure gauge shall be provided on the discharge side of pumps. Gauges shall comply with ASME B40.1. Gauge ranges shall be as appropriate for the particular installation. Gauges shall be a minimum 3 inch dial.

2.1.7 Seal Water Systems

2.1.7.1 Float Valve

The float valve shall be mounted on the pumpwell to maintain a water level to prevent cavitation.

2.1.7.2 Auxiliary Equipment

Auxiliary equipment required to complete the system shall be as indicated and shall include the necessary piping, valving, pressure gauges, pressure regulators, pressure switches, solenoid valves, strainers, and accessories. Provide a magmeter type flow measuring device for each of the two pumps. Refer to pump sequence of operation on the drawings for for additional flow measuring requirements.

2.1.7.3 Controls

Each pump shall have the following sensors:

a. Motor thermal switches

b. Moisture sensor mounted in the stator housing

c. A float switch mounted in a normally dry chamber to detect seal leakage

d. Lower bearing temperature

2.1.7.4 System Characteristics

2.2 SUBMERSIBLE CENTRIFUGAL PUMPS

Submersible centrifugal pumps shall be electric, submersible type pumps with closed nonclog impellers designed to pump solids up to 5 1/4 inches in diameter and shall be capable of withstanding submergence as required for the particular installation. The pumps shall be designed to operate on a guide/rail/wire system.

2.2.1 Pump Characteristics

Pump numbers 1 and 2 located in the wetwell shall have the following operating characteristics:

a. Pump Service: River water.

b. Design Operating Point: 15,000 gpm flow, 60 feet head, 75-85 percent efficiency.

c. Maximum Operating Range: 16,000 to 18,000 gpm flow, 45-55 feet head, 70-80 percent efficiency.

d. Minimum Operating Range: 9,000 to 11,000 gpm flow, 75-85 feet head, 65-75 percent efficiency.

e. Impeller Type: Closed Non-Clogged.

f. Operating Speed: 800-900 rpm.

g. Depth of Submergence: 3 to 20 feet.

h. Motor Type: Squirrel-cage, induction, shell type.

i. Electrical Characteristics: 480 volts ac, 3 phase, 60 Hz.

j. Size: Within rated load driving pump at specified rpm.

k. Pump Control: Variable Frequency Drive (on one of the two pumps).

2.2.2 Pump Casing

The casing shall be capable of withstanding operating pressures 50 percent greater than the maximum operating pressures. Pump casings shall be cast iron or equal conforming to ASTM A 48, Class 35B, shall be of single piece design, and shall have smooth fluid passages.

2.2.3 Mating Surfaces

Mating surfaces where watertight seal is required, including seal between discharge connection elbow and pump, shall be machined and fitted with metal to metal O-rings. Fitting shall be such that sealing is accomplished by metal-to-metal contact between mating surfaces, resulting in proper compression of the O-rings without the requirement of specific torque limits.

2.2.4 Coatings

Exterior surfaces of the casing in contact with sewage shall be protected by a sewage resistant two-part epoxy coating. All exposed nuts and bolts shall be stainless steel.

2.2.5 Impeller

The impeller shall be of the single shrouded non-clogging design to minimize clogging of solids, fibrous materials, heavy sludge, or other materials found in sewage. Impellers shall be gray, cast iron conforming to ASTM A 48, Class 35B. Pumps shall be capable of passing solids up to 5 1/4 inches in diameter. The impeller shall be statically, dynamically, and hydraulically balanced within the operating range and to the first critical speed at 150 percent of the maximum operating speed. The impeller shall be securely keyed to the shaft with a locking arrangement whereby the impeller cannot be loosened by torque from either forward or reverse direction. The manufacturer's standard coating shall be provided.

2.2.6 Wearing Rings

Wearing rings, when required, shall be renewable type and shall be provided on the impeller and casing and shall have wearing surfaces normal to the

axis of rotation. Manufacturers' standard wear rings will be acceptable. Wearing rings shall be designed for ease of maintenance and shall be adequately secured to prevent rotation.

2.2.7 Pump Shaft

Each pump shall be provided with a drive shaft having a single combined shaft of ASTM A 576, Grade 1045, carbon steel. If the shaft is not completely isolated from the fluid, the shaft shall be protected from the pumped media with a stainless steel sleeve. The pump shaft shall be of adequate size and strength to transmit the full driver horsepower with a liberal safety factor.

2.2.8 Seals

A tandem mechanical shaft seal system running in an oil bath shall be provided. Seals shall be of tungsten carbide or equivalent with each interface held in contact by its own spring system. Conventional mechanical seals which require a constant pressure differential to effect sealing will not be allowed. The seals shall require neither maintenance nor adjustment, but shall be easily inspected and replaceable.

2.2.9 Bearings

Pump bearings shall be ball or roller type designed to handle all thrust loads in either direction. Pumps depending only on hydraulic balance end thrust will not be acceptable. Bearings shall have an ABEMA L-10 life of 50,000 hours minimum, as specified in ABMA 9 or ABMA 11. If open-type (non-shielded) bearings are used, provide re-lubrication ports with positive anti-leak seals for periodic addition of lubrication from external to the pump.

2.2.10 Motor

The pump motor shall have Class H insulation and shall be watertight. Motor insulation system shall be inverter compatible. The motor shall be air filled with a water jacket, or air filled with cooling fins which encircles the stator housing. Pump motors shall be squirrel-cage, induction, shell-type design. Each motor shall be totally non-overloading throughout the entire range of the pump curve.

2.2.11 Power Cable

The power cable shall comply with NFPA 70, Type SO, and shall be of standard construction for submersible pump applications. The power cable shall enter the pump through a heavy duty entry assembly provided with an internal grommet assembly to prevent leakage. The cable entry junction chamber and motor shall be separated by a stator lead sealing gland or terminal board which shall isolate the motor interior from foreign material gaining access through the pump top. This cable entry design shall then insure that no entry of moisture is possible into the high-voltage motor terminal area, even if the cable is damaged or severred below the water level, to a submerged depth of up to 36 feet. Provide 85 feet of power cable. The 85 feet of power cable shall be cut in the field so as to avoid any excessive power cable.

2.2.11.1 Control Cable

Control cable shall be color coded and as described on drawings.

2.2.12 Installation Systems

2.2.12.1 Rail Mounted Systems

Rail mounted installation systems shall consist of a stainless steel guide rails, a sliding bracket, and a discharge connection elbow. Guide rails shall be of the size and type standard with the manufacturer and shall not support any portion of the weight of the pump. The sliding guide bracket shall be an integral part of the pump unit. Pump manufactuer shall provide means of holding sliding guide rails in tension to prevent excessive wear. The discharge connection elbow shall be permanently installed in the wet well along with the discharge piping. The pump shall be automatically connected to the discharge connection elbow when lowered into place and shall be easily removed for inspection and service without entering the pump well. Cable or rail mounted installation system shall consist of 316 stainless steel guide cables or rails, a sliding bracket and a discharge elbow, final connection shall insure zero leakage between the pump and discharge connection flange. Contractor shall provide a means of connecting the pump lifting mechanism to the eye bolt of the pump so as to lift the pump with the crane in an easy way.

2.2.12.2 Bolt Down Systems

The pump mount system shall include a base designed to support the weight of the pump. The base shall be capable of withstanding all stresses imposed upon it by vibration, shock, and direct and eccentric loads.

2.2.12.3 Lifting Chain

Lifting chain to raise and lower the pump through the limits indicated shall be provided. The chain shall be stainless steel and shall be capable of supporting the pump.

2.3 ELECTRICAL WORK

Electrical motor driven equipment specified shall be provided complete with motors, motor starters, and controls. Electric equipment and wiring shall be in accordance with Section 16415A ELECTRICAL WORK, INTERIOR. Electrical characteristics shall be as specified or indicated. Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary for the motor control specified. Manual or automatic control and protective or signal devices required for the operation specified, and any control wiring required for controls and devices but not shown, shall be provided.

PART 3 EXECUTION

3.1 EQUIPMENT INSTALLATION

3.1.1 Pump Installation

Pumping equipment and appurtenances shall be installed in the position indicated and in accordance with the manufacturer's written instructions. All appurtenances required for a complete and operating pumping system shall be provided, including such items as piping, conduit, valves, wall

sleeves, wall pipes, concrete foundations, anchors, grouting, pumps, drivers, power supply, seal water units, and controls.

3.1.2 Concrete

3.1.3 Grouting Screw Pump Flow Channel

3.2 PAINTING

Pumps and motors shall be thoroughly cleaned, primed, and given a two-part epoxy paint at the factory in accordance with the recommendations of the manufacturer.

3.3 FIELD TESTING AND ADJUSTING EQUIPMENT

3.3.1 Operational Test

Prior to acceptance, an operational test of all pumps, drivers, and control systems shall be performed to determine if the installed equipment meets the purpose and intent of the specifications. Tests shall demonstrate that the equipment is not electrically, mechanically, structurally, or otherwise defective; is in safe and satisfactory operating condition; and conforms with the specified operating characteristics. Prior to applying electrical power to any motor driven equipment, the drive train shall be rotated by hand to demonstrate free operation of all mechanical parts. Tests shall include checks for excessive vibration, leaks in all piping and seals, correct operation of control systems and equipment, proper alignment, excessive noise levels, and power consumption.

3.3.2 Retesting

If any deficiencies are revealed during any test, such deficiencies shall be corrected and the tests shall be reconducted.

3.4 MANUFACTURER'S SERVICES

Services of a manufacturer's representative who is experienced in the installation, adjustment, and operation of the equipment specified shall be provided. The representative shall supervise the installation, adjustment, and testing of the equipment. Two (2) days shall be provided for the supervision by the representative.

3.5 POSTING FRAMED INSTRUCTIONS

Framed instructions containing wiring and control diagrams under glass or in laminated plastic shall be posted where directed. Condensed operating instructions, prepared in typed form, shall be framed as specified above and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the system.

3.6 FIELD TRAINING

A field training course shall be provided for designated operating and maintenance staff members. Training shall be provided for a total period of 8 hours of normal working time and shall start after the system is functionally complete but prior to final acceptance tests. Field training shall cover all of the items contained in the operating and maintenance manuals.

3.7 WITNESS TEST

A factory witness test, per Hydraulic Institute - Level A, shall be provided in the presence of the Owner's Engineer. All performance parameter's shall be demostrated and guaranteed, in the presense of the Owner's Engineer. All tests shall be repeated, until all performances parameters, as specified in this section and on the drawings, are met.

