

Watson-Marlow Bredel 10-100 Hose Pumps and Appurtenances

Part 1 – General

1.01 Description

- A. Pumps shall be peristaltic hose-type complete with appurtenances as indicated and specified.
- B. Pumps driven as indicated in the process pump schedule.
- C. Design and proportion all parts of pumps for duty specified.
- D. Provide ample room and facilities for inspection, repair, and adjustment.

1.02 Related Work

(ENGINEER TO EDIT SECTION AS REQUIRED BY THE INSTALLATION)

1.03 Quality Assurance

- A. All hose pumps to be the product of one manufacturer.
- B. Pumps to be manufacturer's standard catalog product.
- C. Shop tests as specified.
- D. Pump manufacturer must provide pumps and accessories which are integral to pump operation and specified herein as a coordinated package, regardless of manufacturer. This includes pumps, gear reducers, motors, pulsation dampeners, leak detectors, control panels/drives and other such accessories specified under this section as the responsibility of the pump supplier. Equipment specified herein that is not supplied by the pump manufacturer as an integrated package will be rejected.
- E. Services of a factory trained technician:
 - 1. ***(ENGINEER SHALL DETAIL THE REQUIRED NUMBER OF MAN DAYS FOR STARTUP, TRAINING, ETC. UNDER THIS HEADING)***
 - 2. Technician must be factory certified and specifically trained on the type of equipment specified. Technician must have a minimum of five (5) years direct experience on the size and type of equipment specified. The services of a manufacturer's sales representative will not be accepted to fulfill this requirement.
- F. Manufacturer of hose pumps must have at least five operating installations in the United States the size specified and in the same service as specified for a period of at least 3 years.
- G. Pump manufacturer must have a direct business presence in the United States for at least ten years. Foreign manufacturers without a direct American presence who distribute through a third-party distributor are not acceptable.
- H. Pumps shall be assembled in compliance within ISO9001/20015 standards.
- I. For pump sizes 10 mm through 50 mm, all pumphead components in the fluid path shall be NSF/ANSI 61 certified for the chemical being pumped and shall be of materials specified by the manufacturer as compatible with the process fluid. Pumps with components in the fluid path that are not NSF/ANSI 61 certified for the specific chemical being pumped are not acceptable.

1.04 Submittals

A. Submit the following:

1. Certified shop drawings.
2. Data regarding pump and motor characteristics and performance inclusive of guaranteed performance curves showing equipment meets the specified requirements of head, capacity, and horsepower.
3. Provide characteristic curves for variable speed pumps for both actual maximum pump speed and for speed required to obtain minimum pump flow specified.
4. Provide certification that the pump's materials of construction are compatible with the product being pumped.
5. Shop drawings for all accessory items.
6. Dimensional drawings inclusive of recommended location of anchor bolts.
7. Manufacturer's literature as needed to supplement certified data.
8. Operating and maintenance instruction and parts lists.
9. Certified results of vacuum testing
10. Certified bearing life.
11. Schematic control and power wiring.
12. Recommendations for long and short term storage.
13. Use tag numbers for all equipment as indicated and specified.
14. Recommended location and mounting of pulsation dampening devices.
15. Qualifications of factory trained technician and the number of service man-days provided.

1.05. Delivery, Storage, & Handling

A. Shipping

1. Ship equipment, material, and spare parts complete, except where partial disassembly is required by transportation regulations or for protection of components.
2. Pack all spare parts in containers bearing labels clearly designating the contents.
3. Deliver spare parts at the same time as pertaining equipment.
4. Pumps shall be shipped with hoses installed. In the event long term on site storage is anticipated, pumps may be shipped with hoses uninstalled for field installation by the Contractor prior to startup if so requested by the Contractor/Engineer at time of submittal approval.

B. Receiving

1. Contractor to inspect and inventory items immediately upon delivery to site and is responsible for storing and safeguarding equipment, material, instructions, and spare parts in accordance with manufacturer's written instructions.

