

Watson-Marlow Qdos Chemical Metering System

Part 1 - General

1.1 Description

- A. Chemical metering pump system shall be a complete turnkey system inclusive of all necessary fluid handling and ancillary components to ensure the reliable metering of chemical into a treatment process.
- B. The key components of this system are as follows:
 - 1. Peristaltic Chemical Metering Pump
 - 2. Calibration Column
 - 3. Pressure Relief Valve
 - 4. Discharge Pressure Gauge with Diaphragm Seal
 - 5. Fabricated HDPE Shelf with pre-piped Back Panel in one of following configurations, simplex, duplex-duty/standby, duplex-dual discharge or triplex.

1.2 Quality Assurance

- A. Chemical Metering System (skid) shall be manufactured by the chemical metering pump manufacturer and shall provide pumps and accessories as a complete turnkey system. Skids manufactured by third parties such as separate skid fabricators, pump distributors or pump representatives are not acceptable.
- B. This specification is the basis for design of peristaltic metering pumps. All pumps, whether named as an acceptable supplier or submitted as an equal shall, at a minimum, meet the following critical design requirements.
 - 1. Pump shall be 24 hr continuous duty rated and have a three-year manufacturer's warranty from date of shipment.
 - 2. For quality assurance, pumps shall be supplied and labeled by the original manufacturer. Relabeled products, even under license by manufacturer, shall not be acceptable.
 - 3. Manufacturer shall have a minimum twenty (20) years of experience manufacturing peristaltic pumps, shall have a direct business presence in the United States for minimum of twenty (20) years, and shall employ a minimum of fifty (50) employees in the United States. Manufacturers without a direct American presence who distribute through a third-party distributor are not acceptable.
 - 4. Pumps shall be manufactured in compliance with ISO 9001-2015 standards.
 - 5. Pumps shall meet CE, NSF 61 and applicable electrical standards.
 - 6. To ensure proper function and quality, pumphead, tubing, and drive shall be manufactured by the same company. Tubing purchased by the pump manufacturer from a third party is not acceptable.

1.3 Submittals

- A. Submit the following:
 - 1. Certified shop drawings.
 - 2. Characteristic performance curve showing flow rate as a function of RPM and pressure.
 - 3. Chemical Metering System Arrangement & Installation drawings.
 - 4. Operating, maintenance, programming, and wiring instructions for all equipment
 - 5. Tool-free pumphead replacement instructions

6. Manufacturer's certification that pumphead, drive, and tubing are all manufactured by the same manufacturer.

1.4 Delivery, Storage, & Handling

A. Shipping

1. Ship the Chemical Metering System completely assembled and ready for installation. Ship tubing separately for field installation and process line connection by contractor.
2. Pack all additional spare parts in containers bearing labels clearly designating contents and pieces of equipment for which intended.
3. Deliver spare parts at the same time as pertaining equipment. Deliver to Owner after completion of work.

B. Receiving

1. Contractor to inspect and inventory items upon delivery to site.
2. Contractor to store and safeguard equipment, material, instructions, and spare parts in accordance with manufacturer's written instructions.

Part 2 – Chemical Metering System Design

2.1 Manufacturers

- A. Watson-Marlow, Inc.

2.2 Chemical Metering System Configuration

- A. ***(Engineer to specify either Simplex, Duplex-Duty/Standby, Duplex- Dual Discharge, or Triplex)***

2.3 Chemical Metering System Components

A. Peristaltic Chemical Metering Pump

1. Pumps shall be positive displacement type complete with ReNu replaceable cartridge-style peristaltic pumphead technology and self-contained variable speed drive as specified.
2. Pumps shall be self-priming and shall have a maximum suction lift capability of up to 30-feet vertical water column.
3. Discharge Pressure Rating: Up to 60 psi on Qdos 20 PU and Qdos 120, Up to 70 psi for Qdos 60 PU, and up to 100 psi on Qdos 20, Qdos 30 and Qdos 60 continuous (145 psi intermittent for Qdos 30).
4. Pumps shall be capable of pumping both liquids and gases without vapor locking.
5. Pump shall not require the use of back pressure valves, suction foot valves, strainers, pulsation dampeners, or auto degassing valves and shall not require dynamic seals in contact with the pumped fluid. Process fluid shall be contained within pump tubing and shall not directly contact any rotary or metallic components during operation. Upon failure, the process fluid shall be completely contained within the pump head to prevent hazardous exposure to operators. Manufacturer's that do not offer a completely contained pump head are not acceptable.
6. Pump Process Schedule