-- End of Section --

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SECTION 15200A

PIPELINES, LIQUID PROCESS PIPING
03/02

PART 1 GENERAL

This Section applies to: 1) piping within the approximately 20'x27'x34'deep pumpwell structure; 2)piping within the concrete valve vault located adjacent to the pumpwell structure; 3)the check valve located within the concrete valve vault; 4)through the 24" x 24" x 36" wye connection; 5)and all the associated components within the pumpwell structure and concrete valve vault. The concrete valve vault itself will be as specified on the structurals drawings in lieu of a specification section. Refer to Specification Section 02532A for piping after the check valve located in the valve vault. This piping after the valve vault includes the new 36 inch PVC piping system which connects to the existing 36" PVC piping system. In addition, refer to section 02631 for the reinforced concrete pipe from the intake screens into the pumpwell structure.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 153/A 153M	(2001) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 167	(1999) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 183	(1998) Carbon Steel Track Bolts and Nuts
ASTM A 307	(2000) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength

AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA C110	(1998) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm through 1200 mm), for Water and Other Liquids
AWWA C111	(2000) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115	(1999) Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges
AWWA C150	(1996) Thickness Design of Ductile-Iron Pipe
AWWA C151	(1996) Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
AWWA C153	(2000) Ductile-Iron Compact Fittings, 3 In. Through 24 In.(76 mm through 610 mm) and 54 In. through 64 In. (1,400 mm through 1,600 mm) for Water Service
AWWA C207	(1994) Steel Pipe Flanges for Waterworks Service - Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm)

AWWA C508	(1993; C508a) Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS
AWWA C540	(1993) Power-Activating Devices for Valves and Sluice Gates

DUCTILE IRON PIPE RESEARCH ASSOCIATION (DIPRA)

DIPRA TRD	(1997) Thrust Restraint Design for Ductile Iron Pipe

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-25	(1998) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-58	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	(1996) Pipe Hangers and Supports - Selection and Application
MSS SP-89	(1998) Pipe Hangers and Supports - Fabrication and Installation Practices

1.2 TEXT DELETED

TEXT DELETED

1.3 SYSTEM DESCRIPTION

This specification covers the requirements as stated in the Part 1 of this Specification 15200A

1.3.1 Design Requirements

Support systems shall be selected and designed in accordance with MSS SP-58, MSS SP-69, and MSS SP-89 within the specified spans and component requirements. The absence of pipe supports and details on the contract drawings does not relieve the Contractor of responsibility for sizing and providing supports throughout facility. The structural design, selection, fabrication and erection of piping support system components shall satisfy the seismic requirements in accordance with Sections 13080 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT and 13080 SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT psf soil bearing capacity, a maximum wind speed of 150mph

1.3.2 Performance Requirements

The pressure ratings and materials specified represent minimum acceptable standards for piping systems. The piping systems shall be suitable for the services specified and intended. Each piping system shall be coordinated to function as a unit. Flanges, valves, fittings and appurtenances shall have a pressure rating no less than that required for the system in which they are installed.

1.3.2.1 Above Grade Piping Systems

Piping systems shall be suitable for design conditions, considering the piping both with and without internal pressure, and installation factors such as insulation, support spans, and ambient temperatures. Consideration shall be given to all operating and service conditions both internal and external to the piping systems.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Pipe and Equipment; G, DF

Equipment shop drawings and support system detail drawings showing piping systems and appurtenances, such as mechanical joints, valves, local indicators and hangers, including a complete list of equipment and materials. As-built drawings showing pipe anchors and guides, and layout of piping systems relative to other parts of the work including clearances for maintenance and operation. As-built piping and instrumentation diagrams (P&IDs) identifying and labeling equipment, instrumentation, valves, vents, drains, and all other inline devices; if the contract drawings contained P&IDs, the P&IDs found in the contract drawings shall be revised to reflect the constructed process system, as directed by the Contracting Officer.

SD-03 Product Data

Qualifications; G, DF

A statement certifying that the Contractor has the specified experience.

Welders; G, DF

Waste Water Disposal; G, DF

The method proposed for disposal of waste water from hydrostatic tests and disinfection, and all required permits, prior to performing hydrostatic tests.

Assistance and Training; G, DF

A signed statement certifying that the installation is satisfactory and in accordance with the contract drawings and specifications and the manufacturer's prescribed procedures and techniques, upon completion of the project and before final acceptance.

Delivery, Storage and Handling; G, DF

Material safety data sheets.

Materials and Equipment; G, DF

Manufacturer's descriptive and technical literature for each piping system, including design recommendations; pressure and temperature ratings; dimensions, type, grade and strength of pipe and fittings; thermal characteristics (coefficient of expansion and thermal conductivity); and chemical resistance to each chemical and chemical mixture in the liquid stream.

Installation; G, DF

The manufacturer's installation recommendations or instructions for each material or procedure to be utilized, including materials preparation.

Pipe Schedule; G, DF

A list of piping systems, pressure ratings and source of supply for each piping system broken out by material, size and application as indicated on the contract drawings. A list of any special tools necessary for each piping system and appurtenances furnished for adjustment, operation, maintenance and disassembly of the system.

Valve Schedule; G, DF
Operator Schedule; G, DF

A list of valve materials, pressure ratings, valve operator's materials, air supply pressure, electrical service, location, source of supply, and reference identification as indicated in the contract drawings. A list of any special tools necessary for each valve type and appurtenances furnished for adjustment, operation, maintenance and disassembly.

SD-06 Test Reports

Manufacturer's engineering end load calculations for anchors in double containment piping systems.

Pipe Leakage Tests; G, DF
Hydrostatic Tests; G, DF
Pneumatic Tests; G, DF
Valve Testing; G, DF

Copies of all field test reports within 24 hours of the completion of the test.

SD-07 Certificates

The name and qualifications of the manufacturer's representative and written certification from the manufacturer stating that the representative is technically qualified to supply and install FRP piping systems.

Contractor's Installation; G, DF

SD-10 Operation and Maintenance Data

Piping and Appurtenances; G, DF

Six copies each of operation and maintenance manuals in indexed booklet form. Operation manuals shall detail the step-by-step procedures required for specialized startup, operation and shutdown of piping systems, and shall include the manufacturer's name, model number, parts list and brief description of piping equipment such as valves and other appurtenances and their basic operating features. Maintenance manuals shall list routine maintenance procedures and troubleshooting guides for the equipment, and shall include piping layout and valve locations.

1.5 QUALIFICATIONS

1.5.1 Contractor

Contractor shall have successfully completed at least 3 projects of the same scope and size or larger within the last 6 years. Contractor shall demonstrate specific experience in regard to the system installation to be performed.

1.6 GENERAL JOB REQUIREMENTS

Piping materials and appurtenances shall be as specified and as shown on the

drawings, and shall be suitable for the service intended. Piping materials, appurtenances and equipment supplied as part of this contract shall be new and unused except for testing equipment. Components that serve the same function and are the same size shall be identical products of the same manufacturer. The general materials to be used for the piping systems are indicated by service in the Pipe Schedule.

1.6.1 Components

Piping equipment and appurtenances shall be new products of equal material and ratings as the connecting pipe.

1.6.2 Standard Products

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacturing of the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Nominal sizes for standardized products shall be used. Pipe, valves, fittings and appurtenances shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

1.6.3 Identification and Tagging

Each piece of pipe shall bear the ASTM designation and all other markings required for that designation. Valves shall be marked in accordance with MSS SP-25 and shall bear an identification tag securely attached using stainless steel wire. Identification tags shall be 1.375 inch] minimum diameter, made of stamped stainless steel. Indentations shall be black for reading clarity. The service, valve identification number shown on the Operator Schedule], the manufacturer's name, and the valve model number shall be displayed.

1.7 DELIVERY, STORAGE AND HANDLING

Materials delivered and placed in storage shall be stored with protection from the weather, excessive humidity variation, excessive temperature variation, dirt, dust and/or other contaminants. Proper protection and care of material before, during and after installation is the Contractor's responsibility. Any material found to be damaged shall be replaced at the Contractor's expense. During installation, piping shall be capped to keep out dirt and other foreign matter. A material safety data sheet in conformance with 29 CFR 1910 Section 1200(g) shall accompany each chemical delivered for use in pipe installation. At a minimum, this includes all solvents, solvent cements, glues and other materials that may contain hazardous compounds. Handling shall be in accordance with ASTM F 402. Storage facilities shall be classified and marked in accordance with NFPA 704, with classification as indicated in NFPA 49 and NFPA 325-1. Materials shall be stored with protection from puncture, dirt, grease, moisture, mechanical abrasions, excessive heat, ultraviolet (UV) radiation damage, or other damage. Pipe and fittings shall be handled and stored in accordance with the manufacturer's recommendation. Plastic pipe shall be packed, packaged and marked in accordance with ASTM D 3892.

1.8 PROJECT/SITE CONDITIONS

1.8.1 Environmental Requirements

Buried piping at the site may be subject to corrosion from the surrounding soil. Testing and measurements shall be conducted. Piping system design, supply and installation shall address the external corrosion conditions so indicated.

1.8.2 Existing Conditions

The Contractor shall be responsible for the verification of existing piping and penetrations. Prior to ordering materials, the Contractor shall expose all existing pipes which are to be connected to new pipelines. The Contractor shall verify the size, material, joint types, elevation, horizontal location, and pipe service of existing pipes, and inspect size and location of structure

penetrations to verify adequacy of wall sleeves, and other openings before installing connecting pipes.

1.8.3 Verification of Dimensions

After becoming familiar with all details of the work, the Contractor shall verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

1.9 SEQUENCING AND SCHEDULING

For slab, floor, wall, and roof penetrations, the Contractor shall have on site pertinent wall pipes and sleeves before they are required for placement in concrete forms. The Contractor shall verify and coordinate the size and location of building and structure pipe penetrations before forming and placing concrete.

1.10 MAINTENANCE

1.10.1 Service

Services for automatic valve shall be provided by a manufacturer's representative who is experienced in the installation, adjustment and operation of the equipment specified. The representative shall inspect the installation, and supervise the adjustment and testing of the equipment.

1.10.2 Extra Materials

Concurrent with delivery and installation of the specified piping systems and appurtenances, spare parts for each different item of material and equipment specified that is recommended by the manufacturer to be replaced any time up to 3 years of service shall be furnished. For each type and size of valve, the following extra materials shall be provided: lubricator, lubricant with appropriate temperature rating, lubricator/isolating valve; galvanized operating wrench,4.1 feet long, for T-handled operators; galvanized operating key for cross handled valves. Extra materials shall include 2 of the following spare parts for each type and size of valve: gaskets; O-ring seals; diaphragms (molded); all elastomer parts; stem packing; seat rings and seat ring pulling tool.

PART 2 PRODUCTS

2.1 MATERIALS (GENERAL)

Materials for various services shall be in accordance with TABLE I. Pipe fittings shall be compatible with the applicable pipe materials.

2.2 DUCTILE IRON PIPING SYSTEM

2.2.1 Ductile Iron Pipe

Ductile iron pipe for pressure service shall have a design and wall thickness conforming to AWWA C150. Ductile iron pipe shall have a standard lining.

2.2.2 Ductile Iron Joints

Joints shall have a working pressure rating for liquids equal to the pressure rating of the connected pipe. Dielectric fittings or isolation joints shall be provided between all dissimilar metals.

2.2.2.1 Mechanical Joints

Mechanical joints shall conform to AWWA C110 and AWWA C111. Gaskets, glands, bolts and nuts shall be furnished in sufficient quantity for the complete assembly of each mechanical joint. Glands shall be ductile or gray iron with an asphaltic coating. Gaskets shall be vulcanized synthetic rubber, reclaimed rubber is not acceptable. For grooved shoulder piping, self-centering gasketed couplings designed to mechanically engage piping and lock in a positive

watertight couple shall be used. Housings shall be composed of malleable iron, ASTM A 47/A 47M or ductile iron, ASTM A 536 and gaskets of molded synthetic rubber, halogenated isobutylene isoprene shall be used. Bolts and nuts shall be heat treated carbon steel, ASTM A 183, minimum tensile . Mechanical joints shall have bolt holes oriented straddling the vertical centerline of the valves and fittings.

2.2.2.2 Push-on Joints

Push-on type joints shall conform to AWWA C111. Each push-on joint shall be supplied complete with gasket and lubricant. Gaskets shall be compatible with joint design and comprised of vulcanized synthetic rubber, reclaimed rubber is not acceptable. Lubricant shall be specifically formulated for use with push-on joints and shall be non-toxic, odorless, tasteless and shall not support bacteria growth.