Part 2 – Hose Pump

2.01 Manufacturers

A. Watson-Marlow Bredel Pumps - Wilmington, MA

2.02 Process Pump Schedule

Pump Model	*(ENGINEER TO SPECIFY)*									
Quantity	*(ENGINEER TO SPECIFY)*									
Tag Number(s)	*(ENGINEER TO SPECIFY)*									
Fluid Type/concentration Viscosity Specific Gravity Fluid Temperature Solid Content	*(ENGINEER TO SPECIFY)*									
Capacity Min GPM Normal GPM Max GPM	*(ENGINEER TO SPECIFY)* *(ENGINEER TO SPECIFY)* *(ENGINEER TO SPECIFY)*									
Max pump RPM	*(ENGINEER TO SPECIFY)*									
Suction Pressure Max Positive Static Head Max Suction Lift	*(ENGINEER TO SPECIFY)*									
Max Discharge Pressure (PSI)	*(ENGINEER TO SPECIFY)*									
Pump Model	Bredel 10	Bredel 15	Bredel 20	Bredel 25	Bredel 32	Bredel 40	Bredel 50	Bredel 65	Bredel 80	Bredel 100
Pump Pitch Diameter	4.56"	7.68"	7.68"	10.4"	13.0"	16.9"	21.8"	29.4"	34.5"	41.0"
Displacement/Revolution (Gallons)	0.0058	0.022	0.040	0.079	0.165	0.351	0.766	1.77	3.09	5.28
Pump Flange Size (150 lb)	1/2"	3/4"	3/4"	1"	1.5"	1.5"	2"	2.5"	3"	4"
Insert Material *(ENGINEER TO CHOOSE BASED ON PROCESS FLUID)*	AISI 316 Stainless Steel, Polypropylene or PVDF as recommended by the manufacturer for compatibility with the process fluid.									
Motor Hp	*(ENGINEER TO SPECIFY)*									
Power (VAC, Phase, Frequency)	*(ENGINEER TO SPECIFY)*									
Hose Material *(ENGINEER TO CHOOSE BASED ON PROCESS FLUID)*	CSM, EPDM, F-NBR, NBR, & NR as recommended by the manufacturer for compatibility with the process fluid.									
Orientation (Facing Pump) *(ENGINEER TO CHOOSE BASED ON INSTALLATION LAYOUT)*	Ports Left (Position 1) Ports Right (Position 2)									

2.03 Pump Construction

A. Pump

1. General

- a. Horizontal, Positive displacement, peristaltic hose pump
- b. Capable of operating in either direction without flow variation

- c. Capable of running dry without damage to pump or hose.
 - d. Capable of pulling 95% of full vacuum
 - e. Repeatability: $\pm 1\%$ accurate
 - f. Valveless/Glandless design with no dynamic seals in contact with the pumped product.
 - g. Pump shall be capable of being rotated in 90-degree increments for four (4) different port-mounting configurations.
 - h. Direct Coupled gear drive arrangement as specified herein.
 - i. Pump hardware shall be galvanized steel.
2. Hose and Lubricant
- a. Hose shall be manufactured of three-layer elastomer with an extruded inner wetted layer compatible with the process fluid, four layers of nylon reinforcement for 25mm-100mm hoses and two layers of nylon reinforcement for 10mm -20mm, and a Natural Rubber outer layer. Hose outside diameter shall be machined to maintain a wall thickness within ± 0.25 mm tolerance for 25mm-100mm and ± 0.4 mm for the 10mm -20mm hoses. The hose external surface shall have a surface roughness of $Ra 8 \pm 4\mu$. Hoses must have a smooth extruded internal surface and have tolerance controlled through machining. Hoses that do not meet these minimum requirements are not acceptable.
 - b. Minimum Static Burst Pressure rating of 800 psi for the 25mm-100mm hoses and 1090 psi for the 10mm -20mm hoses.
 - c. 53-68 shore A durometer.
 - d. Hose must be replaceable without cover or pump removal.
 - e. Pump housing shall contain a NSF-listed food-grade glycerin based hose lubricant blended to provide a medium for cooling and lubrication.
3. Pump Housing , Rotor, and Internal Bearing Frame
- a. Housing construction: Pump housing shall be cast iron and shall be supplied with an internal bearing hub to support the rotor on its own bearings. Provide a threaded drain plug at the lowest point of the pumping chamber to allow complete drainage of lubricant.
 - 1. 10-20 mm pumps: Cast Iron ASTM A48 Class 40 (DIN GG25)
 - 2. 25-100 mm pumps: Cast Iron ASTM A48 Class 25
 - b. Pump rotor
 - 1. Rotor shall be cast iron with two pressing shoes located 180 degrees apart. To perfectly match the pump to the process conditions and eliminate slip, shoe occlusion must be adjustable. Rotors incorporating rollers or fixed occlusion shoes are unacceptable.
 - i. 25-100 mm pumps: Cast Iron rotor ASTM A48 Class 25 with adjustable, shimmable shoes constructed of epoxy or extruded aluminum as recommended by the manufacturer. Shims shall be constructed of 316 Stainless Steel with a shim thickness of 0.5mm. The specified manufacturing tolerance of the hose, when compressed, shall not exceed the occlusion setting of one shim.

