



Domestic® Pump Series MJ™

Industrial, Clinical & Laboratory Vacuum Units

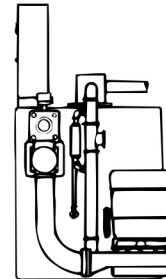
Guide Specification Index

Domestic Pump Series MJ Simplex Unit

.... Pages 2-3

Designed for piped central vacuum systems up to 120 cfm at 20" Hg. Simplex Vacuum Units are equipped with a single pump and motor assembly and with either a suspended, horizontal storage tank or vertical, floor mounted storage tank.

NOTE: Storage tanks are not standard.

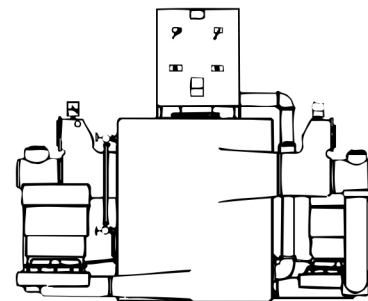


Domestic Pump Series MJ Duplex Unit

..... Pages 4-5

Duplex Vacuum Units provide vacuum for systems up to 240 cfm at 20" Hg. They are used with either horizontal or vertical type storage units. Standard Duplex units are equipped with two pump and motor assemblies, one of which is a standby. Double Capacity Units are furnished with four pump and motor assemblies. With this double capacity arrangement, two pumps always operate simultaneously, and the standby includes two pump and motor assemblies which also operate simultaneously.

NOTE: Storage tanks are not standard.

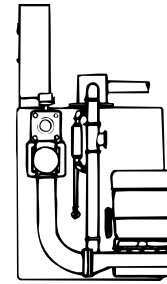


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**Description of Standard and
Optional Equipment and Controls** Page 8

Guide Specification

Domestic® Series MJ™ Industrial, Clinical & Laboratory Simplex Vacuum Units



NOTE: Optional Accessories are Underlined

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Unit shall be a Domestic™ Series MJ™ simplex vacuum heating and condensate pumping unit as manufactured by ITT Bell & Gossett
 - 1. (1) Cast iron or steel air and water separation chamber
 - 2. (1) Multi-jet vacuum producer
 - 3. (1) Dual purpose pump
 - 4. (1) Discharge valve assembly
 - 5. (1) Vacuum and float controls
 - 6. (1) Pump Control Panel

1.2 REFERENCES

- A. HI - Hydraulic Institute
- B. NEMA - National Electric Manufacturers Association
- C. UL - Underwriters Laboratories
- D. CSA - Canadian Standards Association
- E. ISO - International Standards Organization
- F. IEC - International Electrotechnical Commission

1.3 SUBMITTALS

- A. Submittals shall include the following:
 - 1. Submittal data cover sheet
 - 2. Unit description sheet
 - 3. Dimensional print
 - 4. Sales bulletin
 - 5. Piping diagram
 - 6. Wiring diagram
 - 7. Instruction manual

1.4 QUALITY ASSURANCE

- A. The manufacturer shall have a minimum of 20 years experience in the design and construction of condensate return equipment.
- B. The manufacturer shall be fully certified by the International Standards Organization per ISO 9001. Proof of this certification shall be furnished at the time of submittal.
- C. The manufacturer shall carry a minimum product liability insurance of \$5,000,000.00 per occurrence.
- D. All control cabinet components shall be U.L. listed or recognized. The control panel assembly shall be listed by Underwriters' Laboratories, Inc.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with these specifications, the following manufacturers shall be acceptable:
 - 1. ITT Bell & Gossett Domestic™ MJ™
 - 2. Pre-approved equal

2.2 COMPONENTS

- A. Air and water separation chamber
 - 1. Receiver shall be of close grained cast iron construction (warranted for 20 years from the date of shipment against failure due to corrosion) or steel (1 year warranty).
 - 2. The cfm capacity of the unit shall be as indicated on the drawings.
 - 3. Receiver shall be furnished with:
 - a. Control equipment:
 - 1.) (1) Double pole vacuum switch
 - 2.) (1) Probe style level detector
 - 3.) (1) Temperature limit switch
 - b. (1) Angle Thermometer
 - c. (1) Suction swing check valve
 - d. (1) Multijet vacuum producer
 - e. (1) Vacuum gauge
 - f. (1) Vacuum breaker
 - g. (1) Water level gauge glass for visual tank inspection
 - h. (2) Lifting eye bolts