2.2.2.3 Restrained Joints

Restrained joints shall conform to the requirements of AWWA C111, and be designed for a working pressure equal to connected pipe rating. When using ductile iron pipe with restrained joints, field cuts shall be supplied with a lock ring complete with retainer, retainer lock and roll-pin, as required by manufacturer's recommendations, procedures and/or installation instructions.

2.2.2.4 Flanged Joints

Flanged joints shall conform to AWWA C110. Gaskets, bolts and nuts shall be provided with flanged joints in sufficient quantity for the complete assembly of each joint. Gaskets shall be vulcanized synthetic rubber, reclaimed rubber is not acceptable.

2.2.3 Ductile Iron Fittings

Fittings shall be ductile iron AWWA C110. Flanges and flanged fittings shall conform to ASME B16.1 and shall be rated for 250 psig service. Materials shall be ductile iron . Bolts and nuts shall be carbon steel conforming to ASTM A 307, Grade B. Bolts shall be provided with washers of the same material as the bolts. Gaskets shall be rubber ringfull face, maximum 0.125 in thick.

2.3 VALVES

2.3.1 General Requirements For Valves

Valves shall include operator, actuator, handwheel, chain wheel, extension stem, floor stand, worm and gear operator, operating nut, chain, wrench, and all other accessories required for a complete operation. The valves shall be suitable for the intended service. Renewable parts are not to be of a lower quality than those specified. Valves shall be the same size as adjoining pipe. Valve ends shall be compatible with adjacent piping system. An operator shall be sized to operate the associated valve for the full range of pressures and velocities. Valves will open by turning counterclockwise. Operators, actuators, and accessories shall be factory mounted.

2.3.2 Factory Finishing

Valves shall have an epoxy lining and coating in accordance with AWWA C550 unless otherwise specified. The epoxy shall be either a two-part liquid material or a heat-activated (fusion) material except that only a heat-activated material shall apply if a valve coating is specified as "fusion" or "fusion bonded" epoxy. The epoxy lining and coating shall have a minimum 7.0 mils dry film thickness except where it is limited by valve operating tolerances. Safety isolation valves and lockout valves with handles, handwheels, or chain wheels shall be painted "safety yellow."

2.3.3 Check Valves

2.3.3.1 Swing Check Valves

Swing check valves shall conform to the following:

c. Swing check valves, 2 inches through 36 inches, shall conform to AWWA C508, and have , welding, mechanical joint end connections. Valves shall have a ductile iron body, bronze -mounted disc, solid bronze hinges, and a stainless steel hinge shaft. Valves 2 inches through 12 inches shall be rated for 175 psig service and valves 14 inches through 36 inches shall be rated for 150 psig service at 140 degrees F. Valves shall be fitted with an adjustable outside lever and spring. An increasing-pattern body valve may be used where increased outlet piping size is shown.

2.3.3.2 Slanting Disc Check Valve

Slanting disc check valves, 2 inches through 60 inches, shall be of a slanting or tilting disc design, with off-center pivot. Valve bodies shall be bronze, and of a wafer-style design. Seats shall be bronze set on a 55 -degree angle. Discs shall be bronze with pivot pin and bushing constructed of aluminum bronze, disc seal, spring, valve disc position indicator. Valves shall be rated for 150 psig service and have ASME flanged end connections.

2.3.3.3 Silent Check Valve

Silent check valves shall conform to the following:

a. Silent check valves, 2 inches through 10 inches, shall be wafer style, center guided valve with a bronze body, bronze trim, seat, and springs. Valves shall be rated for service at 140 degrees F.

b. Silent check valves, 2.5 inches through 42 inches, shall be globe style, center guided valve with ASME B16.1 Class 125 flanged end connections, a bronze body, bronze trim, seat, and bronze spring. Valves shall be rated for 150 psig service.

2.3.4 Ball Valves

2.19.5.1 General Purpose Ball Valves

General purpose ball valves shall conform to the following:

c. Ball valves, 2 inches to 12 inches, shall conform to ASME B16.34 Class , and have a bronze body, stainless steel ball and stem, polytetrafluoroethylene (PTFE) packing and gasket, and flanged ends, full port. Valves shall be rated for 200 psig service, and have hand lever operators.

2.19.6 Gate Valves

2.3.5 Pump Control Valve

Pump control valve shall be diaphragm actuated, pilot controlled globe valve with cast iron ductile iron bodies, ASME B16.5 Class 150 flanged end connections, bronze trim, stainless steel stems, and externally mounted strainers with cocks. Valves shall be designed to eliminate pipeline surge caused by pump startup and shutdown, and shall include automatic check features.

2.3.6 Valve Accessories

2.3.6.1 Extension Bonnet for Valve Operator

All extension bonnets shall be provided as necessary, complete with stem and accessories applicable to the specific valve and operator.

2.3.6.2 Floor Stand and Extension Stem

A floor stand and extension stem shall be the nonrising, indicating type; complete with stem, coupling, handwheel, stem guide brackets, and yoke attachment. The stem guide shall be spaced such that stem L/R ratio does not exceed 200. Anchors shall be supplied as required.

2.3.6.3 Floor Box and Stem

A floor box and stem shall be the plain type, for support of nonrising type stem; complete with stem, operating nut, and stem guide brackets. The stem guide shall be spaced such that stem L/R ratio does not exceed 200. Anchors shall be supplied as required.

2.3.6.4 Chain Wheel and Guide

A chain wheel and guide shall be the handwheel direct-mount type, complete with galvanized or cadmium-plated chain.

2.4 DRAINS

Valved drains may not be shown on the detailed drawings for individual pipelines; their absence will not relieve the Contractor of the responsibility for providing and installing them as indicated in the piping and instrumentation diagrams to complete the piping system for the use intended.

2.4.1 Locations

All pipeline low points shall be drained.

2.4.2 Sizes

For pipelines 2.5 inches and larger, drains shall be 0.75 inch and equipped with gate valves. For pipelines 2 inches and smaller, drains shall be 0.5 inch and equipped with ball valves.

2.5 SAMPLE PORTS

Sample ports shall be provided as indicated in the piping and instrument diagrams to complete the piping systems for the use intended. The sample ports shall be located in easily accessible locations, and shall avoid potential stagnant points and/or areas where material could collect. A double block and bleed configuration shall be provided.

2.6 MISCELLANEOUS PIPING COMPONENTS

2.6.1 Air Release and Vacuum Breakers

Air release vents shall be located, and vented, such that a hazardous atmosphere will not be created upon operation.

2.6.1.1 Locations

All pipeline high points shall have air release vents and vacuum breakers. . Vacuum breakers shall be provided on all tanks and process equipment.

2.6.1.2 Vacuum Breakers

Vacuum breakers 2 inches and smaller shall be an angle type with all bronze bodies and bonnets, and shall be installed at least 6 inches above the flood line of associated equipment and shall conform to ASSE 1001 for pipe applied units.

2.6.1.3 Air and Vacuum Valve Suitable for Corrosive Service

2.6.1.4 Air Release Valve Suitable for Corrosive Service

The air release valve shall automatically exhaust entrained air that accumulates in a system and shall be Factory Mutual listed. The valve shall be rated for 150 psig working pressure and built with a standard elongated body. The valve shall have a ductile iron body and cover, with stainless steel float and trim. Valve end connections shall be ASME B16.5 Class 150 flanged. The air and vacuum valve shall be fitted with blowoff valve, quick disconnect couplings, and a minimum 6.6 feet of hose in order to permit back flushing after installation without dismantling the valve.

2.6.1.5 Combination Air Valve Suitable for Corrosive Service

2.6.2 Strainers

Strainers shall be duplex with a Y-pattern body. Port sizes shall be 1 inch and be ASME B1.20.1 threaded, female. The strainers shall be rated for 150 psig working pressure at 150 degrees F and conform to ASTM F 1199. The body shall be cast bronze with a screwed bronze cap. The screen shall be heavy-gauge stainless steel, 30 mesh and be equipped with a ASME B1.20.1 pipe threaded blowoff hole.

2.6.3 Indicating Devices

2.6.3.1 Pressure and Vacuum Gauges

Pressure and vacuum gauges shall be stem mounted, with brass cases equipped with safety pressure blowout backs and dry dials. The gauge sensors shall be diaphragm actuated and constructed of phosphor bronze. The gauges shall be equipped with brass threaded 0.25 inch female connections. The dials of the gauges shall be 6 inches in diameter with scale readings in psig and inches of mercury ranging from zero to approximately twice the anticipated process operating or equipment pressure. A slotted adjustable pointer shall be provided with accuracy to conform to ASME B40.1, Grade A. A lever handled gauge cock and filter type snubber shall be provided.

2.6.3.2 Thermometers

Thermometers shall be bi-metal actuated, with 5 inches dished anti-parallax dials that have external calibration adjustment and stainless steel cases. Mercury shall not be used in thermometers. The thermometers shall have stainless steel stems, adjustable angle type for the correct viewing angle. The union connections with associated thermowells shall be included. Scale shall be 25 to 125 degrees F with accuracy within one scale division.

2.6.3.3 Thermowells

Thermowells shall be brass with a diameter of 1 inch. The length shall be as shown on the contract drawings and coordinated with the associated temperature element. Process connections shall be constructed of stainless steel and shall have flanges, faced and drilled to ASME B16.5 Class 150. Thermowells that shall be used with thermocouples or RTDs shall be equipped with terminal connection heads rated NEMA 250 Type 4.

2.6.4 Pressure Relief Devices

Pressure relief devices shall conform to the requirements of ASME B31.3.

2.6.4.1 Pressure-Relief Valve

Pressure-relief valves shall conform to the following:

2.6.4.2 Rupture Discs

2.7 PIPE SUPPORTS AND PENETRATIONS

Auxiliary steel shall be provided by the Contractor where the support of piping systems and equipment is required between building structural elements. Light

gauge and structural steel shapes shall conform to the requirements of ASTM A 36/A 36M. The Contractor shall have the option to use pre-engineered support systems of electrogalvanized steel products. However, a mixture of support system manufacturers products is not permitted. Where auxiliary steel is indicated as stainless steel, the Contractor shall provide TP304 stainless steel conforming to ASTM A 167, No. 1 Finish .

2.7.1 Pipe Supports

Pipe supports shall conform to the requirements of MSS SP-58, MSS SP-69, and MSS SP-89. Where pipe supports contact bare piping or in-line devices, provide supports of compatible material so that neither shall have a deteriorating action on the other.

2.7.1.1 Beam Clamps

For upper attachments on structural steel, the Contractor shall provide beam clamps of ASTM A 36/A 36M carbon steel and MSS SP-58 Types 19 through 23, 25 or 27 through 30. Holes drilled in structural steel for hanger support rods will not be permitted. Clamps shall be provided with hardened steel cup-point set screws and lock-nuts for anchoring in place. Clamp size selection shall only be based on the support of the required load.

2.7.1.2 Riser Clamps

Vertical runs of piping shall be supported at each floor, or closer where required, with ASTM A 36/A 36M carbon steel clamps bolted around pipes and attached to the building construction. Copper plated clamps shall be provided for copper tubing support. Two bolt-type clamps designed for installation under insulation shall be used on insulated pipe runs.

2.7.1.3 Brackets

Where piping is run adjacent to walls or steel columns, the Contractor shall provide welded ASTM A 36/A 36M steel brackets, pre-punched with a minimum of two fastener holes.

2.7.1.4 Offset Pipe Clamp

Where pipes are indicated as offset from wall surfaces, a double-leg design two-piece pipe clamp shall be supplied by the Contractor.