- ii. 10-20 mm pumps: Cast Iron rotor ASTM A48 Class 45B (DIN GG30) with integrally mounted shoes. Occlusion adjustment shall be made through availability of two alternative rotors with High and Low pressure occlusion settings. Manufacturer shall supply the rotor applicable for the conditions in the Pump Schedule.
 - c. Internal Bearing Frame
 - 1. Pump rotor shall be independently supported on its own set of heavy-duty ball bearings such that the bearings are located directly under the rotor's load. Bearings shall be supported by the bearing hub located within the pump housing and shall be sealed via a dynamic seal. Bearings shall be sealed and greased for life. Pumps which use pump lubricant to lubricate the bearings, external bearing frames which allow overhung loading and require long coupling configurations, or close coupling where the rotor is not supported by pump bearings are not acceptable.
 - 2. Gearing shall be direct coupled to the back of the pump housing and shall be completely isolated from the process fluid and pump fluid through the sealed bearing hub. Gear unit and drive components shall be serviceable without removal of the pump rotor.
- 4. Flanged Connectors
 - a. Supply pump with flanged inlet and outlet to ANSI/ASA 150# standards with wetted inserts compatible with the process fluid as indicated in the Process Pump Schedule. Flange construction:
 - i. 10-20 mm: 316 Stainless Steel
 - ii. 25-100 mm: 15 micron min galvanized steel, **(Engineer to specify if 316SS option is desired in lieu of galvanized steel)**
 - b. Pump hose shall extend from the pumping chamber to allow visual confirmation of hose/flange insert connection. Flange insert shall be secured to the pump hose via a single band clamp. Securing the hose using multiple clamps or internal compression fittings that cannot be visually verified as secure without disassembly of the pump is not acceptable.
 - c. Flange supports shall be of one-piece construction and shall secure to the pump housing via two or four bolts to maintain a compression seal between the pump housing and hose. Flange support construction:
 - i. 10-20 mm: 316 Stainless Steel
 - ii. 25-100 mm: 15 micron min galvanized steel, **(Engineer to specify if 316SS option is desired in lieu of galvanized steel)**
- 5. Pump Cover
 - a. Pump cover shall be constructed of Cast Iron
 - i. 10-20mm pumps: ASTM A48 class 40
 - ii. 25-32 mm pumps: ASTM A48 class 25

- iii. 40-100 mm pumps: ASTM A245 class 36
- b. Viewing Window: Equip cover with a viewing window constructed of PMMA to allow clear visual confirmation of direction of rotation. Window shall be marked with a minimum lubricant registration mark for proper indication of lubricant level when pump is stationary. For 25-100 mm pumps with adjustable shoes, the window shall be large enough to replace pressing shoes and allow shim adjustment without removing pump cover.
- c. Cover Mounting: 25-100 mm pump covers shall be bolted along the perimeter to the pump housing and shall seal via a captive quadring seal. 10-20 mm pumps shall bolt to the pump housing with no more than four bolts and shall be sealed via a gasket seal.

6. Frame

- a. Support frame shall be torsion free and constructed of formed hot dipped galvanized steel with a coating thickness of 15 microns. Welded steel or modular adjustable frames are not acceptable.

