

Watson-Marlow 621R Series Close Coupled Pumps

Part 1 - General

1.01 Description

- A. Pumps shall be positive displacement peristaltic type complete with spring loaded pumphead, close coupled gearbox, motor, variable frequency drive (VFD) and flexible extruded tube as specified. Peristaltic pumping action is created by the compression of the flexible tube between the pumphead rollers and track, induced forward fluid displacement within the tube by the rotation of the pump rotor, and subsequent vacuum-creating restitution of the tube.
- B. Pumps shall be dry self priming, capable of being run dry without damaging effects to pump or tube, and shall have a maximum suction lift capability of up to 30' vertical water column. Max pressure rating: 30 psi.
- C. Pump shall use no check valves or diaphragms and shall require no dynamic seals in contact with the pumpage. Process fluid shall be contained within pump tubing and shall not directly contact any rotary or metallic components.
- D. Flow shall be in the direction of the rotor rotation, which can be reversed and shall be proportional to rotor speed.

1.02 Quality Assurance

- A. This specification is the basis for design for peristaltic metering pumps. All pumps, whether named as an acceptable supplier or submitted, as an equal must, at a minimum, meet the following critical design requirements.
- B. To maximize pump efficiency and minimize tube fatigue that will impact life, performance, and accuracy, pumps must be designed not to exceed a P/10 ratio (Theoretical maximum number of occlusions per 10 gallons pumped). Pumps exceeding the specified P/10 ratio will not be considered suitable for the duty condition. The following criteria is set to maintain the P/10 of ratio for the tube size specified for this application:
 - 1. Maximum two compressing rollers for two compressions per revolution.
 - 2. Tube wall thickness of 3.2 mm and material specified
 - 3. Large diameter spring-loaded roller set for 3.2mm wall thickness tubing
 - 4. Max base drive speed of 225 RPM for 3.2mm wall thickness tubing.
 - 5. Track geometry of no less than 180 degrees and rotor geometry with roller 180 degrees apart.
- C. P/10 ratio shall not exceed the following per tube size:

Tube Size	P/10 ratio
6.4mm x 3.2mm	5,848
9.6mm x 3.2mm	3,022
12.7mm x 3.2mm	1,892
15.9mm x 3.2mm	1,580
- D. For quality assurance, all pump tubing must be manufactured by the pump manufacturer in accordance with their specifications. Tubing not manufactured by the pump manufacturer will not be acceptable.

- E. Pumps to be manufacturer's standard product. Manufacturer of tubing pumps must have at least ten operating installations in the United States over a period of at least five years in the same service and size as specified.
- F. Drive and pump heads shall be 24 hr continuous duty rated and have a two-year manufacturer's warranty from date of shipment.
- G. Pumps must be manufactured under ISO 9001-2000.

1.03 Submittals

- A. Submit the following
 1. Certified shop drawings.
 2. Characteristic performance curve showing flow rate as a function of RPM and pressure.
 3. Dimensional drawings.
 4. Operating and maintenance instruction.
 5. P/10 ratio calculation

1.04. Delivery, Storage, & Handling

- A. Shipping
 1. Ship pump and drive assembled complete. VFD shall be shipped unwired to the motor, for field wiring. Ship tubing elements separately.
 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 - Pump Design

2.01 Manufacturers

- A. Watson-Marlow, Inc.

2.02 Process Pump Schedule

Pump Model	621R
Quantity	*(Engineer to specify)*
Tag Number(s)	*(Engineer to specify)*
Fluid Type/concentration Viscosity Specific Gravity Fluid Temperature	*(Engineer to specify)*
Tubing Material	Marprene II *(Alternate Material Available Upon Request)*

Max – Min Capacity	*(Engineer to specify)*			
Max Pump RPM for Application	*(Engineer to specify)*			
Tubing ID *(Engineer to Specify)*	1/4"	3/8"	1/2"	5/8"
Displacement/Revolution (Gallons)	0.00342	0.00662	0.01058	0.01267
Displacement/Revolution (Liters)	0.013	0.025	0.040	0.048
P/10 Ratio (Theoretical Maximum Number of Occlusion/10 Gallons Pumped)	5,848	3,022	1,892	1,580
Max Flow Rate (GPM) w/ 77 rpm unit	0.26	0.51	0.81	1.11
Max Flow Rate (LPM) w/ 77 rpm unit	0.98	1.93	3.07	4.20
Max Flow Rate (GPM) w/ 225 rpm unit	0.77	1.49	2.38	2.85
Max Flow Rate (LPM) w/ 225 rpm unit	2.91	5.64	9.01	10.79
Max Discharge Pressure (PSI)	*(Engineer to Specify)*			
Suction Head	*(Engineer to Specify)*			
Power (VAC, Frequency, Phase)	*(Engineer to Specify)*			