2.7.1.5 Racks

Multiple pipe racks or trapeze hangers shall be fabricated from ASTM A 36/A 36M steel, and designed to suit the conditions at the points of installation. Pipes shall be kept in their relative positions to each other by the use of clamps or clips. Pipelines subject to thermal expansion must be free to slide or roll.

2.7.1.6 Hangers

Hangers shall be fabricated of ASTM A 36/A 36M carbon steel. All hangers shall be of a uniform type and material for a given pipe run and application. Coated or plated hangers shall be used to isolate steel hangers from dissimilar metal tube or pipe. Hangers for pipe sizes 2.5 inches or larger shall incorporate a means of vertical adjustment after erection while supporting the load. For piping systems with operating temperatures from 122 to 446 degrees F the following shall be used: MSS SP-58 Types 35 through 38 for sliding support. For piping systems with liquid temperatures up to 122 degrees F the following shall be used: MSS SP-58 Types 35 through 38 with support from below.

2.7.1.7 Hanger Rods

2.7.2 Pipe Guides

2.7.2.1 Intermediate Guides

For piping 6 inch and smaller, a pipe clamp with an oversize pipe sleeve shall be provided for a minimum 0.16 inch clearance. For piping 8 inch and larger, U-bolts with double nuts that are manufactured for the purpose shall be used to provide a minimum 0.28 inch clearance around pipe. The stock sizes for the U-bolts are as follows: for a 8 inch pipe use a 0.625 inch U-bolt; for a 10 inch pipe, use a 0.75 inch U-bolt; for a 12 inch to 16 inch pipe, use a 0.875 inch U-bolt; and for 18 inch to 30 inch pipes use 1 inch U-bolts.

2.7.2.2 Alignment Guides

For piping, 8 inch and smaller, alignment guides shall be galvanized steel, sleeve type. For piping, 10 inch and larger, alignment guides shall be galvanized steel, roller type guides.

2.7.3 Flashing Sleeves

Galvanized steel flashing sleeves shall be installed wherever piping passes through concrete roof structures. The flashing shall extend 8 inches from the pipe in all directions, extend up the pipe, and shall be fitted with double-threaded flashing for pipes 3 inches and smaller. Flashing shall turn down inside the pipe for 4 inches and larger pipes.

2.7.4 Wall Penetrations

2.7.4.1 Above Grade Wall Penetrations

Piping which passes through fire-rated or smoke-rated walls, floors, or ceilings shall be provided with insulated and encased pipe sleeves. Penetrations through an existing fire or fire barrier wall shall be sealed with a fire stop system that has an "F" rating not less than the required fire resistance rating of the penetrated wall. The fire stopping sealant for metal piping systems shall be vibration resistant, polysiloxane (also known as silicone) based, nonslumping, premixed sealant with intumescent properties, that is rated for 3 hours pursuant to ASTM E 814 and UL requirements. The fire stopping sealant for plastic and insulated piping systems shall be a polysiloxane (also known as silicone) based, nonslumping, premixed sealant with intumescent properties, that is vibration and moisture resistant, and is rated for 3 hours pursuant to ASTM E 814 and UL requirements with metal collars. Vented plastic pipe penetrations shall be fitted with galvanized steel collars that have intumescent inlays.

2.7.4.2 Below Grade Wall Penetrations

Below-grade wall penetrations shall be provided with hydrostatic seals designed to seal opening between pipe or conduit and a through-structure opening. The seals shall be modular mechanical type consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening .

2.7.4.3 Galvanizing

Galvanizing shall be hot-dip applied and meet the requirements of ASTM A 153/A 153M. Stainless steel components may be substituted where galvanizing is specified.

2.8 MISCELLANEOUS MATERIALS

2.8.1 Pipe Insulation Material

Insulation for pipes, valves, instrumentation and controls, and other equipment shall be one inch ASTM C 552 cellular glass and integral moisture barriers.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Protection

Pipe and equipment openings shall be closed with caps or plugs during installation. Equipment shall be protected from dirt, water, and chemical or mechanical damage.

3.1.2 System Preparation

3.1.2.1 Pipe and Fittings

Pipe and fittings shall be inspected before exposed piping is installed or buried piping is lowered into the trench. The Contractor shall clean the ends of pipes thoroughly, remove foreign matter and dirt from inside of pipes, and keep piping clean during and after laying.

3.1.2.2 Damaged Coatings

The Contractor shall repair damaged coating areas in the field with material equal to the original coating, except for damaged glass-lined pipe which shall be promptly removed from the site. The Contractor shall not install damaged piping materials. Field repair of damaged and uncoated areas of galvanized piping shall conform to ASTM A 780.

3.1.2.3 Field Fabrication

The Contractor shall notify the Contracting Officer at least 2 weeks prior to the field fabrication of pipe or fittings and at least 3 days prior to the start of any surface preparation or coating application work. Welding electrodes shall be provided in accordance with as required for the applicable base metals and welding process. Fabrication of fittings shall be performed in accordance with the manufacturer's instructions.

3.2 EXPOSED PIPING INSTALLATION

Exposed piping shall be run as straight as practical along the alignment shown on the contract drawings and with a minimum of joints. Piping and appurtenances shall be installed in conformance with reviewed shop drawings, manufacturer's instructions and ASME B31.3. Piping shall be installed without springing or forcing the pipe.

3.2.1 Anchors and Fasteners

Impact expansion (hammer and explosive charge drive-type) anchors and fastener systems are not acceptable. Lead shields, plastic or fiber inserts, and drilled-in plastic sleeve/nail drive systems are also not acceptable.

3.2.1.1 Drilled-In Expansion Anchors and Fasteners

The anchor/fastener assembly shall be UL listed with a one-piece stud (bolt) that has integral expansion wedges, nuts and washers. The stud shall be constructed of TP304 stainless steel, and nut and washer of TP304 stainless steel. The anchor length, diameter, and embedment depth shall meet the manufacturer's requirements for the maximum allowable working load of the application.

3.2.1.2 Drilled-In Adhesive Anchors

Drilled-in adhesive anchors shall not be used for overhead applications. The anchors shall be composed of an anchor rod assembly and an anchor rod adhesive cartridge. The anchor rod assembly shall be a chamfered and threaded stud rod of zinc plated ASTM A 36/A 36M steel with a nut and washer of TP316 stainless steel. The anchor length, diameter, and embedment depth shall meet the manufacturer's requirements for the maximum allowable working load of the application. The adhesive cartridge shall be a sealed capsule containing premeasured amounts of resin, quartz sand aggregate, and a hardener contained in a separate vial within the capsule. The capsule ingredients shall be activated

by the insertion procedure of the anchor rod assembly.

3.2.2 Piping Expansion and Contraction Provisions

The piping shall be installed to allow for thermal expansion and contraction resulting from the difference between installation and operating temperatures. Design for installation of plastic pipe exposed to ambient conditions or in which the temperature variation of the contents is substantial shall have provisions for movement due to thermal expansion and contraction documented to be in accordance with PPI TR21. Anchors shall be installed as shown in the contract drawings to withstand expansion thrust loads and to direct and control thermal expansion. An intermediate pipe guide shall be installed for every pipe at each metal channel framing support not carrying an anchor or alignment guide. Where pipe expansion joints are required, pipe alignment guides shall be installed adjacent to the expansion device and within four pipe diameters. Expansion devices shall be installed in accordance with the manufacturer's instructions .

3.2.3 Piping Flexibility Provisions

Thrust protection shall be provided as required. Flexible couplings and expansion joints shall be installed at connections to equipment, and where shown on the contract drawings. Additional pipe anchors and flexible couplings beyond those shown on the contract drawings, shall be provided to facilitate piping installation, in accordance with reviewed shop drawings.

3.2.4 Couplings, Adapters and Service Saddles

Pipes shall be thoroughly cleaned of oil, scale, rust, and dirt in order to provide a clean seat for gaskets. Gaskets shall be wiped clean prior to installation. Flexible couplings and flanged coupling adapter gaskets shall be lubricated with the manufacturer's standard lubricant before installation on the pipe ends. Couplings, service saddles, and anchor studs shall be installed in accordance with manufacturer's instructions. Bolts shall be tightened progressively, drawing up bolts on opposite sides a little at a time until all bolts have a uniform tightness. Torque-limiting wrenches shall be used to tighten bolts.

3.2.5 Piping Equipment/Component Installation

Piping components and indicators shall be installed in accordance with manufacturer's instructions. Required upstream and downstream clearances, isolation valves, and miscellaneous devices shall be provided for an operable installation. The upstream and downstream lengths of undisturbed piping shall be in accordance with flow indicator manufacturer's recommendations.

3.2.5.1 Local Indicators

All direct-reading indicator devices, thermometers, and pressure gauges shall be installed so that they can be easily read from floor level, and are readily accessible for maintenance and service. All temperature sensing bulbs shall be coated with a silver base heat transfer grease prior to insertion into the thermowell. Pressure gauges and thermometers shall be installed where indicated in the contract drawings. Field calibration of all indicators shall be performed at time of installation to ensure measuring and reading accuracy. Differential pressure gauges shall be installed across all process equipment, in accordance with the manufacturer's recommendations, and arranged for easy observation.

3.2.6 Pipe Flanges

Pipe flanges shall be set level, plumb, and aligned. Flanged fittings shall be installed true and perpendicular to the axis of the pipe. The bolt holes shall be concentric to the centerline of the pipe and shall straddle the vertical centerline of the pipe.

3.2.7 Valve Locations

Valves shall be located in accordance with the contract drawings where actuators are shown. Where actuators are not shown, valves shall be located and oriented to permit easy access to the valve operator, and to avoid interferences.

3.2.8 Pipe Tap Connections

Taps to pipe barrels are unacceptable. Taps to ductile iron piping shall be made only with a service saddle or at a tapping boss of a fitting, valve body, or equipment casting. Taps to steel piping shall be made only with a welded threadolet connection.

3.2.9 Insulation

3.3 BURIED PIPE PLACEMENT

3.3.1 Excavation and Backfilling

Earthwork shall be performed as specified in Section 02315N EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Backfilling shall be accomplished after inspection by the Contracting Officer. The Contractor shall exercise care when lowering pipe into the trench to prevent damage or twisting of the pipe.

3.3.2 Fittings

At valves and connections, the trench bottom shall be dug out with sufficient length, width, and depth to ensure clearance between the undisturbed trench bottom and the valves and such connections.

3.3.3 Thrust Restraint

Thrust restraint devices are generally not shown in the contract drawings; their absence will not relieve Contractor of the responsibility for providing them as required to provide complete systems for the use intended. The Contractor shall provide thrust blocks and ties where required, whether or not shown on the contract drawings. At a minimum, thrust restraint shall be provided at pipeline tees, plugs, caps, bends, and other locations where unbalanced forces exist.

3.3.3.1 Thrust Blocks

Thrust blocking shall be concrete of a mix not leaner than 1 cement, 2.5 sand and 5 gravel, and have a compressive strength of not less than 2000 psi after 28 days. Blocking shall be placed between solid ground and the fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of the thrust blocks shall be poured against undisturbed earth. The sides of thrust blocks not subject to thrusts may be poured against forms. The area of bearing shall be as shown or directed. Blocking shall be placed so that fitting joints shall be accessible for repair. Steel rods and clamps, protected by galvanizing or a coating of bituminous paint shall be used to anchor vertical down bends into gravity thrust blocks.

3.3.3.2 Restrained Joints

For ductile iron pipe, restrained joints shall be designed by the Contractor or the pipe manufacturer in accordance with DIPRA TRD.

