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SECTION 11381

**HYDRAULIC DIAPHRAGM CHEMICAL METERING PUMPS**

**PART 1 GENERAL**

1.01 DESCRIPTION

- A. SCOPE: This section specifies pumps and accessories for feeding \_\_\_\_\_ solution.
- B. TYPE: The chemical feed pumps shall be positive displacement hydraulic diaphragm chemical metering pumps with manual stroke length positioners and adjustable speed drives. **Mechanical diaphragm pumps will not be acceptable.**
- C. EQUIPMENT LIST:

<u>Item</u>	<u>Equipment No.</u>
CHEMICAL DOSING PUMP 1	P 306,151
CHEMICAL DOSING PUMP 1 ASD	ASD 306,151
CHEMICAL DOSING PUMP 1 PRESS RELIEF VALVE	PRV 306,151A
CHEMICAL DOSING PUMP 1 PULSATION DAMPENER	PVL 306,151
CHEMICAL DOSING PUMP 1 PRESS REG VALVE	PRV 306,151B
CHEMICAL DOSING PUMP 1 CALIBRATION COLUMN	ME 306,151
CHEMICAL DOSING PUMP 2	P 306,152
CHEMICAL DOSING PUMP 2 ASD	ASD 306,152
CHEMICAL DOSING PUMP 2 PRESS RELIEF VALVE	PRV 306,152A
CHEMICAL DOSING PUMP 2 PULSATION DAMPENER	PVL 306,152
CHEMICAL DOSING PUMP 2 PRESS REG VALVE	PRV 306,152B
CHEMICAL DOSING PUMP 2 CALIBRATION COLUMN	ME 306,152

D. PERFORMANCE AND DESIGN REQUIREMENTS:

1. GENERAL:

- a. The metering pumps and equipment shall be designed and selected for pumping the following chemical solutions:

Equipment number	P 306,151; P 306,152
Chemical	
Solution strength, weight %	
Solution density, lbs per gal	

- b. Pump operation shall be automatic. The adjustable speed drive shall be controlled by a 4-20 mA signal.

2. DESIGN REQUIREMENTS: The hydraulic diaphragm chemical metering pumps shall be designed for continuous duty under the following operating conditions:

Equipment number	P 306,151; P 306,152
Net positive suction head available, psia	9
Maximum chemical feed rate, gallons per hour	55
Operating pressure, psi	40
Maximum discharge pressure, psi	150
Maximum pump speed, strokes per minute	

Maximum motor size, hp  
Base motor speed, rpm 1,725

## 1.02 QUALITY ASSURANCE

- A. REFERENCES: This section contains references to the following documents. They are a part of this section, as specified and modified. In case of a conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

<u>Reference</u>	<u>Title</u>
AISI-96	Pocketbook of Standard Steels
ASTM A743/A743M-88	Castings, Iron-Chromium, Iron-Chromium-Nickel, and Nickel-Base Corrosion-Resistant for General Application
NEMA MGI-1978	Motors and Generators
NEMA ICS-1983	Industrial Control Devices Controller and Assemblies

- B. UNIT RESPONSIBILITY: The Contractor shall assign unit responsibility, as specified in paragraph 11000-1.02 C, to the pump manufacturer for all equipment specified in this section, and the adjustable speed drives specified in Section 16156. A certificate of unit responsibility shall be provided.
- C. RELATED WORK SPECIFIED ELSEWHERE: Section 16156, Direct Current Adjustable Speed Drives

## 1.03 ENVIRONMENTAL CONDITIONS:

- A. The equipment shall be located indoors in a heated and ventilated area.