Quantity of Chemical Metering Systems	*(Engineer to specify)*
Chemical Metering System Configuration	*(Engineer to specify either Simplex, Duplex-Duty/Standby, Duplex- Dual Discharge or Triplex)*
Tag Number(s)	*(Engineer to specify)*
Fluid Viscosity Specific Gravity Fluid Temperature	*(Engineer to specify)*
Flow Range Min– Max (GPH)	*(Engineer to specify)*
Average Flow (GPH)	*(Engineer to specify)*
Average Discharge Pressure (PSI)	
Maximum Discharge Pressure (PSI)	*(Engineer to specify)*
Suction Head	*(Engineer to specify)*

7. Pump Construction

a. Pumphead

1. Technology: Provide tool-free ReNu cartridge-style peristaltic pumphead technology. For operator safety, pumphead shall be serviceable as a single replaceable component. Pumps that require an operator to open the pumphead for tube replacement, cleaning, or rebuilding or that require tools for maintenance are unacceptable.
2. Max rating:
 - Qdos 20, with SEBS pumphead – 5.3 GPH at 55 rpm and 100 psi of discharge pressure
 - Qdos 20 PU, with PU pumphead – 7.7 GPH at 55 rpm and 60 psi of discharge pressure
 - Qdos 30, with SEBS pumphead - 7.93 GPH at 125 rpm and 60 psi of discharge pressure.
 - Qdos 30, with Santoprene pumphead - 7.93 GPH at 125 rpm and 100 psi of discharge pressure.
 - Qdos 60, with SEBS pumphead - 15.85 GPH at 125 rpm and 60 psi of discharge pressure.
 - Qdos 60, with PU pumphead - 15.85 GPH at 125 rpm and 70 psi of discharge pressure.
 - Qdos 60, with Santoprene pumphead - 15.85 GPH at 125 rpm and 100 psi of discharge pressure.
 - Qdos 120, with Santoprene pumphead - 31.7 GPH at 140 rpm and 60 psi of discharge pressure.
3. Housing construction: corrosion resistant and high impact resistant glass filled PPS or PPE/PS.
4. Geometry: Pumphead shall consist of sealed track housing with in- line porting. Suction and discharge ports shall be 180 degrees apart with bottom suction and top discharge.
5. Rotor: Pumphead rotor shall be constructed of glass

- filled Nylon, sealed within the track housing, and supported by its own bearings. Peristaltic occlusion level shall be factory set to ensure flow accuracy of +/- 1% and repeatability performance of +/- 0.5% and shall not require any field adjustment.
6. Contact Materials: All pumphead components in the fluid path shall be NSF61 listed and shall be of materials specified by the manufacturer as compatible with the process fluid.
 7. Leak containment/detection: In the event of peristaltic element failure, the leak sensor shall shut the pump down immediately with all process fluid contained within the sealed pumphead.
 - a. Sensor type: Utilize non-contacting optical sensor. Sensor shall not come in contact with the process fluid, shall contain no moving parts, shall not depend on the capacitance of the process fluid, shall not require fluid to leak out of the pump housing for engagement, nor shall require any sensitivity or calibration adjustment.
 - b. Alarm: Sensor shall shut down the pump, give a visual indication on the drive controller, and if specified shall provide an output general alarm signal.
 - c. For operator and environmental safety, pumps which do not have leak containment, leak sensor, and shutdown are not acceptable. For additional overpressure safety, sealed pumphead shall have a controlled drain-to-waste port.
 8. Port connections: Pumphead shall utilize PVDF compression fittings which shall mate to 1/4" x 3/8" or 3/8" x 1/2" PE interface tubing. Provide polypropylene compression by 1/2" NPT adaptors for connecting interface tubing to process line.
 9. Spares: Provide one (1) spare pumphead per pump supplied.
- b. Drive
1. Rating: Continuous 24-hour operation, 45° C ambient.
 2. Voltage: Drive shall be suitable for 100-240VAC, 50-60Hz, 1- Phase with an internal switch-mode power supply. Supply nine- foot length mains power cord with standard 115VAC three-prong plug.
 3. Max drive power consumption: 190VA.
 4. Enclosure: NEMA 4X constructed out of corrosion and impact resistant engineering plastic, 20% Glass filled PPE/PS. By nature of the environmental conditions, painted or unpainted metallic housing including 316SS are not acceptable. Enclosure shall house the drive motor and all control circuitry in one integrated unit. Separate VFDs and motors are not acceptable.