3.3.4 Marking Tape

Pipe marking tape shall be provided and installed in accordance with the requirements of Section 02315N EXCAVATION AND FILL.

3.3.5 Plastic Pipe Installation

3.4 CONNECTING DISSIMILAR PIPE

Flexible transition couplings, dielectric fittings and isolation joints shall be

installed in accordance with the manufacturer's instructions.

3.5 EXTERNAL CORROSION PROTECTION

Protect all pipe and piping accessories from corrosion and adverse environmental conditions.

3.5.1 Underground Metallic Piping

Buried metallic piping shall be protected from corrosion using protective coatings. Cathodic Protection shall be provided for metallic underground piping systems as specified in . Where dissimilar metals are joined underground, gas-tight isolation joints shall be used. Insulating joint material shall be provided where shown to control galvanic or electrical action.

3.6 DOUBLE CONTAINMENT

3.6.1 Assistance and Training

The Contractor shall provide manufacturer's technical assistance for Contractor training, installation inspection, start up, and owner operating and maintenance training. The Contractor shall follow manufacturer's instructions for installation.

3.6.2 Field Test of System

Tests shall be performed to demonstrate the ability of the system to detect and locate breaks, shorts and probes on the sensor string. Leak testing shall be performed pursuant to the following procedure in order to verify operation and the ability to work with condensation pools or other static moisture. The double containment piping system leak detection field test procedures shall be as follows: (1) Wet the sensor cable near the start of the sensor string and acknowledge the detection/location alarm and remap the system. (2) Wet the sensor cable near the end of the sensor string with the first location still wetted and acknowledge the detection/location alarm and remap the system. (3) Wet the sensor cable in three additional locations between the first and second leak locations with each detection/location alarm being acknowledged and with all prior leak locations still wetted. (4) Prepare and submit a report verifying each leak location and detection accuracy. A hard copy report of the test results shall be furnished.

3.7 FLEXIBLE JOINTS AT CONCRETE STRUCTURES

Flexible joints shall be provided at the face of all structures, whether or not shown on the contract drawings. Rubber ring joints, mechanical joints, flexible couplings, and proprietary restrained ductile iron pipe joints shall be considered flexible joints; welded pipe joints shall not. Joints may be flush with the structure face or may be located up to pipe diameter away from face , but not further than 17.7 inches away from face. For pipelines larger than 18 inches in diameter the first joint shall be within 1 pipe diameter.

3.8 CLOSURES

Closure pieces shall be installed as necessary to end pipe runs and shall conform to ASME B16.9 or ASME B16.11. Elastomer sleeves bonded to pipe ends are not acceptable. Pressure piping shall have closures of blind flanges, unless otherwise shown on contract drawings or approved by the Contracting Officer. Pipes with restrained joints shall have pipe closures installed with thrust tie-rod assemblies .

3.9 PENETRATIONS

Steel pipe sleeves shall be hot-dipped galvanized after fabrication for above grade applications in nonsubmerged areas. For below grade, or in submerged and damp environments, steel pipe sleeves shall be lined and coated. Embedded metallic piping shall be isolated from concrete reinforcement using coated pipe

penetrations. Wall pipes shall be securely supported by form work to prevent contact with reinforcing steel and tie-wires. Joints shall be caulked with rubber sealant. For existing concrete walls, rotary drilled holes may be provided in lieu of sleeves.

3.10 VALVE INSTALLATION

Flanged valve bolt holes shall be installed so as to straddle the vertical centerline of pipe. Flanged faces shall be cleaned prior to inserting the gasket and bolts, and then the nuts shall be tightened progressively and uniformly. Threaded ends shall have the threads cleaned by wire brushing or swabbing prior to installation.

3.10.1 Valve Orientation

The operating stem of a manual valve shall be installed in a vertical position when the valve is installed in horizontal runs of pipe having centerline elevations 4.5 feet or less above finished floor, unless otherwise shown on contract drawings. The operating stem of a manual valve shall be installed in a horizontal position in horizontal runs of pipe having centerline elevations between 4.5 feet and 6.75 feet above finish floor, unless otherwise shown on contract drawings. Automatic valves shall be installed in accordance with .

3.10.2 Operator Extension Stems

Where the depth of the valve is such that its centerline is more than 3 feet below grade, an operator extension stem shall be furnished with a 2 inch operating nut to bring the operating nut to a point 5.9 inches below the surface of the ground and/or box cover. The operating nut shall be located in a floor box.

3.10.3 Torque Tube

Where the operator for quarter-turn valve is located on a floor stand, an extension stem torque tube shall be furnished, properly sized for the maximum torque capacity of the valve.

3.10.4 Chain Wheel and Guide

Chain wheel and guide assemblies or chain lever assemblies shall be installed on manually operated valves located over 6.73 feet above finished floor elevation. Where chains hang in normally traveled areas, appropriate "L" type tie-back anchors shall be used.

3.11 AIR RELEASE, DRAINS AND SAMPLE PORTS

Sample ports shall be provided where indicated on the contract drawings. The Contractor shall install specified vents at piping high points for entrapped air release and install drains in the low points of pipelines regardless of whether shown on contract drawings.

3.12 PIPING SUPPORT SYSTEMS INSTALLATION

The absence of pipe supports and details on the contract drawings shall not relieve the Contractor of responsibility for sizing and providing supports throughout plant.

3.12.1 General Support Requirements

Pipe support systems shall meet the requirements of MSS SP-58. Contractor-designed and selected support systems shall be installed in accordance with MSS SP-69, and as specified herein. Piping connections to equipment shall be supported by pipe supports and not off the equipment. Large or heavy valves, fittings, and/or equipment shall be supported independently of associated piping. Pipes shall not be supported off other pipes. Supports shall be provided at piping changes in direction or in elevation, adjacent to flexible joints and couplings, and where otherwise shown on the contract drawings. Pipe supports and

hangers shall not be installed in equipment access areas or bridge crane runs. Hanging pipes shall be braced against horizontal movement by both longitudinal and lateral sway bracing. At each channel type support, every pipe shall be provided with an intermediate pipe guide, except where pipe anchors are required. Existing support systems may be used to support additional new piping only if the Contractor can demonstrate that the existing support systems are adequate for the additional loads, or if the existing systems are strengthened to support the additional loads. Pedestal type pipe supports shall be provided under base flanges adjacent to rotating equipment and where required to isolate vibration. Piping 2.5 inches in diameter and larger shall be braced for seismic forces. Lateral supports for seismic loads shall be installed at all changes in direction.

3.12.2 Support of Insulated Piping

The Contractor shall install oversized supports to fit the insulation inserts. Supports shall be provided with galvanized or stainless steel protection shields and oversized rollers.

3.12.3 Dielectric Barriers

Dielectric barriers shall be installed between supports and copper or stainless steel piping, and between stainless steel supports and non-stainless steel ferrous piping.

3.12.4 Support Spacing

3.12.4.1 Acceptable Limits for Metallic Piping

3.12.4.2 Acceptable Limits for Thermoplastic Piping

3.12.4.3 Acceptable Limits for Rubber/Elastomer Piping

3.12.5 Support Methods

Piping support shall be provided as specified and as shown in the contract drawings. Single horizontal suspended piping shall be supported by adjustable swivel-ring, split-ring, or clevis hangers. Multiple horizontal suspended piping shall be supported by trapeze hangers with channel type supports. Horizontal pedestal mounted piping shall have saddle type supports. Horizontal wall mounted piping shall have wall brackets. Vertical piping shall be supported by wall brackets, base elbows, or riser clamps on floor penetrations.

3.13 PIPE IDENTIFICATION, PAINTING AND COLOR CODING

3.14 FIELD QUALITY CONTROL

3.14.1 Hydrostatic Tests

Where any section of a pipeline is provided with concrete thrust blocking for fitting, the hydrostatic tests shall not be made until at least 5 days after the installation of the concrete thrust blocking, unless otherwise approved by the Contracting Officer.

3.14.1.1 Buried Piping

3.14.1.2 Exposed Piping

Hydrostatic testing shall be conducted in accordance with ASME B31.3. Piping systems shall be tested under normal service conditions (as indicated in the Pipe Schedule in the contract drawings) to demonstrate compliance. The test pressure shall not be less than 1.5 times the design pressure. Water shall be used as the hydrostatic test fluid. The Contractor shall provide clean test water of such quality to prevent corrosion of the piping system materials. Air release vents shall be opened at all high points of the piping system in order to purge air pockets while the piping system is filling.

a. For rigid piping hydrostatic testing, the maximum test pressure shall be calculated according to ASME B31.3, but shall not exceed the yield strength of the piping system. The maximum velocity during filling shall be 0.25 fps applied over full area of pipe . Venting during filling may also be provided by loosening flanges with a minimum of four bolts or by the use of equipment vents. The Contractor shall test all parts of the piping system. The hydrostatic test pressure shall be maintained continuously for 30 minutes minimum and for such additional time as necessary to conduct examinations for leakage. All joints and connections shall be examined by the Contractor for leakage. The piping system, exclusive of possible localized instances at pump or valve packing, shall show no visual evidence of leaking. The Contractor shall correct visible leakage and retest. Unless otherwise directed by the Contracting Officer, the piping system shall be left full of water after leaks are repaired.

b. For non-rigid, non-metallic piping and metallic piping with a non-metallic liner hydrostatic testing, the maximum test pressure shall be calculated according to ASME B31.3, but shall not exceed 1.5 times the maximum pressure rating of the lowest rated component in the piping system. The maximum velocity during filling shall be 0.25 fps applied over full area of pipe in accordance with the manufacturer's instructions. The system shall be initially pressurized to 50 percent of the normal service conditions and inspected. Any leaks shall be repaired by the Contractor. The system shall then be pressurized to the test pressure. Small amounts of water shall be added as required on a hourly basis for a maximum of 3 hours in order to maintain the test pressure. After 4 hours, the test pressure shall be lowered by 10.2 psi . If the hydrostatic pressure remains steady for 1 hour, then no leakage is indicated. The Contractor shall inspect for leaks, repair and retest if necessary. The piping system shall be allowed to relax for 8 hours before retesting.

3.14.1.3 Time for Making Test

Except for joint material setting or where concrete thrust blocks necessitate a delay, underground piping jointed with rubber gaskets, mechanical or push-on joints, or couplings may be subjected to hydrostatic pressure, inspected, and tested for leakage at any time after partial completion of backfill. Tests for above ground pressure piping shall be conducted after the piping has been completely installed, including all supports, hangers, and anchors, and inspected for proper installation but prior to installation of insulation.

3.14.2 Pneumatic Tests

Pneumatic testing shall be prepared for and conducted in accordance with the requirements of ASME B31.3. Care must be taken to minimize the chance of a brittle fracture or failure during a pneumatic leak test. Only non-toxic, nonflammable, inert gases or air shall be used.

3.14.2.1 Pressure Relief Device

During pneumatic testing, a pressure relief device shall be provided for each piping section being tested. The device shall have a set pressure not higher than the test pressure plus the lesser of 10 percent of the test pressure or 50.8 psi .

3.14.2.2 Pneumatic Testing Procedures

The test fluid shall be air and the test pressure shall be 110 percent of the design pressure. The test pressure shall be incrementally increased until the gage pressure reaches the lesser of 50 percent of the test pressure or 25 psig. The Contractor shall examine piping joints for leakage. If no leakage is occurring, the Contractor shall continue to increase the pressure incrementally, while maintaining each incremental increase long enough to equalize pipe strains, until the test pressure is reached. The test pressure shall then be reduced to

the design pressure and maintained for 10 minutes without additional energy expenditure. If the pneumatic pressure remains steady, then no leakage is indicated. The Contractor shall inspect for and repair leaks, and retest if necessary.