7. High lubricant leak detector

- a. Provide a float type magnetic reed switch located near the top of the pump to detect leakage of pumped product into the pump housing.
- b. Supply sensor Normally Closed with the ability for field adjustment to Normally Open
- c. Pump manufacturer to supply switch only. Contractor is responsible for alarm and relay to turn pump off unless otherwise specified herein.
- d. Float switch shall be rated to the following maxima:

$$V_{\max} = 240\text{VAC}, I_{\max} = 1 \text{ Amp}, P_{\max} = 50\text{VA}$$

8. Revolution Sensor **(Engineer to specify Revolution Sensor as an option)**

- a. Provide inductive type sensor to detect rotor revolutions. Mount sensor on the rear of the pump housing for 25mm-100mm pumps and between the suction and discharge ports on the 10mm -20mm pumps.
- b. Pump manufacturer to supply sensor only. Contractor is responsible for any additional equipment which may be required to integrate this into their control system.
- c. Inductive sensor actuates a non-maintained NO switch when triggering device passes the sensor. When inductive sensor is powered and pump is in operation a pulse waveform is generated.
- d. Inductive sensor shall be rated to the following maxima:

$$V_{\max} = 30\text{VDC}, I_{\max} = 150 \text{ mA}, P_{\max} = 4.5\text{VA}$$

(Note: The revolution sensor needs to be connected to a meter in order to display the number of revolutions counted. This meter can be located inside of a control panel or in a separate enclosure. This meter is not included within this specification.)

2.04 Pump Drive System

- A. Direct Coupled Gearing with Fully Protected Drive mounting.

1. Provide gearing with Fully Protected Drive direct-coupled mounting to the pump housing.
 - a. The gearbox shall bolt directly to the pump housing which shall include a buffer zone between the gearing and pumphead to prevent gearbox contamination from pump fluid or lubricant in the event of a hose lubricant seal failure. The pump's internal bearing hub shall be vented through the rear of the pump housing to allow visual detection in the event of a hose lubricant seal failure.
 - b. Close coupled pump designs which utilize the gearbox to seal the pump housing and expose the gearbox to lubricant or pumpage are not acceptable.
 - c. Long coupled pumps which require external couplings, coupling alignment, and coupling guards are not acceptable.
2. Design gear reduction to match output speed requirement of the pump using two or three-stage gearing and matching torque rating of pumping equipment. Gearing shall be classified for continuous heavy shock duty, 24 hr duty with a minimum of 1.4 service factor.
 - a. 10-32 mm pumps: helical gearing with cast iron housing
 - b. 40-100 mm pumps: ultra compact, high torque planetary gearing with cast iron housing

B. Motors

(BELOW MOTOR DETAIL IS THE TYPICAL MOTOR SPECIFICATION FOR AC FIXED SPEED OR INVERTER DUTY APPLICATIONS. ALTERNATE MOTORS ARE AVAILABLE UPON REQUEST)

1. Provide premium efficient, TEFC or TENV, squirrel-cage induction motors, NEMA C face, conforming to the latest applicable requirements of NEMA, IEEE, ANSI, and NEC standards.
2. Provide motor HP in accordance with Process Pump Schedule.
3. Motors are to be designed for continuous duty for 3-phase, 230/460VAC operation, NEMA Design B with torque and starting currents in accordance with NEMA MG1-1993-12.35 and 12.38. Ratings to be based on a 40 degree C ambient 3,300 feet altitude or lower operation with a maximum temperature rise of 80 degree by resistance C at 1.0 service factor (and 90 degree C rise 1.15 service factor).
4. Motors shall be furnished with Class F insulation utilizing materials and insulation systems evaluated in accordance with IEEE 117 classification tests. Motors shall have 1.15 service factor but shall be selected for operation within their full load rating without applying the service factor.
5. Bearings shall be selected to provide L10 rating of 100,000 hrs minimum for C-face flexible coupled applications. For frame sizes 56-140, bearings shall be permanently lubricated. For frame sizes 180 and larger, proved capped grease fitting.
6. For frame sizes 180 and larger, motor enclosure including frame, end brackets locking bearing inner caps, fan guard, and conduit box and cover shall be cast iron, ASTM Type A48, Class 25 or better. Conduit box shall be diagonally split with tapped NPT threaded conduit entrance hole, neoprene conduit box

cover gasket, neoprene lead seal gasket between box and motor frame, and ground lug. For frame sizes 56-140, motor enclosure, fan guard, conduit box, and cover shall be carbon steel. End shield shall be constructed of aluminum. Conduit box shall be top mounted with F1/F2 conduit entrance holes, grounding lug, and neoprene conduit box gasket between box and motor frame.