5. Direct coupled pumphead with fully protected drive
 - a. Pumphead shall direct couple mount to the controller via a splined drive shaft and shall be locked in place by two tool-free thumbscrews or lever mechanism.
 - b. Pumphead shall be fully sealed to prevent any contamination of the controller or drive shaft by process fluid.
 - c. Pumphead shall contain its own rotor bearings and not impart an overhung load on the pump shaft.
 - d. Pumpheads shall be supplied mounted to the left or right side of the drive enclosure as specified in the drawings.
 - e. Drive shall stop shaft rotation and give visual alarm in the event the pumphead is removed.
6. Drive motor: brushless DC motor with integral gearbox and closed loop tachometer feedback.
 - a. Circuitry complete with temperature and load compensation and protection.
- c. Human-Machine Interface (HMI) and Control

*******Engineer to specify either Option A, B, or C only *******

Option A) For both Analog Remote Control and Manual Control capability

1. Manual Control Interface
 - a. Flow range:
 - Qdos20 – 5,300:1 flow range from 0.001-5.3 GPH in 0.001 GPH increments
 - Qdos 20 PU – 7,700:1 flow range from 0.001 – 7.7 gph in 0.001 GPH increments.
 - Qdos 30 - 7,930:1 flow range from 0.001-7.93 GPH in 0.001 GPH increments.
 - Qdos 60- 15,850:1 flow range from 0.001-15.85 GPH in 0.001 GPH increments.
 - Qdos 120- 31,700:1 flow range from 0.001-31.7 GPH in 0.001 GPH increments.
 - b. Display: Backlit graphical TFT Display capable of up to 8 lines of text with up to 26 characters per line to display pump tag number, flow rate, and programming instructions. Display shall also provide visual indication of running status via screen color: Blue = Running, White = Stopped and Red = Warning.
 - c. Keypad: Keypad for start, stop, speed increment, speed decrement, rapid prime, and programming.
 - d. Flow units: Programmable in either ml/min or gallons/hour.
 - e. Security: Programmable keypad lock and PIN security for optional lockout of all keys except emergency start/stop.
 - f. Auto Restart: feature to resume pump status in the event of power outage interruption.
 - g. Multilingual menu: include programming menus in nine

- languages, including at a minimum English, Spanish, and French.
- h. Fluid level monitor: Programmable flow totalization to advise operator when their supply tank is low.
2. Remote Control I/O
- a. Speed Control Input: Analog 4-20mA speed input with 1,600:1 turndown with incremental steps of 10 microamps.
*******If scalable and programmable response to speed signal is required, alternatively specify the following:**
 - a. Speed Control Input: Analog 4-20mA speed input with 1,600:1 turndown with incremental steps of 10 microamps. Signal shall be trimmable and speed scaleable over any part of the drive speed range. Pump shall be programmable to either increase pump speed or decrease pump speed against an increasing Analog 4-20 mA signal. *****
 - b. Run/Stop Input: Either 5-24V industrial logic, dry contact or powered 110 VAC contacts as shown per the process and instrumentation drawings.
 - c. Run/Stop & General Alarm Status Outputs: Either 24VDC Open Collector, 24VDC Status relay, or 110VAC Status Relay
*******If alternative status outputs are required, specify the following:**
 - c. Status Outputs: Four status outputs, 24VDC Status relay, or 110VAC Status Relay as required by the process and instrumentation drawings software configurable to indicate the following:
 - 1. General Alarm status
 - 2. Running/Stopped status
 - 3. Manual Mode status
 - 4. Analog Mode status
 - 5. Contact Mode status
 - 6. Fluid Level status
 - 7. Leak Detected status
- *****If a speed feedback signal is required, specify the following:**
- d. Speed Analog Output: Analog 4-20mA *****
- 3. HMI, analog connections, and mains power shall be accessible from the front or side of the enclosure.
 - 4. Minimum requirements: Pumps that do not meet the minimum manual and automatic control requirements as specified above are not acceptable.