3.14.2.3 Double Containment Secondary Piping

The primary piping of a double containment piping system shall be hydrostatically tested in accordance with Subparagraph Buried Piping. Secondary containment piping of a double containment piping system shall be pneumatically pressure tested at the maximum test pressure of 5 psi or manufacturer's recommended maximum. The test fluid shall be air. Testing procedures shall be in accordance with manufacturer's recommendations. The Contractor shall inspect for and repair leaks, and retest if necessary.

3.14.3 Pipe Leakage Tests

Unless approved by the Contracting Officer, leakage testing shall be conducted after the pressure tests have been satisfactorily completed. The duration of each leakage test shall be at least 2 hours, and during the test the piping shall be subjected to not less than 200 psig pressure. Leakage is defined as the quantity of the test liquid, water, that is supplied to the piping system, or any valved or approved section thereof, in order to maintain pressure within 5 psi of the specified leakage test pressure after the piping has been filled with the test liquid and all air is expelled. No piping installation will be accepted if leakage exceeds the allowable leakage determined by the following formula:

$$L = Cf \times N \times D \times P0.5$$

Cf = conversion factor = 0.0001351
L = allowable leakage, gallons per hour
N = number of joints in the length of piping tested
D = nominal pipe diameter, inches
P = average test pressure during the test, psig.

Should any test disclose leakage greater than that allowed, the leaks shall be located and repaired until the leakage is within the specified allowance, without additional cost.

3.14.4 Testing New to Existing Connections

New piping connected to existing pipe, existing equipment, existing treatment systems, or tanks and treatment systems furnished under other Sections shall be tested. The Contractor shall isolate the new piping with pipe caps, spectacle blinds, or blind flanges. The joint between new piping and existing piping shall be tested by methods that do not place the entire existing system under the test load. The Contractor shall then proceed with the testing of new piping systems as specified herein.

3.14.5 Valve Testing

Valves may either be tested while testing pipelines, or as a separate step. It shall be demonstrated that valves open and close smoothly with operating pressure on one side and atmospheric pressure on the other, and in both directions for two-way valve applications. The Contractor shall count and record the number of turns required to open and close each valve, and account for any discrepancies with manufacturer's data. Air and vacuum relief valves shall be examined as the associated pipe is being filled to verify venting and seating is fully functional. The Contractor shall set, verify, and record set pressures for all relief and regulating valves. Self-contained automatic valves shall be tested at both maximum and minimum operating ranges, and reset upon completion of test to the design value.

3.15 FINAL CLEANING

3.15.1 Interim Cleaning

The Contractor shall prevent the accumulation of weld rod, weld spatter, pipe cuttings and filings, gravel, cleaning rags, and other foreign material within piping sections during fabrication. The piping shall be examined to assure removal of these and other foreign objects prior to assembly and installation.

3.15.2 Flushing

Following assembly and testing, and prior to final acceptance, piping systems shall be flushed with water to remove accumulated construction debris and other foreign matter. The piping shall be flushed until all foreign matter is removed from the pipeline. The Contractor shall provide all hoses, temporary pipes, ditches, and other items as required to properly dispose of flushing water without damage to adjacent properties. The minimum flushing velocity shall be 2.5 fps. For large diameter pipe where it is impractical to flush the pipe at the minimum flushing velocity, the pipeline shall be cleaned in-place from the inside by brushing and sweeping, then flushing the pipeline at a lower velocity. Cone strainers shall be installed in the flushing connections of attached equipment and left in place until cleaning is completed. Accumulated debris shall be removed through drains, or by removing spools or valves.

3.15.3 Disinfection

3.16 WASTE WATER DISPOSAL

The water used for testing, cleaning, flushing and/or disinfection shall be disposed of in accordance with all applicable regulations. Disposal is solely the responsibility of the Contractor. The method proposed for disposal of waste water shall be provided to, and approved by, the Contracting Officer prior to performing any testing, cleaning, flushing and disinfection activities.

3.17 TABLES

TABLE I
PIPE AND FITTING MATERIALS FOR COMMON PIPING SYSTEMS

Item No.	Pipe Material	SERVICE A	B1
2.2	DI Pipe	x	x

LEGEND:

A - Underground
B1 - Aboveground: with ambient temperature exposure -13 degrees F to 113 degrees F and ultraviolet light exposure

-- End of Section --

16261N

VARIABLE FREQUENCY DRIVE SYSTEMS UNDER 600 VOLTS
09/99

PART 1 GENERAL

Specification below covers Variable Frequency Drive (VFD) and solid State Reduced Voltage controller (SSRV). In addition this section contains an option for the wireless controls (telemetry) between the pump controller and the remote on site maintenance building.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

47 CFR 15	Radio Frequency Devices

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE Std 519	(1992) Harmonic Control in Electrical Power Systems
IEEE C62.41	(1991) Surge Voltages in Low-Voltage AC Power Circuits

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD-461	(Rev. D) Control of Electromagnetic Interference Emissions and Susceptibility

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(1991) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ICS 1	(1993) Industrial Control and Systems
NEMA ICS 3.1	(1990) Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems
NEMA ICS 6	(1993) Industrial Control and Systems Enclosures
NEMA ICS 7	(1993) Industrial Control and Systems Adjustable-Speed Drives

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1999) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 489	(1996; R 1998) Molded-Case Circuit Breakers and Circuit-Breaker Enclosures

UL 508C (1996) Power Conversion Equipment

1.2 RELATED REQUIREMENTS

Section 16415A, "Electrical Work Interior".

1.3 SYSTEM DESCRIPTION

1.3.1 Performance Requirements

1.3.1.1 Electromagnetic Interference Suppression

Computing devices, as defined by 47 CFR 15, MIL-STD-461 rules and regulations, shall be certified to comply with the requirements for class A computing devices and labeled as set forth in part 15.

1.3.1.2 Electromechanical and Electrical Components

Electrical and electromechanical components of the Variable Frequency Drive (VFD) shall not cause electromagnetic interference to adjacent electrical or electromechanical equipment while in operation.

1.3.1.3 Harmonic Protection

The upstream distribution shall be protected from harmonics in compliance with IEEE std 519. As a minimum a line reactor is shown on plans.

1.3.2 Electrical Requirements

1.3.2.1 Power Line Surge Protection

IEEE C62.41, IEEE Std 519 Control panel shall have surge/harmonic protection, included within the panel or upstream to protect the unit from damaging transient voltage surges. Surge arrestor shall be mounted near the incoming power source and properly wired to all three phases and ground. Fuses shall not be used for surge protection.

1.3.2.2 Sensor and Control Wiring Surge Protection

I/O functions as specified shall be protected against surges induced on control and sensor wiring installed outdoors and as shown. The inputs and outputs shall be tested in both normal mode and common mode using the following two waveforms:

a. A 10 microsecond by 1000 microsecond waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.

b. An 8 microsecond by 20 microsecond waveform with a peak voltage of 1000 volts and a peak current of 500 amperes.

1.4 SUBMITTALS

Submit the following in accordance with Section 01330, "Submittal Procedures."

SD-02 Shop Drawings

Schematic diagrams; G, RE

Interconnecting diagrams; G, RE

Installation drawings; G, RE

Wireless system (Telemetry for remote pump controls); G, RE

(a). Schematic diagrams

(b). Interconnecting diagrams

(c). Installation drawings

(d). Site survey to verify location, line of sight & any obstructions

Submit drawings for government approval prior to equipment construction or integration. Modifications to original drawings made during installation shall be immediately recorded for inclusion into the as-built drawings.

SD-03 Product Data

VFD & SSRV controller; G, RE

Wires and cables

Equipment schedule

Include data indicating compatibility with motors being driven.

SD-06 Test Reports

VFD & SSRV controller Test

Performance Verification Tests

Endurance Test

SD-08 Manufacturer's Instructions

Installation instructions

SD-09 Manufacturer's Field Reports

VFD & SSRV controller Factory Test Plan; G

Factory test results

SD-10 Operation and Maintenance Data; G

VFD & SSRV controller, Data Package 4

Submit operation and maintenance manuals in accordance with Section 01780, "Closeout Submittals." Provide service and maintenance information including preventive maintenance,

assembly, and disassembly procedures. Include electrical drawings from electrical general sections. Submit additional information necessary to provide complete operation, repair, and maintenance information, detailed to the smallest replaceable unit. Include copies of as-built submittals. Provide routine preventative maintenance instructions, and equipment required. Provide instructions on how to modify program settings, and modify the control program. Provide instructions on drive adjustment, trouble-shooting, and configuration. Provide instructions on process tuning and system calibration.

1.5 QUALITY ASSURANCE

1.5.1 Schematic Diagrams

Show circuits and device elements for each replaceable module. Schematic diagrams of printed circuit boards and ribbon connectors to tie the boards with sufficient information provided for government maintenance personnel to verify proper operation of the boards.

1.5.2 Interconnecting Diagrams

Show interconnections between equipment assemblies, and external interfaces, including power and signal conductors. Include for enclosures and external devices.

1.5.3 Installation Drawings

Show floor plan of the site, with VFD, SSRV controller and motors indicated. Indicate ventilation requirements, adequate clearances, and cable routes.

1.5.4 Equipment Schedule

Provide schedule of equipment supplied. Schedule shall provide a cross reference between manufacturer data and identifiers indicated in shop drawings. Schedule shall include the total quantity of each item of equipment supplied. For complete assemblies, such as VFD & SSRV controller, provide the serial numbers of each assembly, and a sub-schedule of components within the assembly. Provide recommended spare parts listing for each assembly or component.

1.5.5 Installation instructions

Provide installation instructions issued by the manufacturer of the equipment, including notes and recommendations, prior to shipment to the site. Provide operation instructions prior to acceptance testing.

1.5.6 Factory Test Results

Document test results and submit to government within 7 working days after completion of test.

1.6 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

1.7 WARRANTY

The complete system shall be warranted by the manufacturer for a period of 24 months from the date of certified start up (acceptance), or the contracted period of any extended warrantee agreed upon by the contractor and the Government, after successful completion of the acceptance test. Any component failing to perform its function as specified and documented shall be repaired or replaced by the contractor at no additional cost to the Government. Items repaired or replaced shall be warranted for an additional period of at least one year from the date that it becomes functional again, as specified in the FAR CLAUSE 52.246-21.

1.8 MAINTENANCE

1.8.1 Spare Parts

Manufacturers provide spare parts in accordance with recommended spare parts list.

1.8.2 Maintenance Support

During the warranty period, the Contractor shall provide on-site, on-call maintenance services by Contractor's personnel on the following basis: The service shall be on a per-call basis with 36 hour response. Contractor shall support the maintenanc e of all hardware and software of the system. Various personnel of different expertise shall be sent on-site depending on the nature of the maintenance service required. Costs shall include travel, local transportation, living expenses, and labor rates of the service personnel while responding to the service request. The provisions of this Section are not in lieu of, nor relieve the Contractor of, warranty responsibilities covered in this specification. Should the result of the service request be the uncovering of a system defect covered under the warranty provisions, all costs for the call, including the labor necessary to identify the defect, shall be borne by the Contractor.