B. WATER PUMP

- 1. The water pump shall be centrifugal design, bronze fitted with enclosed cast bronze centrifugal impeller, permanently aligned and flanged mounted for vertical operation.
- 2. Capacities and electrical characteristics for the pump shall be scheduled on the drawings.
- 3. Each pump shall be close-coupled to a 1750 or 3500 rpm, vertical, drip-proof motor.
- 4. Carbon/ceramic mechanical shaft seal shall be rated for 250°F (121°C).
- 5. The pump shall be rated and tested according to the latest ASRAE Standard Code for "Return Line Low Vacuum Heating Pumps," 5.5 inches Hg and 160°F (71°C).
- 6. Each pump shall include:
 - a. Dynamically balanced cast bronze impeller
 - b. Renewable bronze case ring
 - c. Stainless steel shaft
 - d. Discharge gauge port tapping
 - e. Drain tapping

C. CONTROL PANEL

- 1. The control panel shall be a mounted and wired NEMA 2 control cabinet with drip lip and piano hinged door enclosing the following:
 - a. (1) Combination magnetic contactor with adjustable thermal overload protection with fused disconnect and cover interlock
 - b. (1) "Auto-Off-Continuous" selector switch
 - c. (1) Numbered terminal strip
 - d. (1) Fused control circuit transformer when the motor voltage exceeds 230 Volts

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install equipment in accordance with manufacturer's instructions.
- B. Power wiring, as required, shall be the responsibility of the electrical contractor. All wiring shall be performed per manufacturer's instructions and applicable state, federal, and local codes.
- C. All factory wiring shall be numbered for easy identification and the numbers shall coincide with those shown on the wiring diagram.
- D. All interconnecting wiring between the pump controls and control panel shall be enclosed in liquid tight flexible conduit.
- E. The unit shall be factory tested as a complete unit and the unit manufacturer shall furnish elementary and connection wiring diagrams, piping diagrams, installation and operation instructions.
- F. The unit manufacturer shall furnish, mount on the unit and wire a NEMA 2 control cabinet with drip lip and piano hinged door.
- G. The unit shall be shipped completely assembled.
- H. Certified test report shall be provided by the factory.
- I. Unit shall be a Domestic™ Series MJ™ as manufactured by Bell & Gossett, ITT Industries, Morton Grove, IL.

Domestic® Series MJ™ Industrial, Clinical & Laboratory Simplex Vacuum Units

STANDARD UNIT FEATURES:

- Cast iron (20 Year Warranty) or steel (1 Year Warranty) separation chamber
- Multi-jet vacuum producer
- Suction check valve
- Automatic hurling water controls
- Temperature limit switch
- Water level gauge and thermometer
- Centrifugal pump with open drip proof motor
- Vacuum switch, diaphragm type, double pole

OPTIONAL EQUIPMENT AS SPECIFIED:

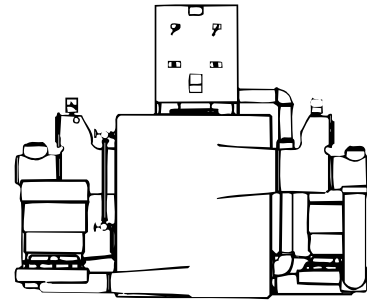
- Steel separation chamber
- NEMA 2 – U.L. Listed Control Panel
- TEFC or Explosion Proof motors and controls
- Vertical or horizontal storage tank including vacuum gauge and vacuum breaker
- Vertical storage tank has liquid level gauge and flush port
- Liquid tight conduit furnished with mounted and wired panel
- Vacuum gauge

10 SOLID REASONS TO CHOOSE DOMESTIC®:

- Durable cast iron or steel separation chamber
- Bronze fitted pump
- Renewable bronze wearing ring
- Quiet ball-bearing type motor
- Mechanical seal construction
- Factory wired and tested before shipment available
- Packaged construction for compact installation
- Stainless steel pump shaft
- Engineered reliability
- 100 years of experience