2.03 Pump Construction

A. Pumphead

1. Pumphead shall consist of a fixed track with tool lockable-hinged guard. For operator safety, pumps without lockable guard, and/or flip-top design pump heads are not acceptable.
2. Pumphead door shall have two clear windows for viewing of rotation direction. When closed, pump door shall seal against the pump track for leak containment and controlled waste through the pumphead waste port in the event of a tube failure. For operator and environmental safety, pumps without clear viewing windows and/or waste port are not acceptable.
3. Rotor assembly shall be equipped with two compression rollers, which shall be retractable for tube loading, SIP, or CIP flushing cycles. Compression rollers shall be located 180 degrees apart for compression of the tube against the track twice per rotor revolution. One roller shall at all times be fully engaged with the tubing providing complete compression to prevent backflow or siphoning. Occlusion gap shall come factory set to accommodate 3.2 mm wall thickness tube. To maximize pump efficiency, pumps without retractable rollers and/or more than 2 compressing rollers are not acceptable.
4. The rotor assembly shall be close coupled to the output shaft of the drive gearmotor by a 19 mm keyed rotor mounting shaft and B14 IEC flange arrangement.
5. Material of Construction
 - a. Track: Aluminum, Trimite polyester powder coat, electrostatically applied and baked
 - b. Door:
 1. Inner Shell: Grilamid TR55
 2. Outer Shell: shock resistant Polyurethane
 3. Door Seal: Silicone
 4. Drain Port Adapter: Acetyl
 - c. Rotor:
 1. Hub & Roller Arms: Fortron 1140L4 (PPS)
 2. Hub Cover: Dupont Hytrel G5544

3. Main Rollers: 304SS
4. Main Roller Bearings: Carbon Steel (sealed)
5. Guide Rollers: Nylatron
6. Hardware & leaf springs: 304S

B. Tubing

1. Pump tubing shall be in contact with the inside diameter of the track (housing) through an angle of 180 degrees and be held in place on the suction and discharge by tube retainer clamps. The tubing shall be replaceable without the use of tools and with no disassembly of the pumphead. To achieve maximum flow per revolution, pump heads with a track angle of less than 180 degrees are not acceptable. See 1.02.
2. Pump tubing shall be constructed of Marprene II, a thermoplastic elastomer with a 64 Shore A durometer and 3.2mm wall thickness. Pump manufacturer must manufacture Marprene tubing in-house. Pump manufacturers who purchase third party tubing are not acceptable.
3. Pump shall readily accept tubing ID's of 6.4mm, 9.6mm, 12.7mm, or 15.9mm without pump adjustment or replacement. Tubing with a wall thickness less than 3.2mm is not acceptable. See 1.02.
4. Supply 15-meter roll of specified tubing size.

C. Drive

1. Gearmotor:
 - a. Gearmotor shall be double reduction helical in line gearing with a housing constructed of SAE Class 30 cast iron. Gearbox output shaft and face shall accept the direct coupling of the peristaltic pumphead. Gearing shall be manufactured to AGMA Class 11-12 requirements with an overall gearbox rating of AGMA Class II under continuous operation. Minimum efficiency shall be 95%. Gearmotor shall be equipped with an integral TEFC motor, Design B, Class F insulation, 1.15 motor service factor, 4 pole, 230/460VAC, 60 Hz, 3-phase, inverter duty
 - b. Provide ½ HP gearmotor for 600 series
(Engineer may specify alternate if required provided it is matched to the VFD specified)
2. Variable Frequency Drive: PWM type VFD with a NEMA 4X/12 enclosure, Operator keypad for programming, start, stop, reverse, and speed control with LED speed indicator. Drive shall be capable of remote speed control via 4-20 mA analog input. Power: 460VAC, 60 Hz, 3-phase input, Manufacturer: Reliance SP500. ***(Engineer may specify alternate VFD if required provided it is matched to the motor specified)***
3. Mounting: Drive shall be mounted to epoxy coated aluminum baseplate

D. Spares

1. Supply one spare pumphead assembly with rotor.
2. Supply (4) tube elements of the specified size per pump.
 - **(For regular preventative maintenance and normal corrective maintenance, only tubing need be stocked and is supplied with the pump in sufficient quantity for this purpose: 15-meter. For additional corrective maintenance, it is advisable to have a spare pump head stocked.)**

Part 3 - Execution

3.01 Installation (By Contractor)

- A. Contractor shall install items in accordance with manufacturer's printed instructions and as indicated and specified.
- B. Contractor to supply compatible line adapters for connection of pump tubing to process lines.

Part 4 – Installation Accessories (Optional)

4.01 Leak Detectors

- A. Pump manufacturer shall supply float-type leak sensor mounted to the drain ports of the pumphead for leak detection and pump shut down in the event of a tubing failure.