PART 2 PRODUCTS

2.1 VARIABLE FREQUENCY DRIVES (VFD)

Provide frequency drive to control the speed of induction motor. The VFD shall include the following minimum functions, features and ratings.

a. Input circuit breaker per UL 489 with a minimum of 25,000 amps symmetrical interrupting capacity and door interlocked external operator.

b. A converter stage per UL 508C shall change fixed voltage, fixed frequency, ac line power to a fixed dc voltage. The converter shall utilize a full wave bridge design incorporating diode rectifiers, 6 pulse. Silicon Controlled Rectifiers (SCR) are not acceptable. The converter shall be insensitive to three phase rotation of the ac line and shall not cause displacement power factor of less than .95 lagging under any speed and load condition.

c. An inverter stage shall change fixed dc voltage to variable frequency, variable voltage, ac for application to a standard NEMA design B squirrel cage motor. The inverter shall be switched in a manner to produce a sine coded pulse width modulated (PWM) output waveform. The VFD shall utilize soft- switching IGBT's (insulated

gate Biopolar transistors). VFD utilizing SCR's and output filtering will not be accepted. The drive shall be capable of operating submersible pump type motor with a drive to motor distance of up to 300' without the use of load side filters.

d. The VFD shall be capable of supplying 110 percent of rated full load current for one minute at maximum ambient temperature.

e. The VFD shall be designed to operate continously without fault with input voltage of 480 volt, - 15 % / + 10%, three phase, 60 Hz supply.

f. Acceleration and deceleration time shall be independently adjustable from one second to 360 seconds.

g. Adjustable full-time current limiting shall limit the current to a preset value which shall not exceed 120 percent of the controller rated current. The current limiting action shall maintain the V/Hz ratio constant so that variable torque can be maintained. Short time starting override shall allow starting current to reach 175 percent of controller rated current to maximum starting torque.

h. The controllers shall be capable of producing an output frequency over the range of 3 Hz to 60 Hz (20 to one speed range), without low speed cogging. Over frequency protection shall be included such that a failure in the controller electronic circuitry shall not cause frequency to exceed 110 percent of the maximum controller output frequency selected.

i. Minimum and maximum output frequency shall be adjustable over the following ranges: 1) Minimum frequency 3 Hz to 50 percent of maximum selected frequency; 2) Maximum frequency 40 Hz to 60 Hz.

j. The controller efficiency at any speed shall not be less than 96 percent.

k. The controllers shall be capable of being restarted into a motor coasting/spinning in the forward direction or backward direction without tripping.

l. Protection of power semiconductor components shall be accomplished without the use of fast acting semiconductor output fuses. Subjecting the controllers to any of the following conditions shall not result in component failure or the need for fuse replacment:

    1. Short circuit at controller output

    2. Ground fault at controller output

    3. Open circuit at controller output

    4. Input undervoltage

    5. Input overvoltage

    6. Loss of input phase

    7. AC line switching transients

8. Instantaneous overload

9. Sustained overload exceeding 115 percent of controller rated current

10. Over temperature

11. Phase reversal

m. Solid state motor overload protection shall be included such that current exceeding an adjustable threshold shall activate a 60 second timing circuit. Should current remain above the threshold continuously for the timing period, the controller will automatically shut down.

n. A slip compensation circuit shall be included which will sense changing motor load conditions and adjust output frequency to provide speed regulation of NEMA B motors to within + / - 0.5 percent of maximum speed without the necessity of a tachometer generator.

o. The VFD shall be factory set for manual restart after the first protective circuit trip for malfunction (overcurrent,undervoltage, overvoltage or overtemperature) or an interruption of power. The VFD shall be capable of being set for automatic restart after a selected time delay. If the drive faults again within a specified time period (adjustable 0-60 seconds), a manual restart will be required.

p. The VFD shall include external fault reset capability. All the necessary logic to accept an external fault reset contact shall be included.

q. Provide critical speed lockout circuitry to prevent operating at frequencies with critical harmonics that cause resonant vibrations. The VFD shall have a minimum of three user selectable bandwidths. The AFD's shall be able to operate with an IGBT switching frequency up to 15kHz for drives below 30 hp @ 460v, up to 10kHz for drives greater than 30 hp up to 100 hp @ 460v, and upt to 6kHz for all drives over 100 hp @ 460v. Drive shall be capable of producing full rated KW ouptut at rated voltage and current across the entire switching frequency range. All drives must be sized based on their output rating at maximum carrier frequency.

r. Provide the following operator control and monitoring devices mounted on the front panel of the VFD or through keypad functions:

1. Manual speed potentiometer.

2. Hand-Off-Auto (HOA) switch.

3. Power on light.

4. Drive run power light.

5. Local display.

6. RS -485 serial port (located inside the cabinet)

s. Provide properly sized UL amperage rated by-pass contactors and lockable isolation switch as shown on plans to enable operation of motor in the event of VFD failure. Mechanical interlocks shall be installed between the by-pass contactors and isolation switch. Provide a selector switch and transfer delay timer. Provide motor protection in by-pass mode circiutry. Circuit breaker serving both the drive & bypass section shall have full branch circuit protection without the requirement of additional fuses or circuit breakers.
t. Drive shall be rated for 50 degree C ambient condition at nameplate ampere draw.

2.2 ENCLOSURES

Provide equipment enclosures free standing or mounted to wall conforming to NEMA 250, NEMA ICS 7, NEMA ICS 6. access door shall be hinged to allow easy access to all internal components.

2.3 WIRES AND CABLES

All wires and cables shall conform to NEMA 250, NEMA ICS 7, NFPA 70.

2.4 NAMEPLATES (VFD & SSRV controller)

Nameplates external to NEMA enclosures shall conform with the requirements of Section 16415A, "Basic Electrical Work, Interior." Nameplates internal to enclosures shall be manufacturer's standard, with the exception that they must be permanent.

2.5 SOURCE QUALITY CONTROL

2.5.1 VFD & SSRV controller Factory Test Plan

To ensure quality, VFD & SSRV shall be subject to a series of in-plant quality control inspections before approval for shipment from the manufacturer's facilities. Provide test plans and test reports.

2.6 SSRV Controller

2.6.1 General Description

Provide SSRV controller to limit the inrush current of induction motor. The SSRV controller shall include the following minimum functions, features and ratings
A. The soft starter shall be provided by the manufacturer in a configuration suitable for panel mounting. The component must be suitable for mounting in a pollution degree 3 environment. All power devices and components must not be accessible during routine maintenance or set-up.
B. The soft start shall utilize thyristor (SCR) bridge consisting of at least two SCRs per phase to control the starting and stopping of industry standard motors.
C. The soft start shall provide torque control for linear acceleration without external feedback independent of motor load or type of application. The gating of the thyristors will be controlled in such a manner to ensure smooth and stable acceleration ramp.
D. The soft start shall be controlled by a microprocessor that continuously monitors the current and controls the phasing of the SCRs.

Analog control algorithms shall not be allowed.
E. All soft start power ratings will utilize the same control module.
F. Integral protective capabilities and selectable deceleration control shall be available even if a shorting contactor is used with soft starts rated 47 amps or above. Power terminals shall be provided to simplify integration shorting contactor integration without additional components.

2.6.2 Motor Data
The soft start shall be designed to operate a NEMA design B motor with a nameplate rating of 315_horsepower, rated for 395 amp continuous at 480_ volts +/- 10%.

2.6.3 Ratings
A. The soft start shall be designed to operate in an ambient temperature) degrees C to 40 degrees C. For ambient temperatures between 40 degrees C and 60 degrees C, derate the current by 1.2% per degrees C above 40 degrees C.
B. Storage temperature range shall be -25 degrees C to 70 degrees C.
C. Maximum relative humidity shall be 93% at 40 degrees C, non-condensing.
D. The soft start shall be designed to operate in altitudes up to 3300ft. For higher altitudes, derate by 0.5% for each additional 330ft.
E. The soft start shall be capable of operation within +/-10% of nominal voltage rating.
F. The soft start shall automatically adapt for operation at 50 or 60 Hz. Frequency tolerance shall be +/-5% when starting and +5% or -15% during steady state operation.
G. The soft start shall be capable of supplying 300% of rated full load current for 30 seconds at maximum ambient temperature.
H. The SCRs shall have minimum P.I.V. rating of 1400 Vac. Lower rated SCRs with protection by MOVs are not acceptable.

2.6.4 Adjustments and Configurations
A. All dialogue functions, display units, remote functions, terminal blocks, configuration switches and adjustment potentiometers shall be accessible on the front of the control module. Exposure to control circuit boards or electrical power devices during routine adjustments shall be prohibited.
B. Digital indication shall provide, as a minimum, the following conditions:
1. Soft start status - ready, starting/stopping, run
2. Motor status - current, torque, thermal state, power factor
3. Fault status - Motor thermal overload, starter thermal fault, phase fault, frequency fault, supply fault, locked rotor fault, motor underload, max start time exceeded, external fault, serial link fault, phase inversion, internal failure, overcurrent
C. The starter shall be preset to the following for operation without adjustment in most applications.
1. Torque acceleration ramp of 10 seconds
2. Current limitation to 300% of the motor full load current rating
3. Class 10 overload protection
4. Motor current preset per NEC and UL tables for standard HP motors
D. A digital keypad shall be utilized configure the following operating parameters as required:
1. Motor full load amps adjustable from 50 to 130% of the controller's rating
2. Current limitation on starting adjustable from 1.5 to 7.0 times rated motor current, not to exceed 5.0 times the controller rating
3. Torque ramp adjustable from 1 to 60 seconds
4. Initial torque adjustable from 10 to 100% of nominal motor torque

5. Torque limit adjustable from 10 to 200% of nominal motor torque
6. Maximum start time adjustable from 10 to 999 seconds
7. Voltage boost adjustable from 50 to 100% of the nominal supply voltage
8. Selection of freewheel, soft stop or braking
9. Adjustable soft stop torque ramp time from 1 to 60 seconds
10. Threshold to change to freewheel following a soft stop from 0 to 100% of the nominal motor torque
11. Braking torque level adjustable from 0 to 100% effectiveness
12. Selection of Class 2, 10, 10A, 15, 20, 25 or 30 motor thermal overload protection

E. A Digital keypad shall be utilized configure the following controller parameters as required:
1. Selectable automatic reset operation
2. Cancellation of the torque control loop for multi motor installations
3. Adjustment of the stator loss estimation for specialty motors
4. Assignment of controller inputs and outputs
5. Activation of phase reversal protection
6. Reset of motor thermal state
7. Return to factory settings
8. Activation of test mode for use with low power motors
9. Indication of elapsed time in hours of starting, running and stopping

F. Output relays shall provide the following status indications:
1. One form A (N.O.) and one form B (N.C.) minimum for indication of fault or control of an isolation contactor
2. One form A (N.O.) for indication that torque ramp is complete and current is below 130% motor FLA (End of start)

G. Additional inputs and outputs shall be available to provide the following status indications:
1. One logic input for force to freewheel, indication of external fault, force to local control, control of cascading motors, or external motor overload reset
2. One logic output for indication of motor thermal overload re-alarm or presence of motor current and one logic output to indicate overcurrent alarm
3. One analog output shall be available for 4 - 20 or 0 - 20 milliamp indication of motor current, torque, thermal state or power factor

H. Relay and I/O functions listed above must be isolated with respect to common

2.6.5 Protection

A. A microprocessor controlled thermal protection system shall be included which continuously calculates the temperature-rise of the motor and soft start and provides:
1. An overload pre-alarm which indicates by relay contact that the motor has exceeded its rated temperature rise by 110%. This function shall be annunciation only.
2. A thermal fault condition which stops the motor if the temperature-rise exceeds 120% of the motor thermal capability.
3. An analog electronic circuit with a time constant adjustable to the motor's thermal cooling time constant ensuring the memorization of the thermal state even after power supply disconnection or shorting out of the power semiconductors.