Guide Specification

Domestic® Series MJ™ Industrial, Clinical & Laboratory Duplex Vacuum Units



NOTE: Optional Accessories are Underlined

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Unit shall be a Domestic™ Series MJ™ duplex vacuum heating and condensate pumping unit as manufactured by ITT Bell & Gossett
 - 1. (1) Cast iron or steel air and water separation chamber
 - 2. (2) Multi-jet vacuum producer
 - 3. (2) Dual purpose pump
 - 4. (1) Vacuum and float controls
 - 5. (1) Pump Control Panel

1.2 REFERENCES

- A. HI - Hydraulic Institute
- B. NEMA - National Electric Manufacturers Association
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 - 4. Sales bulletin
 - 5. Piping diagram
 - 6. Wiring diagram
 - 7. Instruction manual

1.4 QUALITY ASSURANCE

- A. The manufacturer shall have a minimum of 20 years experience in the design and construction of condensate return equipment.
- B. The manufacturer shall be fully certified by the International Standards Organization per ISO 9001. Proof of this certification shall be furnished at the time of submittal.
- C. The manufacturer shall carry a minimum product liability insurance of \$5,000,000.00 per occurrence.
- D. All control cabinet components shall be U.L. listed or recognized. The control panel assembly shall be listed by Underwriters' Laboratories, Inc.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with these specifications, the following manufacturers shall be acceptable:
 - 1. ITT Bell & Gossett Domestic™ MJ™
 - 2. Pre-approved equal

2.2 COMPONENTS

- A. Air and water separation chamber
 - 1. Receiver shall be of close grained cast iron construction (warranted for 20 years from the date of shipment against failure due to corrosion) or steel (1 year warranty).
 - 2. The cfm capacity of the unit shall be as indicated on the drawings.
 - 3. Receiver shall be furnished with:
 - a. Control equipment:
 - 1.) (1) Double pole vacuum switch
 - 2.) (1) Probe style level detector
 - 3.) (1) Temperature limit switch
 - b. (1) Angle Thermometer
 - c. (2) Suction swing check valve
 - d. (2) Multijet vacuum producer
 - e. (1) Vacuum gauge
 - f. (1) Vacuum breaker
 - g. (1) Water level gauge glass for visual tank inspection
 - h. (2) Lifting eye bolts

B. WATER PUMPS

- 1. The water pumps shall be centrifugal design, bronze fitted with enclosed cast bronze centrifugal impeller, permanently aligned and flanged mounted for vertical operation.
- 2. Capacities and electrical characteristics for the pump shall be scheduled on the drawings.
- 3. Each pump shall be close-coupled to a 1750 or 3500 rpm, vertical, drip-proof motor.
- 4. Carbon/ceramic mechanical shaft seal shall be rated for 250°F (121°C).
- 5. The pump shall be rated and tested according to the latest ASRAE Standard Code for "Return Line Low Vacuum Heating Pumps," 5.5 inches Hg and 160°F (71°C).
- 6. Each pump shall include:
 - a. Dynamically balanced cast bronze impeller
 - b. Renewable bronze case ring
 - c. Stainless steel shaft
 - d. Discharge gauge port tapping
 - e. Drain tapping

C. CONTROL PANEL

- 1. The control panel shall be a mounted and wired NEMA 2 control cabinet with drip lip and piano hinged door enclosing the following:
 - a. (2) Combination magnetic contactor with adjustable thermal overload protection with fused disconnect and cover interlock
 - b. (2) "Off-Lead-Lag-Continuous" selector switch
 - c. (1) Numbered terminal strip
 - d. (1) Fused control circuit transformer when the motor voltage exceeds 230 Volts

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install equipment in accordance with manufacturer's instructions.
- B. Power wiring, as required, shall be the responsibility of the electrical contractor. All wiring shall be performed per manufacturer's instructions and applicable state, federal, and local codes.
- C. All factory wiring shall be numbered for easy identification and the numbers shall coincide with those shown on the wiring diagram.
- D. All interconnecting wiring between the pump controls and control panel shall be enclosed in liquid tight flexible conduit.
- E. The unit shall be factory tested as a complete unit and the unit manufacturer shall furnish elementary and connection wiring diagrams, piping diagrams, installation and operation instructions.
- F. The unit manufacturer shall furnish, mount on the unit and wire a NEMA 2 control cabinet with drip lip and piano hinged door.
- G. The unit shall be shipped completely assembled.
- H. Certified test report shall be provided by the factory.
- I. Unit shall be a Domestic™ Series MJ™ as manufactured by Bell & Gossett, ITT Industries, Morton Grove, IL.