## 1.04 SUBMITTALS

- A. The following submittals shall be provided as specified in Section 01300:
1. Shop drawings with complete dimensions and mounting details for the pumps.
  2. Catalog data and information including:
    - a. Type of liquid handled.
    - b. Capacity, gph; maximum and minimum gph using a manual stroke length positioner and adjustable speed drive.
    - c. Minimum and maximum stroke length.
    - d. Maximum strokes per minute.
    - e. Motor and adjustable speed drive type.
  3. Materials of construction.
  4. Net positive suction head required.
  5. Motor data form 11060-A in accordance with Section 11060.
  6. Manufacturer's data on the silicon controlled rectifier-direct current adjustable speed drives, including wiring diagram, as specified in Section 16156.
  7. Manufacturer's catalog data on all accessories including pressure relief valves, pressure regulating valves, pulsation dampeners, flow calibration chambers, and suction assemblies. Data shall demonstrate sizing procedure for pulsation dampeners.
  8. A copy of the contract document control diagrams and process and instrumentation diagrams that apply to the equipment in this section, marked to show specific changes necessary for the supplied equipment. If no changes are required, the drawings shall be marked "no changes required."
  9. A copy of this specification section and all referenced sections with each paragraph marked to show specification compliance or deviations.

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10. A copy of all related contract schematic, structural, and mechanical drawings with all piping, foundations, supports, and layout sizes and dimensions requiring Contractor confirmation marked.
11. Certification of Unit Responsibility Assignment in accordance with paragraph 11381-1.02 B.

### PART 2 PRODUCTS

#### 2.01 ACCEPTABLE MANUFACTURER

- A. Milton Roy
- B. PalsaFeeder
- C. Approved equal.

#### 2.02 MATERIALS

- A. The feed pumps shall be manufactured of the following materials:

<u>Component</u>	<u>Material</u>
Diaphragm head	PVC
Diaphragm	PTFE
Ball seats	PVC
Ball checks	Ceramic or PVC
Other wetted parts	PVC or Viton

#### 2.03 EQUIPMENT

- A. PUMP AND DRIVE MECHANISM:
  1. The pumps shall be chemical metering pumps with hydraulically actuated diaphragm liquids ends. **There shall be no mechanical connection between the plunger and the diaphragm. Only the hydraulic fluid shall move the diaphragm. Pump shall be capable of operating at NPSHA without the use of any mechanical device touching the diaphragm** and without the use of a pulsation dampener upstream of the pump. Repetitive accuracy of the pumps shall be plus or minus one percent.
  2. **The motor shall drive a worm gear and eccentric cam which translates the motor's rotary motion into reciprocating linear motion by a plunger. The plunger shall force hydraulic fluid against a diaphragm which separates the hydraulic fluid from the process fluid being pumped. The plunger's motion shall be transferred by the hydraulic fluid to the diaphragm, which in turn displaces the process fluid. The manual stroke length positioner (micrometer) shall adjust pump capacity via mechanical or hydraulic lost motion. Mechanical lost motion micrometer shall position a screw which limits plunger movement. Hydraulic lost motion micrometer shall adjust the location of a hydraulic bypass port which determines the volume of hydraulic fluid forced against the diaphragm.**
  3. The drive mechanism shall be totally enclosed with all moving parts running in the hydraulic fluid. The pumps shall include a lubrication system to provide hydraulic fluid to all dynamic load carrying surfaces. **The pumps shall be provided with an internal pressure relief valve for protection of the pump in the event of a system failure. Pumps shall be provided with an automatic bleed valve to remove any air or hydraulic fluid vapors.**
- B. LIQUID END:

1. Pumps shall be provided with disc diaphragm liquid ends. The liquid ends shall be vertical in-line design, and provided with integral ball check valves in both suction and discharge ports to prevent backflow and loss of prime. Ball check valves shall be removable for maintenance.
  2. **The diaphragm shall be preshaped, and shall be positioned between two dish-shaped supporting plates with flow-through holes. Diaphragm shall be hydraulically balanced during all operating conditions.**
- C. PIPING CONNECTION: The manufacturer shall coordinate the inlet and discharge piping sizes with the drawings.

#### 2.04 DRIVE UNITS AND CONTROLS

- A. ADJUSTABLE SPEED DRIVE: Pumps shall be provided with adjustable speed drive consisting of silicon controlled rectifier (SCR) control unit and direct current drive motor. The speed setting of the SCR drive shall be continuously adjustable over a 20:1 operating range. The adjustable speed drives shall be in accordance with Section 16156.
- B. MOTORS: Motors for all pumps specified in this section shall be adjustable speed, wound field with a TEFC enclosure, Class F insulation, and rated at 40 degrees C ambient. Horsepower shall be as scheduled in paragraph 11381-1.01 D.2.
- C. MANUAL STROKE LENGTH POSITIONERS: Manual stroke length positioners shall be local control, springloaded, with a locking mechanism. Manual stroke length positioner shall provide a 10:1 turndown ratio of pump capacity, independent of adjustable speed drive.