B. The soft start shall provide phase loss, phase reversal, underload, stall, and jam protection

C. The integral protective features shall be active even if an external shorting contactor is used to bypass the SCRs during steady state operation.

2.6.6 Controls

A. The soft start's control circuit shall be completely independent its power circuit and adaptable to 240, 380 or 460 Vac 50 or 60 Hz.

B. The soft start shall accept control logic either by operator devices (push buttons, selector switches, etc.) wired directly to the unit or from external relay logic. SSRV shall also be capable of remote control as described in this section.

2.7 Wireless controls (Telemetry) for remote pump control and monitoring (OPTION 1)

Wireless system includes the following:
2.7.1 General.

A Remote Start/Stop panel (HMI) that reports status of one pump's variable frequency drive and the other pump's soft start. The distance between the Start/Stop panel and the drive panel is approximately 3 miles.

A radio system and a 5.7" STN color touchscreen shall be provided. The radio equipment shall include the radios, antennas, cables. A site survey to verify line of sight and obstructions shall be provided and is required prior to bid. The antenna height shall be a minimum of 20ft. Antenna shall be connected to the radio enclosure with a cable.

The operator interface touchscreen shall be capable of communicating with the Modbus protocol to the drives and the soft start.

2.7.2 Equipment description.

a. Graphic Touchscreen HMI Series 5.7" Graphic Touchscreen, 256-color STN LCD, Compact Flash, Ethernet, SW and cables Maple model No HMI520C, quantity 1

b. Radios MDS model No EL805 Transent 900

c. Bulkhead Lightning Arrestor

MDS model No
IS-B50LN-C2
125/1000 MHZ N Female to Bulkhead N-Fem quantity 2.

d. Radio to Polyphaser Cable

MDS model No
F1-PNMTM-3
Standard Cable N Male to TNC Male 3 feet, quantity 2.

e. Antenna at Master Station

MDS model No
MYG9303
6 dB Yagi 900 Mhz Gold Anodized Mounting Kit Included, quantity 1.

f. Antenna at Remote Station

MDS model No
MP8906PTNF
5.4dB 890-960MHZ Panel 90 Deg Horizontal Beamwidth, quantity 1.

g. Antenna to lightning arrestor cable

MDS model No
CON-LMR400-50
50' LMR 400 connecterized w/ N Male both ends, quantity 2.

h. Grounding kit for antenna cable

MDS No
97-1677A06
Ground Kit, Factory Lug for LDF4-50A, 36" ground wire, 204989-31, quantity 2.

i. Power Supplies

MDS No
ML30.100
PULS P/S, Input Voltage (1P) 100-240V, Output Voltage 24-28V, Output Amps 1.3A, quantity 2.

The above Manufacturer/Model Numbers are listed to estabish the minimun acceptable quality. Other equal manufacturers' equipment may be accepted upon review and approval by the Contracting Officer.

PART 3 EXECUTION

3.1 INSTALLATION

Per NEMA ICS 3.1, install equipment in accordance with the approved manufacturer's printed installation drawings, instructions, wiring diagrams, and as indicated on project drawings and the approved shop drawings. A field representative of the drive manufacturer shall supervise the installation of all equipment, and wiring. Provide a minimum clearance of 4" on each side of the enclosure. Install wireless system as recommended by the manufacturer and described in this section. Length of antenna cable shall be determined by the Contractor prior to bid. Coordinate the location of devices with the user at maintenance building and 120V power requirement at the maintenance building.

3.2 FIELD QUALITY CONTROL

Specified products shall be tested as a system for conformance to specification requirements prior to scheduling the acceptance tests. Contractor shall conduct performance verification tests in the presence of Government representative, observing and documenting complete compliance of the system to the specifications. Contractor shall submit a signed copy of the test results, certifying proper system operation before scheduling tests.

3.2.1 VFD & SSRV controller Tests

A proposed test plan shall be submitted to the contracting officer at least 28 calendar days prior to proposed testing for approval. The tests shall conform to NEMA ICS 1, NEMA ICS 7, and all manufacturer's safety regulations. The Government reserves the right to witness all tests and review any documentation. The contractor shall inform the Government at least 14 working days prior to the dates of testing. Contractor shall provide video tapes, if available, of all training provided to the Government for subsequent use in training new personnel. All training aids, texts, and expendable support material for a self-sufficient

presentation shall be provided, the amount of which to be determined by the contracting officer.

3.2.2 Performance Verification Tests

"Performance Verification Test" plan shall provide the step by step procedure required to establish formal verification of the performance of the VFD. Compliance with the specification requirements shall be verified by inspections, review of critical data, demonstrations, and tests. The Government reserves the right to witness all tests, review data, and request other such additional inspections and repeat tests as necessary to ensure that the system and provided services conform to the stated requirements. Tests shall be performed by the equipment manufacturer. The contractor shall inform the Government 14 calendar days prior to the date the test is to be conducted.

3.2.3 Endurance Test

Immediately upon completion of the performance verification test, the endurance test shall commence. The system shall be operated at varying rates for not less than 192 consecutive hours, at an average effectiveness level of .9998, to demonstrate proper functioning of the complete PCS. Continue the test on a day-to-day basis until performance standard is met. During the endurance test, the contractor shall not be allowed in the building. The system shall respond as designed.

3.3 DEMONSTRATION

3.3.1 Training

Coordinate training requirements with the Contracting Officer.

3.3.1.1 Instructions to Government Personnel

Provide the services of competent instructors who will give full instruction to designated personnel in operation, maintenance, calibration, configuration, and programming of the complete control system. Orient the training specifically to the system installed. Instructors shall be thoroughly familiar with the subject matter they are to teach. The Government personnel designated to attend the training will have a high school education or equivalent. The number of training days of instruction furnished shall be as specified. A training day is defined as eight hours of instruction, including two 15-minute breaks and excluding lunch time; Monday through Friday. Provide a training manual for each student at each training phase which describes in detail the material included in each training program. Provide one additional copy for archiving. Provide equipment and materials required for classroom training. Provide a list of additional related courses, and offers, noting any courses recommended. List each training course individually by name, including duration, approximate cost per person, and location of course. Unused copies of training manuals shall be turned over to the Government at the end of last training session.

3.3.1.2 Operating Personnel Training Program

Provide one 8 hour training session at the site at a time and place mutually agreeable between the Contractor and the Government. Provide session to train 4 operation personnel in the functional operations of the system and the procedures that personnel will follow in system operation.

This training shall include:

a. System overview

b. General theory of operation

c. System operation

d. Alarm formats

e. Failure recovery procedures

f. Troubleshooting

3.3.1.3 Engineering/Maintenance Personnel Training

Accomplish the training program as specified. Training shall be conducted on site at a location designated by the Government. Provide a one day training session to train 4 engineering personnel in the functional operations of the system. This training shall include:

a. System overview

b. General theory of operation

c. System operation

d. System configuration

e. Alarm formats

f. Failure recovery procedures

g. Troubleshooting and repair

h. Maintenance and calibration

i. System programming and configuration

-- End of Section --

COLUMBIA BOTTOM PUMP STATION
SOLICITATION NO. W912DQ-04-0010
PRE-BID MEETING AT THE COLUMBIA BOTTOM SITE

10:00 am, 1-JUL-2004

LIST OF QUESTIONS FROM PROSPECTIVE BIDDERS

Question 1: Can construction debris be burned on the site?

Answer: See specification section 02231-2, par. 3.6.2.

Question 2: Where can the successful bidder park a construction trailer?

Answer given at the site: A construction Trailer can be parked within the fenced parking area at the Department of Conservation (MDC) Maintenance Shop. Electrical and telephone service are accessible at this site.

Question 3.: What are the goals for subcontracting?

Answer: The goals are laid out in the solicitation package.

Question 4: Tom Leifield pointed out which portions of the area are protected by the agricultural levee and that the levee provides less than 10 year flood protection and that most of the construction will take place outside of the area protected by the levee.

Question 5: What is the preferred route for construction access:

Answer: Access for construction equipment will not be allowed on the asphalt public roads on the Columbia Bottom area. MDC's preferred access route would be through the pole gate leading to the Maintenance shop and along access roads created as part of phase II or along existing field roads.

Question 6: Is there electrical power available at the pump station site?

Answer: No. The closest existing electrical power is at the MDC maintenance shop. The contractor will need to supply any electrical power he will need for the construction effort.

Question 7: We noted that Ameren would be upgrading the power supply along Columbia Bottom Road to accommodate the level of service need for the pumpsThe

upgrade would most likely take place concurrently with construction of the pump station.

Question 8: Several prospective bidders asked that we supply the river stage for the date of the pre-bid meeting (July 1, 2004).

Answer: St. Louis District provided the following information for Mississippi River stage and elevation at two gages close to the site of the Pump Station for Thursday, July 1, 2004.

> Mel Price Lock and Dam 26 Tailwater – 17.4 ft. The gage elevation is 395.48 ft. at a gage reading of zero ft.
>
> Lock and Dam 27 (Chain of Rocks) Headwater – elevation 410.3 ft.

Question 9: One of the prospective bidders pointed out that the exact dimension (length of intake pipe) from the main pump structure to the intake screens was not given anywhere on the plans.

Answer: Drawing MS101 is a scaled drawing and the dimension can be interpreted from that drawing.

Question 10: One potential bidder asked whether all large stone (stone protection) is included in the two estimated quantity bid items.

Answer: Yes that is the intent of the specification.

Question 11: Is the site accessible for further site visits between now and the bid opening?

Answer: Yes. Anyone can access the site via the public roadways, then walking the rest of the way to the desired area. If a prospective bidder wants to drive to the site on one of the maintenance roads that are not generally open to the public they can do so but must first coordinate with Tom Leifield or Andy Tappmeyer of the Missouri Department of Conservation. Failure to coordinate may result in the bidder being ticketed or arrested for unauthorized use of the maintenance roads.
Mr. Leifield and Mr. Tappmeyer can be reached at 314-877-6019.

Question 12: Will any clearing be required for the borrow area?

Answer: The borrow areas is located in an area used for borrow during Phase II construction within the last several years and should be relatively clear. One to two-year-old cottonwood trees may have begun to grow in the borrow site.

Question 13: Do we have a recommended method for the placement of protective rock under water?

Answer: Bid as specified.

Question 14: Will the site be open to hunting?

Answer: The site will be open to certain managed hunts that can draw a considerable number of hunters for some weeks during the year. Parts of the site can be closed to the public during construction, but most of the site will remain open. The successful bidder will need to coordinate closely with the MDC, Columbia Bottom staff (Tom Leifield or Andy Tappmeyer) about hunting times and access restrictions.

Questions submitted at times other than the Pre-bid Meeting

Question: Sheeting and shoring are addressed in Specification Section 02315N. A design by a Professional Engineer is required, however, no mention is made of material requirements. Will used sheeting and shoring materials (temporary and permanent) be allowed?

Answer: Used sheeting and shoring will be allowed.

Question: On Spec 01520 Structural Steel, the spec is referencing AISC FCD. What is FCD?

Answer: The spec is referencing that the fabricator should meet the minimum standards of SBR (Simple Steel Bridge Structures) and also meet MB (Metal Buildings). Actually the AISC document is called AISC FCD in the upper right hand corner of the document.

Question: What type of overhead wire is required from pole #1B to pole #1?

Answer: Overhead conductors type from pole 1B to pole #1 are #1/0 ACSR (see note 2 sheet ES101).

Question: Specification Section 02456A - Steel H-Piles refers to load tests in

Paragraph 1.2.3 and 3.1.1. How many load tests are required?

Answer: Load testing of only one pile is required.