CENTRIFUGAL PUMPS
MODEL QM SERIES

IOM MANUAL

INSTALLATION, OPERATION AND MAINTENANCE (IOM) INFORMATION

PLEASE LEAVE THIS MANUAL FOR OWNER'S USE

SAFETY INSTRUCTIONS

Read this manual carefully to learn how to safely install and operate your pump. Throughout this manual there are a number of SAFETY HAZARDS that must be read and adhered to in order to prevent possible personal injury and/or damage to the equipment.

Three keywords, "DANGER", "WARNING", and "CAUTION", are used to indicate the potential severity of the hazard, and are preceded by a SAFETY ALERT SYMBOL. Failure to follow the safety-related instructions may result in a safety hazard.

DANGER Indicates an imminently hazardous situation which, if not avoided, *WILL* result in serious injury or death.

WARNING Indicates a potentially hazardous situation which, if not avoided, *COULD* result in serious injury or death.

CAUTION Indicates a potentially hazardous situation which, if not avoided, *MAY* result in minor or moderate injury.

THOROUGHLY REVIEW ALL INSTRUCTIONS AND WARNINGS PRIOR TO PERFORMING ANY WORK ON THIS PUMP.

DANGER
Hazard

PUMP HOUSING PRESSURE MAY NOT EXCEED 300 PSIG!

Introduction:

Because pump installations are seldom identical, this manual cannot possibly provide detailed instructions and precautions for each specific application. Therefore, it is the responsibility and the duty of all personnel involved in the installation, operation and maintenance of the equipment to ensure that applications not addressed in this manual are performed only after establishing that neither operator safety nor pump integrity is compromised by the installation.

Pre-Installation Check:

WARNING
Hazard

Open all cartons and inspect for shipping damage. Report any damage to your supplier or shipping carrier immediately.

Always verify that the pump nameplate Voltage, Phase, and Horsepower ratings as well as Amps rating on motor match your control panel and power supply. Warranty does not cover damage caused by connecting pumps and controls to an incorrect power source (i.e., voltage and phase).

Installation:

WARNING
Hazard

Electrical connections are to be made by a qualified electrician in accordance with the National Electrical Code (NEC) or the Canadian Electrical Code, as well as all national, state and local codes. Code questions should be directed to your local electrical inspector. Failure to follow electrical codes and OSHA safety standards may result in personal injury or equipment damage. Failure to follow manufacturer's installation instructions may result in unsatisfactory performance, electrical shock, fire hazard, personal injury or death, damaged equipment, and may void the manufacturer's warranty.

Motor must have a properly sized starter with a properly sized heater to provide overload and under voltage protection.

Pump should not be subjected to pressures beyond its design ratings. Failure to follow these instructions could result in serious injury or death.

Operating personnel should be trained in the operation of the pump and any associated system.

Handling:

WARNING
Hazard

Any lifting eyes supplied on pumps are intended for lifting pump only—NOT complete unit.

Site Inspection:

CAUTION
Hazard

The pump should be of the proper size and capacity for the proposed installation. Refer to nameplate for rated capacities. Check motor voltage against available power supply.

Compounds from a chemical feed tank should be injected into the discharge piping of the boiler feed pumps—NEVER ahead of pump into the pump suction piping. Failure to follow these instructions could result in minor or moderate injury as well as property damage.

Unit and/or Pump Location:

If pump and motor is operating at high or low temperatures, insulate and ventilate as required.

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The pumps are typically furnished with motor classified as either Open Drip Proof (ODP) or Totally Enclosed, Fan Cooled (TEFC). Depending upon the application, other classifications (e.g., Explosion Proof) are available. Locate pumps only in areas of the proper classification. See motor data and NEMA classifications.

The pump should be located at a low point in the piping that keeps the impeller flooded. Consult factory for suction lift applications and use of foot valves. The ambient conditions should be checked with the motor data. A high ambient temperature *will cause* thermal overload protection to shut off the pump. To facilitate maintenance, place unit for easy access to all parts. Allow adequate space for servicing.

Seal Flush Line (or Bleed Line):

Pump seal flush line contains HOT condensate. Failure to close valve or drain line could result in serious injury (i.e., burns) or death.

Failure to connect seal flush line may cause mechanical seal and motor failures.

SHIPCO® pumps are manufactured with provisions for a seal flush line. This line helps prevent the pump from vapor binding and allows the pump to operate against a dead shut-off for periods of time without damaging the seals.

If distance from pump to receiver is greater than 12" but shorter than or equal to 48", use 1" schedule 40 pipe after the first 12" run of copper tubing. If distance is greater than 48", use 1½" schedule 40 pipe after first 12" run of tubing. A valve for maintenance should be installed in the seal flush line. The valve *must remain open* at all times unless pump is removed for servicing. If you can meet above requirements, contact factory.