Option B) For both PROFIBUS and Manual control capability

- 1. Manual Control Interface
 - a. Flow range:
 - Qdos 20 – 5,300:1 flow range from 0.001 – 5.3 GPH
 - Qods 20 PU – 7,700:1 flow range from 0.001 – 7.7 gph in

0.001 GPH increments.

Qdos 30 - 7,930:1 flow range from 0.001-7.93 GPH in 0.001 GPH increments.

Qdos 60- 15,850:1 flow range from 0.001-15.85 GPH in 0.001 GPH increments.

Qdos 120- 31,700:1 flow range from 0.001-31.7 GPH in 0.01 H increments.

- b. Display: Backlit graphical TFT Display capable of up to 8 lines of text with up to 26 characters per line to display pump tag number, flow rate, and programming instructions. Display shall also provide visual indication of running status via screen color: Blue = Running, White = Stopped and Red = Warning.
- c. Keypad: Keypad for start, stop, speed increment, speed decrement, rapid prime, and programming.
- d. Flow units: Programmable in either ml/min or gallons/hour.
- e. Security: Programmable keypad lock and PIN security for optional lockout of all keys except emergency start/stop.
- f. Auto Restart: feature to resume pump status in the event of power outage interruption.
- g. Multilingual menu: include programming menus in nine languages, including at a minimum English, Spanish, and French.
- h. Fluid level monitor: Programmable flow totalization to advise operator when their supply tank is low.

2. PROFIBUS control

- a. Pumps shall be capable of two-way digital communication over a PROFIBUS DP network with bus communication speeds from 9.6 to 1,500 kbits/s and meet the following minimum functionality requirements. All control signal features shall be located internally to the pump. Pumps not meeting this minimum functionality or that require additional external control boxes with gateways are not acceptable.
- b. Control Inputs
 - 1. Speed Control, Start/Stop, and Flow Calibration all configurable via digital command
- c. Control Feedback
 - 1. Measured Speed, Running Status, PROFIBUS Control Enabled status, Leak Detected Status, and Current Calibration Information being utilized by the pump
- d. Extended Diagnostic Feedback
 - 1. Continuous monitoring and feedback of the following:
 - a) Over-Current
 - b) Over-Temperature

- c) Pump Stalled
- d) Tacho Fault
- e) RAM write error
- f) Wrong Speed
- g) RAM corruption
- h) Over Voltage
- i) Under Voltage
- j) Set point out of range (min speed)
- k) Set point out of range (max speed)
- e. Control Cable: Each pump to be supplied with a 5-pin M12 watertight connection for Contractor to connect to the PROFIBUS system.
- f. HMI, PROFIBUS connection, and mains power shall be accessible from the front of the enclosure.
- g. Minimum requirements: Pumps that do not meet the minimum status indicator and automatic control requirements as specified above are not acceptable.

