

Watson-Marlow Qdos H-Flo Chemical Metering Pumps

Part 1 - General

1.1 Description

- A. Pumps shall be positive displacement type complete with ReNu replaceable cartridge-style peristaltic pumphead technology and self-contained variable speed drive as specified.
- B. Pumps shall be self-priming, and shall have a maximum suction lift capability of up to 17' vertical water column.
- C. Discharge Pressure Rating: Up to 36 psi for the Qdos 600 Santoprene, Up to 58 psi for the Qdos 300 SEBS, Up to 73 psi for the Qdos 300 Santoprene and Up to 102 psi for the Qdos 150 Santoprene.
- D. Pumps shall be capable of pumping both liquids and gases without vapor locking.
- E. 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.

1.2 Quality Assurance

- A. 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.
- B. Pump shall be 24 hr continuous duty rated and have a three-year manufacturer's warranty from date of shipment.
- C. For quality assurance, pumps shall be supplied and labeled by the original manufacturer. Relabeled products, even under license by manufacturer, shall not be acceptable.
- D. 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.
- E. Pumps shall be manufactured in compliance with ISO 9001-2015 standards.
- F. Pumps shall meet CE, NSF 61 and applicable electrical standards.
- G. 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. Performance curve showing flow rate as a function of RPM and pressure.
 - 3. Dimensional drawings.
 - 4. Operating, maintenance, programming, and wiring instructions
 - 5. Tool-free pumphead replacement instructions
 - 6. Manufacturer's certification that pumphead, drive, and tubing are all manufactured by the same manufacturer.

Part 2 – Pump Design

2.1 Manufacturers

A. Watson-Marlow, Inc.

2.2 Pump Process Schedule

Quantity	*(Engineer to specify)*
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)	*(Engineer to specify)*
Maximum Discharge Pressure (PSI)	*(Engineer to specify)*
Suction Head	*(Engineer to specify)*

2.3 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 H-Flo 150, with Santoprene pumphead - 39.6 GPH at 102 psi discharge pressure.
Qdos H-Flo 300, with SEBS pumphead – 79.3 GPH at 58 psi discharge pressure.
Qdos H-Flo 300, with Santoprene pumphead– 79.3 GPH at 73 psi discharge pressure.
Qdos H-Flo 600, with Santoprene pumphead – 158.5 GPH at 36 psi 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 ¾" FNPT Union style connection.
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: 350VA.
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 a 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, C or D only *******

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

1. Manual Control Interface

- a. Flow range: Qdos150 with Santoprene Pumphead – 1,237:1 flow range from 0.032-39.6 GPH in 0.001 GPH increments.
Qdos 300 with SEBS & Santoprene Pumpheads – 2,478:1 flow range from 0.032–79.3 gph in 0.001 GPH increments.
Qdos600 with Santoprene Pumphead – 4,953:1 flow range from 0.032-158.5 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. *****
- a. Run/Stop Input: Either 5-24V industrial logic, dry contact or powered 110 VAC contacts as shown per the process and instrumentation drawings.
- b. 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 shall be accessible from the front 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: Qdos150 with Santoprene Pumphead – 1,237:1 flow range from 0.032-39.6 GPH in 0.001 GPH increments.
Qdos 300 with SEBS & Santoprene Pumpheads – 2,478:1 flow range from 0.032–79.3 gph in 0.001 GPH increments.
Qdos600 with Santoprene Pumphead – 4,953:1 flow range from 0.032-158.5 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. 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 and PROFIBUS connection 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 both Ethernet and Manual control capability

1. Manual Control Interface

- a. Flow range: Qdos150 with Santoprene Pumphead – 1,237:1 flow range from 0.032-39.6 GPH in 0.001 GPH increments.
Qdos 300 with SEBS & Santoprene Pumpheads – 2,478:1 flow range from 0.032-79.3 gph in 0.001 GPH increments.
Qdos600 with Santoprene Pumphead – 4,953:1 flow range from 0.032-158.5 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. Ethernet Control

- a. Pumps must be capable of two-way digital communication over an Ethernet/IP network with baud rate of 10/100 mbps full/half duplex operation and meet the following minimum functionality requirements. All control signal features must be located internally to the pump. Pumps not meeting this minimum

functionality or that require additional external control boxes with gateways are not acceptable.

- a. Control Inputs
 1. Speed Control, Start/Stop, and Flow Calibration all configurable via digital command.
 2. Remote Pressure/Flow Sensor: via analog 4-20 mA signal
- b. Control Feedback
 1. Measured Speed, Running Status, Ethernet Control Enabled status, Leak Detected Status, Flow Totalizer, Remote Pressure, Remote Flow and Current Calibration Information being utilized by the pump.
- c. Extended Diagnostic Feedback
 1. Continuous monitoring and feedback of the following:
 - a) General Error
 - b) Motor Stalled
 - c) Over Current
 - d) Under Voltage
 - e) Over Voltage
 - f) Overload
 - g) Over Temperature
 - h) Speed Error
 - i) Signal Out of Range
 - j) Over Signal
 - k) Tacho Fault
 - l) Leak Detect

Option D) For Manual control only

1. Manual Control Interface
 - a. Flow range: Qdos150 with Santoprene Pumphead – 1,237:1 flow range from
0.032-39.6 GPH in 0.001 GPH increments.
Qdos 300 with SEBS & Santoprene Pumpheads – 2,478:1 flow range from 0.032–79.3 gph in 0.001 GPH increments.
Qdos600 with Santoprene Pumphead – 4,953:1 flow range from 0.032-158.5 GPH in 0.001 GPH increments.
 - b. 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.

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 shall supply shielded signal wiring for wiring of the required remote input and output to the connectors.