Domestic® Series MJ™ Industrial, Clinical & Laboratory Duplex Vacuum Units

STANDARD UNIT FEATURES:

- Cast iron (20 Year Warranty) or steel (1 Year Warranty) separation chamber
- Multi-jet vacuum producer
- Suction check valves
- Automatic hurling water controls
- Temperature limit switch
- Water level gauge and thermometer
- Centrifugal pump with open drip proof motor
- Vacuum switches, diaphragm type, double pole

OPTIONAL EQUIPMENT AS SPECIFIED:

- Steel separation chamber
- NEMA 2 – U.L. Listed Control Panel
- TEFC or Explosion Proof motors and controls
- Vertical or horizontal storage tank including vacuum gauge and vacuum breaker
- Automatic electric alternation
- Liquid tight conduit furnished with mounted and wired panel
- Vacuum gauge

10 SOLID REASONS TO CHOOSE DOMESTIC®:

- Durable cast iron or steel separation chamber
- Bronze fitted pump
- Renewable bronze wearing ring
- Quiet ball-bearing type motor
- Mechanical seal construction
- Factory wired and tested before shipment available
- Packaged construction for compact installation
- Stainless steel pump shaft
- Engineered reliability
- 100 years of experience

Domestic® Series MJ™ Industrial, Clinical & Laboratory Quad Vac Units (680 MJ)

- Similar to Duplex Units except Quad Units have 4 each 10 or 15 HP pumps.
- Paired vacuum producers run together to double the capacity of 160 MJ units.

Engineering Data

Domestic® Series MJ™
Industrial, Clinical & Laboratory Vacuum Units

The size and capacity of clinical vacuum pumps depends on the number of outlets and their location. The following rating table is based on data published by the Corps of Engineers, U.S. Army, in the Engineering Manual for military construction.

OUTLET	CFM (FREE AIR)* AT THE OUTLET	SIMULTANEOUS USE FACTOR
Operating rooms, general medical	1.0	1.0
Dental operating	.5	.2
Patients room, wards, nurseries	.5	.2
Laboratories, pharmacies	.5	.4
Operating, eye, ear, nose, throat	.5	.2
Surgical, acute medical, and single rooms for decompression (TB Hospitals)	1.0	1.0
Recovery	.5	1.0
Broncography (TB Hospitals)	.5	.2
Emergency	1.0	1.0
Autopsy	1.0	1.0
O.B. Rooms	1.0	1.0

*Free Air capacity is the amount of air, expressed in cubic feet per minute at a barometric pressure of 29.92" Hg and 60°F, that can be pulled from hospital rooms with a given vacuum.

PUMP SIZE

List the outlets by location and their rating in CFM of "Free Air." Multiple these figures by the number of outlets and the simultaneous use factor. Assuming, for example, that 5 laboratory outlets are required, the circulation will be as follows:

No. Outlets

5

x

Free Air

.5

x

Simultaneous
Use Factor

.4

=

1 cfm

After the requirements for each category have been determined, the sum of these figures represents the maximum pump load in cfm of "Free" or atmospheric air. This must be converted to cfm at the vacuum for the purpose of selecting the unit.

Vacuum requirements range usually from 15" Hg to 20" Hg at the pump suction. The following conversion factors should be applied to the total demand to convert "Free" atmospheric (29.92" Hg barometer) to air at the vacuum:

VACUUM	MULTIPLY cfm FREE AIR by:
15" Hg	2
20" Hg	3

These conversion factors are based on a barometer of 29.92" Hg. The required air capacity, however, can be more accurately calculated by using the following formula which compensates for varying barometric pressures at high elevations.

$$Q_v = \frac{Q_A \times B}{(B - V_a)}$$

Where: Q_v – Air in cfm at the vacuum.
 Q_A – "Free" or atmospheric air in cfm.
 B – Barometer (in inches Hg).
 V_a – Vacuum (in inches Hg).

For example, assuming a barometric pressure of 29" Hg, an operating vacuum of 15" Hg and a maximum requirement of 25 cfm of "Free Air" the pump should have a capacity of:

$$Q_v = \frac{25 \times 29}{(29 - 15)} = 51.8 \text{ cfm}$$

expanded air at the vacuum.