#### 2.05 ACCESSORIES

- A. PRESSURE RELIEF AND BACK PRESSURE VALVES: Pressure relief and back pressure valves shall be provided with all pumps. Pressure relief and back pressure valves shall be PVC body, with teflon diaphragms. Valves shall be suitable for the chemical solution service as specified. Pressure relief valves shall be field adjustable between 50 and 150 psig. Back pressure valves shall be field adjustable between 15 and 75 psig. The back pressure valves shall be factory set at 40 psig and the external pressure relief valves set at 60 psig.
- B. FLOW CALIBRATION COLUMNS:
1. Pumps shall be provided with flow calibration columns on the pump suction lines. Calibration columns shall be manufactured of PVC, and shall be labeled in standard divisions and milliliters.
  2. Calibration columns shall have a volume of 1/2 liter and shall have 1/2-inch female NPT connections at the top and bottom.
- C. PULSATION DAMPENERS: Pumps shall be provided with pulsation dampeners. Pulsation dampeners shall provide sufficient dampening to maintain a pressure variation of less than 5 percent from normal pump discharge pressure. Pulsation dampeners shall be steel or cast iron gas shell with PVC wetted components and an FPM/fluoroelastomer or Hypalon diaphragm. A charging hose shall be provided, consisting of a 10-foot length of tubing with an NPT fitting at one end for connection to a nitrogen bottle regulator, and a cross fitting with charging adapter and purge valve at the other end. Glycerine-filled pressure gages shall be provided on pulsation dampeners.

#### 2.06 STANDBY COMPONENTS

- A. The following standby components shall be provided with each pump:
- 1 gasket set
  - 2 ball check valves

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1 diaphragm

- B. Standby components shall be tagged and stored as specified in paragraph 11000-2.12.

## 2.07 PRODUCT DATA

- A. The following product data shall be provided in accordance with paragraph 00710-4.02:
  - 1. Operation and maintenance data, as specified in Section 01730, on the pumps, adjustable speed drives and accessories.
  - 2. Field test reports per paragraph 11381-3.03.
  - 3. Five copies of the manufacturer's certification (Form 11000-A per Section 01999) that the equipment has been properly installed, aligned and tested and meets all requirements for satisfactory performance under the conditions specified.
  - 4. Five copies of the manufacturer's instruction certification (Form 11000-B per Section 01999) that instructions to operators have been completed.
  - 5. Motor data as specified in Section 16156.
  - 6. Pump Test Data Form 11000-D as specified in paragraph 11381-3.03 A.

## PART 3 EXECUTION

### 3.01 GENERAL

- A. Pumps shall be aligned, connected, and installed in strict accordance with the manufacturer's instructions.

### 3.02 INSTALLATION

- A. The equipment shall be installed and tested under the direction of factory trained personnel as specified in paragraph 11000-3.01. The installation shall be certified on Form 11000-A specified in Section 01999. The pulsation dampeners shall be charged with nitrogen gas to the manufacturer's recommended pressure.

### 3.03 TESTING

- A. After installation, the equipment specified in this section shall be completely tested to ensure compliance with operating requirements, varying pumps speeds and stroke lengths with flows recorded in a test log. A complete test log shall be delivered to the Engineer, as specified in paragraph 11381-2.07. Field testing shall be in accordance with the testing procedures in Section 01660. The pump testing shall be certified on Form 11000-D as specified in Section 01999. Testing shall verify the control strategy specified in Section 17905.
- B. Following successful testing and commissioning of associated control loops, and prior to pumping chemical solution, the pump and chemical piping shall be emptied. See Section 15050 for additional requirements.

### 3.04 TRAINING

- A. A minimum of 16 hours of training, as specified in Section 01660, shall be provided. Training shall be performed in two separate trips. Training shall be certified on Form 11000-B specified in Section 01999.

**END OF SECTION**