7. External cooling fan on TEFC motors shall be corrosion resistant, non-sparking, bi-directional, keyed, clamped, and shouldered on the motor shaft.
8. Motor rotor construction shall be die cast aluminum, fabricated copper, or their respective alloys. Motor shall have copper windings.
9. Motor leads shall be nonwicking type permanently numbered for identification.
10. All motors shall be premium efficient with minimum efficiencies exceeding NEMA MG1-1993 Table 12-10. Motor efficiency shall be determined in accordance with NEMA MG1-1993-12.58.1 and full load efficiency labeled on motor nameplate in accordance with NEMA MG1-1993-12.58.2
11. Motors shall be suitable for use with PWM type variable frequency drives. Motors frame size 56-180 shall be rated for 10:1 constant torque continuous duty over 6-60 Hz. Larger frame motors shall be rated for 4:1 constant torque continuous duty over 15-60 Hz.
12. Acceptable Manufacturers –Baldor or approved equal.

(ENGINEER TO SPECIFY THE REQUIREMENT OF SPACE HEATERS OR THERMAL PROTECTORS IF SO REQUIRED BY THE INSTALLATION)

2.05 Painting

- A. Provide pump assembly painted with manufacturer's standard paint specification
 1. Single coat of a two-component acrylate
 2. Dry thickness 60-80 micron
 3. Color- RAL 3011 brown red

2.06 Accessories & Control Panels

***(ENGINEER TO INCLUDE SPECIFICATION AS REQUIRED BY THE INSTALLATION. SEE WATSON-MARLOW/BREDEL HOSEPUMP ACCESSORIES SPECIFICATION.)**

2.07 Spare Parts

- A. Provide spare parts that are identical to and interchangeable with parts installed. Furnish and deliver the following spare parts for each pump:
 1. Two replacement hoses
 2. Two hose lubricant refills

2.08 Shop Testing

- A. Non-witnessed Inlet Vacuum Testing
 1. Test assembled Pump running on air.
 2. Run test for a minimum of 30 seconds and record vacuum reading which must meet or exceed 28" Hg Vacuum.
 3. In the event that specified tests indicate that the pump does not meet specifications, Engineer has the right to require complete tests for the pump at no additional cost to the owner.

4. Repeat tests until specified results are obtained.
5. Correct or replace promptly all defects or defective equipment revealed by or noted during tests at no additional cost to the Owner.

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 shall install pumping equipment on a concrete pad and make final alignments thereon.
- C. Contractor shall install accessories in accordance with manufacturer's written instruction.
- D. Contractor shall prove the pump's suction and discharge port connections to process lines are nonleaking and made in a free supported state without need to apply vertical or horizontal pressure to align piping with pump nozzles.

3.02 Field Testing

(By Contractor with assistance of Manufacturer's Field Service Technician)

- A. After installation of pumping equipment, and after inspection, operation, testing, and adjustment have been completed by the Contractor in the presence of the Manufacturer's Field Service Technician, Contractor shall conduct running test for each pump in the presence of the Engineer to determine its ability to operate within the performance limits specified and to deliver its rated capacity within the pressure requirements specified. Contractor shall provide labor, piping, equipment, and materials necessary for conducting all field tests.
- B. Make all adjustments necessary to place equipment in specified and working order at the time of above tests.
- C. Test pumps on product only.
- D. Promptly correct or replace all defective equipment revealed by or noted during tests at no additional cost to the Owner and repeat tests until specified results acceptable to Engineer are obtained.

END OF SECTION