Bypass Lines:

Pump bypass line contains HOT condensate. Failure to close valve or drain line could result in serious injury (i.e., burns) or death.

Failure to connect bypass line will cause mechanical seal and motor failures.

On complete units, the manufacturer will install the bypass line. When pump assemblies are purchased separately, the manufacturer will supply a bypass that must be installed from the discharge piping (immediately after the pump discharge flange) back into the receiver entering below the water line. Make sure an isolation valve is also installed in the discharge line for servicing. The isolation value must remain open during operation of pump.

Suction Piping—Floor or Elevated Units:

Pump suction line contains HOT condensate. Failure to close valve or drain line could result in serious injury (i.e., burns) or death.

An isolation valve should be installed in the suction piping between the receiver and pump suction for servicing the pump. The valve should be sized to allow an adequate flow of water to meet the Net Positive Suction Head (NPSH) requirement of the pump.

Suction Piping — Elevated Units Only:

If pump is not bolted (i.e., flange mounted) onto the side of a floor-mounted unit (i.e., tank is elevated above pump), always install a section of straight, horizontal pipe (5 pipe diameters minimum) between the suction of the pump and first elbow.

The recommended suction piping size is shown in the following table:

Suction Pipe Diameter	Maximum GPM 210° F or less	Maximum GPM Greater than 210° F
2″	52	30
2½″	75	43
3″	114	66
4″	200	116
5″	312	181
6″	450	261
8″	750	450
10″	–	750

If size of tapping in tank for suction pipe is larger than pump suction connection, an eccentric reducer must be mounted with flat upward to prevent air binding.

Support the suction and discharge piping independently by using pipe hangers near the pump. Line up the vertical and horizontal piping so that the bolt holes in the pump flange match the bolt holes in the pipe flange. **Do not attempt to spring** the suction discharge lines into position.

The code for pressure piping (ASME Section 1) must be followed as well as any local and state codes.

If considerable condensate temperature changes are anticipated and/or unit is installed within a seismic zone, then fittings for absorbing expansion should be installed in the system in a way to avoid strain on the pump due to potential movement.

For new installation, pump suction strainers are **not to be installed** in the suction piping on the suction side of a *centrifugal* pump. Strainers can shut off or restrict flow of water resulting in failure of pump and/or mechanical seal. In addition, the Available NPSH cannot be calculated when a suction strainer is included. Instead, strainers should be installed in the return lines at the inlet tapping of the receiver and also in the make-up water lines.

For retrofit application with an existing suction strainer, be sure to remove any suction strainer when installing a SHIPCO® centrifugal pump.

Discharge Piping:

A spring-loaded check valve **must be installed** in the discharge piping near to the pump to prevent backflow into the unit. Next, a *circuit setter or automatic flow control valve* (e.g., ball valve, globe valve) **must be installed** near to the pump discharge flange or union to "balance the pump" (i.e., adjusting discharge flow of the pump to keep it running at the design operating conditions for flow rate and discharge pressure). A gate valve **should not be used** as a flow control valve. Note that some people refer to the term "balancing the pump" as either "throttling the pump" or "choking the pump."

Notes on Piping:

1. The piping should include isolation valves on both the suction and discharge sides of the pump and have a drain valve in the suction line.
2. When installing the suction and discharge connections to a threaded pump housing, a Teflon tape sealer or a high quality thread sealant is recommended.

Electrical Wiring:

Pumps are furnished for the most widely used voltages. Make sure the motor wiring, starters, transformers etc., match the power supply before installing. Controls, starter coils, etc., should match the control voltages. The secondary side of transformer is the control circuit.

Single-phase motors are usually furnished as dual 115/230/1/60. Motors should be connected according to manufacturer's instructions for correct voltage.

Three-phase motors are usually furnished as tri-voltage 208/230/460/3/60. Motors should be connected according to manufacturer's instructions for correct voltage.

1. Isolation Valve on Suction, Discharge, and Recirculation lines
2. Spring loaded non-slam check valve on discharge
3. Throttling valve on discharge
4. Suction pipe reducers must be Eccentric with the flat on top.
5. Optional pressure gauge locations
6. Optional pipe expansion joint
7. Suction piping drain port
8. Pump drain port
9. Pump air bleed port
10. Optional bypass location
11. Verify that the pump base arrow is in the direction of flow.
12. Increase manifold size based on total flow from all pumps.
13. Avoid elbows between the recirculation orifice and the tank.