Option C) For Manual control only

1. Manual Control Interface
 - a. Flow range:
 - Qdos20 – 5,300:1 flow range from 0.001-5.3 GPH in 0.001 GPH increments
 - Qdos 20 PU – 7,700:1 flow range from 0.001 – 7.7 gph in 0.001 GPH increments.
 - Qdos 30 - 7,930:1 flow range from 0.001-7.93 GPH in 0.001 GPH increments.
 - Qdos 60- 15,850:1 flow range from 0.001 – 15.85 GPH in 0.001 GPH increments.
 - Qdos 120- 31,700:1 flow range from 0.001-31.7 GPH in 0.01 H increments.
 - b. Display: Backlit graphical TFT Display capable of up to 8 lines of text with up to 26 characters per line to display pump tag number, flow rate, and programming instructions. Display shall also provide visual indication of running status via screen color: Blue = Running, White = Stopped, and Red = Warning.
 - c. Keypad: Keypad for start, stop, speed increment, speed decrement, rapid prime, and programming.
 - d. Flow units: Programmable in either ml/min or gallons/hour.
 - e. Security: Programmable keypad lock and PIN security for optional lockout of all keys except emergency start/stop.
 - f. Auto Restart: feature to resume pump status in the event of power outage interruption.
 - g. Multilingual menu: include programming menus in nine languages, including at a minimum English, Spanish, and French.
 - h. Fluid level monitor: Programmable flow totalization to advise operator when their supply tank is low.

- i. HMI and mains power shall be accessible from the front of the enclosure.
- j. Minimum requirements: Pumps that do not meet the minimum manual control requirements as specified above are not acceptable.

B. Calibration Columns

- 1. Supply Calibration Column made of clear PVC or Acrylic cylinder materials, sealed on both ends with appropriately sized NPT threaded ports both top and bottom. Graduation markings shall be in fractions of gallons or milliliters in proportion to the size of the column.
- 2. Column shall be sized to allow a minimum 30-second draw down at maximum pump speed.

C. Pressure Relief Valve

- 1. Supply Pressure Relief Valve with PVC Body and PTFE/EPDM Diaphragm.
- 2. Relief Pressure shall be adjustable from 10-150 psi.
- 3. Connections shall be designed with unions and socket welded.

D. Discharge Gauge with Diaphragm Seal

- 1. Discharge Pressure Gauge shall have a 2.5-inch dial with a liquid filled case, stainless steel tube and socket with a pressure range of 0-160 psig
- 2. Discharge Gauge shall be assembled to a Diaphragm Seal with a Teflon Diaphragm and 1/2-inch NPT PVC process connection.

E. Fabricated HDPE Shelf with Back Panel

- 1. HDPE Shelf with Back Panel shall be fabricated out of 1/2-inch and 3/4-inch sheet stock. The Shelf and Back Panel shall be fusion welded together maintaining a 1-inch containment lip completely around the surface in which the pump sits. Metallic Shelves & Back Panels including those that are painted or coated are not acceptable.
- 2. All necessary piping to incorporate the above equipment into a single turnkey chemical metering system shall be secured to the Shelf and Back Panel.
- 3. HDPE Shelf & Back Panel shall be designed to be either free standing with fork lift slots or wall mounted. **(*Engineer to specify*)**
- 4. Mounting Hardware & Installation shall be supplied by the Contractor

F. Isolation Valves

- 1. All Ball Valves, sizes 1/2-inch to 4-inch, shall be of true union design with two-way blocking capability. All O-rings shall be EPDM or FPM based on chemical being pumped. Seats shall have elastomeric backing cushion of the same material as the valve seals. Stem shall have double O-rings and be of blowout-proof design. The SCH 80 PVC & CPVC ball valves shall have a pressure rating of 250 psi for sizes 1/2-inch to 2-inch and 235 psi for 2-1/2-inch to 4-inch at 70 degrees F. Ball Valves shall carry a two-year guarantee. Ball valves shall be equal to Hayward TB series as manufactured by Hayward Flow Control

G. Piping

- 1. Polyvinylchloride (PVC) Pipe and fittings shall be manufactured of Rigid Poly Vinyl Chloride (PVC) schedule 80. Fittings shall be heavy-duty Schedule 80

molded fittings.

Part 3 – Execution

3.1 Installation (By Contractor)

- A. Contractor shall install items in accordance with manufacturer's printed instructions and as indicated and specified.
- B. Contractor to connect suction, discharge, vent and drain connections as required.
- C. Contractor shall supply shielded signal wiring for wiring of the required remote input and output to the connectors.