A No. 100S7¹/₂-17 simplex unit rated 62 cfm at 15" Hg would adequately meet this requirement. Duplex units are usually required to carry the full peak load on either pump.

TABLE I. FRICTION LOSSES (F) IN INCHES Hg PER 100 FEET OF EQUIVALENT PIPE LENGTH AND VELOCITIES (V) IN FEET PER MINUTE AT 15" Hg VACUUM*

SIZE	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/4"	3"	4"	SIZE
CFM	F V	F V	F V	F V	F V	F V	F V	F V	F V	CFM
1	.073									1
2	.29	.038								2
3	.65 2190	.086								3
4	1.16 2020	.15	0.36							4
5	1.80 3650	.24	0.56	.018						5
6		.34	.081	.027						6
7		.46	.11	.036						7
8		.61	.14	.047	.019					8
9		.77 2900	.18	.060	.024					9
10		.95 3220	.23	.074	.030					10
15		2.15 4850	.50	.17	.067	.016				15
20			.91 3640	.30	.12	.028				20
25			1.42 4550	.46	.19	.044				25
30			2.04 5450	.67	.27	.064	.021			30
35				.91 4070	.37	.087	.028			35
40				1.19 4650	.48	.11	.037			40
45				1.52 5250	.61	.15	.047			45
50					.74 4030	.18	.057	.016		50
60					1.07 4840	.25	.083	.024		60
70					1.46 5640	.35	.11	.032		70
80						.45	.15	.042	.014	80
90						.57 4100	.19	.053	.018	90
100						.71 4540	.23	.066	.022	100
*Friction Loss (F) Conversion Factors for Operation at:										
125		Inches Hg Vacuum	Multiply (F) by			1.11 5680	.36	.10	.034	125
150							.52 4360	.15	.050	150
175							.71 5080	.20	.067	175
200		10	1.31				.92 5820	.26 4040	.088	200
250		20	.77							
300		25	.33					.41 5040	.14 2840	250
400								.59 6060	.20 3410	300
								1.05	.35 4550	400

PIPING FOR CENTRAL VACUUM SYSTEMS

Several factors have to be considered in vacuum suction system sizing. Air at less than atmospheric pressure is expanded. As a result, friction losses are smaller per cfm of air flow and greater flow rates can be moved through the piping. Greater flow rates and increased velocities can cause excessive line noise. It has been generally satisfactory to select pipe sizes large enough to: (1) limit velocities to 5,000 ft./min. and/or, (2) limit the pressure drop due to friction to 1" Hg per equivalent 100 feet of pipe.

The total friction of pressure drop should not exceed 4" Hg between the most remote outlet and the vacuum unit. Pipe size, except risers to individual outlets should not be less than 3/4". Risers to individual outlets should not be less than 1/2" and mains not less than 1".

Table 1 permits the designer to select pipe sizes considering these limitations. Friction losses have been calculated based on the following simplified formula, derived from Fanning's equation:

$$Q = \frac{P \cdot d^5}{W \cdot L} \text{ Where:}$$

Q – Quantity air cfm at the vacuum.
P – Pressure difference, psi (1 psi = 2.04" Hg).
d – Inside diameter of pipe in inches (nominal).
W – Weight of air, pounds per cubic foot at the vacuum.
L – Length of pipe, feet.

Velocities have been calculated from:

$$V = \frac{Q}{A} \text{ Where:}$$

V – Velocities in feet per minute.
Q – Quantity in cfm.
A – Area of pipe in square feet.

Friction losses as well as velocities are based on nominal pipe diameters. They can, therefore, be considered satisfactory for commercial steel, brass, pipe or copper tube.

TABLE II. RESISTANCE OF FITTINGS & VALVES TO AIR FLOW IN EQUIVALENT LENGTH (FT.) OF STRAIGHT PIPE

SIZE	90° ELBOW	TEE BRANCH FLOW	GATE VALVES (OPEN)
1/2"	2.0	2.6	2.0
3/4"	2.2	2.8	2.0
1"	2.9	3.6	2.5
1 1/4"	3.5	4.5	3.0
1 1/2"	3.9	5.8	3.1
2"	4.5	7.2	3.4
2 1/2"	5.0	9.0	3.6
3"	5.7	10.5	3.9
4"	6.0	14.0	4.2

Domestic® Series MJ™ Units

Description of Standard and Optional Equipment and Controls

Separation Chamber – Unit sizes 20, 50 and 100 are close grained cast iron construction. All units equipped with 10 and 15 HP motors (160, 680 sizes) are heavy fabricated steel construction.

Multi-Jet Vacuum Producer – Consists of a simple, efficient nozzle and venturi assembly. By design, it does not require close clearances or critical adjustments. Its proven ability to retain original efficiencies eliminates any need for oversizing. Nozzle – Bronze; Venturi – Cast Iron.

Centriflo® Centrifugal Pumps – Vertical, close coupled and permanently aligned. These pumps feature bronze fitted construction with enclosed one-piece bronze impeller and renewable wearing ring.

Electric Motors – Vertically mounted, drip-proof, ball bearing type. Standard voltages are: Three phase – 208-230/460V. Single phase – 115/230V. Single phase motors 2 HP and smaller have built-in overload protection.

Special Motors – Motors wound for other than standard voltages are available at extra cost. When open drip-proof construction is not adequate, motors with totally enclosed, explosion proof or other special enclosures can be furnished.

Combination Magnetic Starters – are available with fusible disconnect switches or circuit breakers. Safety cover interlocking switches are furnished with combination starters. Enclosures are available to comply with JIC specifications. NEMA 2 enclosures are standard.

Magnetic Starters – automatic across-the-line type are furnished. Manual reset over-loads are standard equipment ... for the protection of all windings of 3 phase motors against open circuit and/or unbalanced conditions.

A starter is capable of interrupting ten times motor full load current, but short circuit currents may be many times greater. Fuses or circuit breaker must be installed ahead of the starter to clear any such faults that may occur or protect the line wiring.

Selector Switches – Single units are available with “Automatic-Off-Continuous” positions. Duplex units can be furnished with “Off-Lead-Lag-Continuous” positions for each pump when “Lead-Lag” controls are furnished.

Manual Sequence Control (Lead-Lag) – for duplex units, consists of 2 selector switches used in conjunction with 2 magnetic starters and 2 vacuum switches. this control provides for (1) Manual selection of the active pump, (2) Simultaneous operation of both pumps under abnormal load conditions and (3) Automatic operation of the inactive or lag pump of the lead pump or its control fails.

Automatic Hurling Water Control – Automatically replaces hurling water evaporated from the unit. It consists of a float, float switch and solenoid valve.

Temperature Hurling Water Control – Preset at factory to admit cooling water intermittently, only as governed by operating conditions. The switch has adjustable range and differential.

Vacuum Switch – Diaphragm type, double pole switch with minimum differential of 4" Hg. Both range and differential are adjustable.

Vacuum Storage Tank – A separate, steel construction, hot dipped galvanized vacuum storage tank is available, either suspended horizontal, or vertical floor mounted type. The tank is fitted with vacuum gauge and vacuum breaker. Vertical floor mounted tanks include gauge glass and flushing port.

Accessories – Thermometer and water level gauge are heavy duty, industrial type.

Electrical Alternator – For duplex units. This control consists of an automatic electrical sequence relay used in conjunction with 2 magnetic starters, 2 vacuum switches and 2 selector switches. When magnetic starters and selector switches are furnished by us, the alternator is installed in the “Consolitol” cabinet. This control provides for (1) Automatic transfer of operating sequence after each cycle, (2) Simultaneous operation of both pumps under peak load conditions and (3) Automatic operation of the inactive or lag pump if the lead pump or its control fails.

Control Circuit Transformers – Are available and required for all JIC specifications and motor voltages exceeding 250V. One transformer is used for each motor to allow one pump to operate while another is disconnected from its power source.

Special Vacuum Storage Tanks – Standard tanks are hot dipped galvanized. Vertical and horizontal storage tanks can also be furnished without galvanizing or ASME constructed.

EQUIPMENT SELECTION NOTES

Mufflers – No type of silencer is required for Series MJ units because they are inherently quiet; the noise level being limited to the sound emanating from the motor.

Vibration Eliminators – *Not* required except under the most unusual circumstances. The absence of heavy moving parts, the use of well balanced centrifugal pump impellers and smooth, non-pulsating pumping action provide virtually vibration-free operation.



Xylem Inc.
8200 N. Austin Avenue
Morton Grove, Illinois 60053
Phone: (847) 966-3700
Fax: (847) 965-8379
www.bellgossett.com