Avoid horizontal elbows in suction piping because they induce vortexing.
Avoid strainers in suction piping because they cut NPSHa and choke flow.

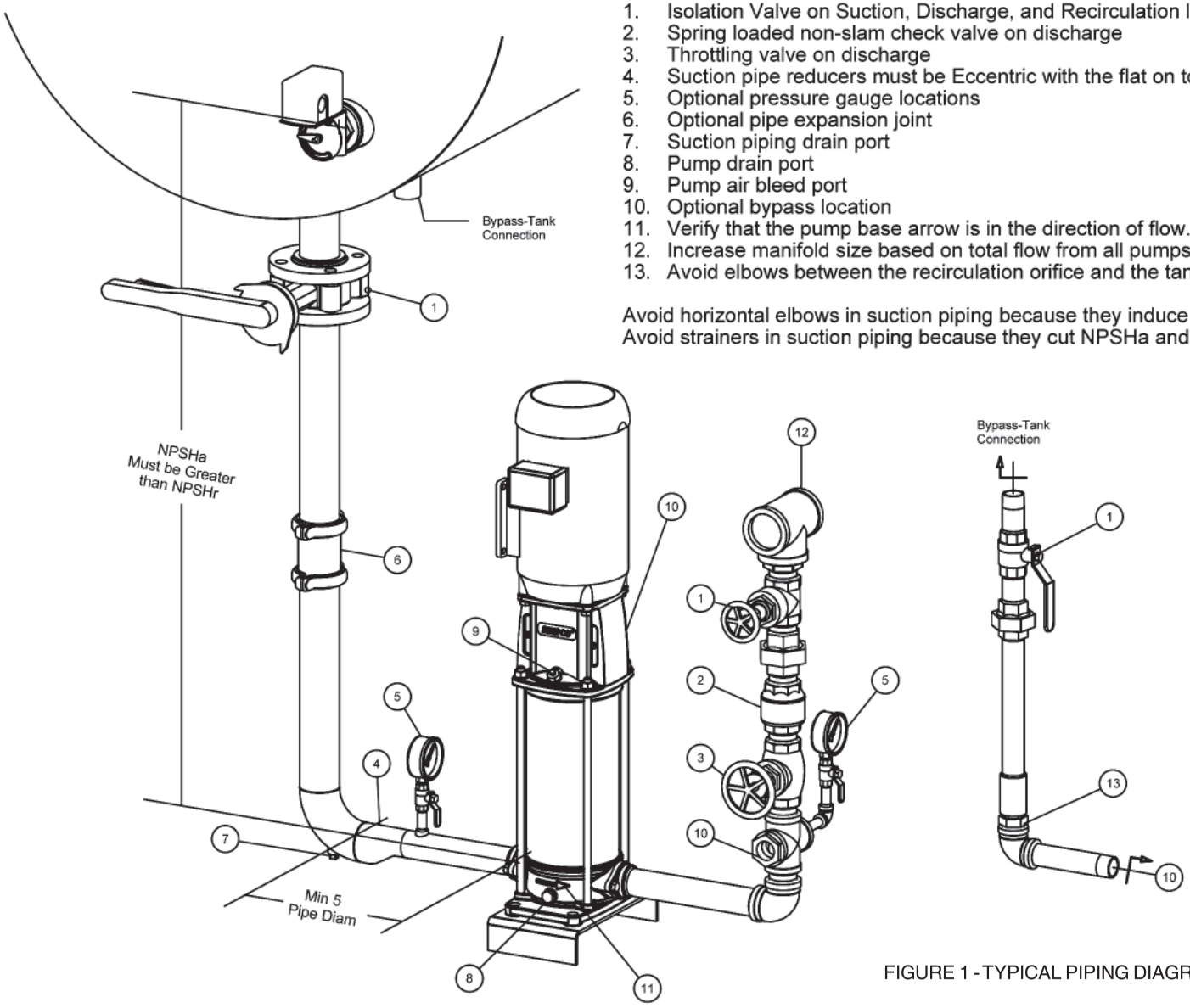


FIGURE 1 - TYPICAL PIPING DIAGRAM

DANGER: PUMP HOUSING PRESSURE MAY NOT EXCEED 300 PSIG!

WARNING: All warranties, including warranties of merchantability and fitness for a particular purpose, will be void and the manufacturer will not be liable for any malfunction, damage, injury, or destruction of property if the equipment is not installed by professionals, licensed and registered as required or in accordance with specification drawings as prepared by professionals, licensed and registered as required or in accordance with all local, state, and federal codes.

Maximum HP Maximum Volts					NEMA Size	Maximum Voltage	Class K5 or R Fuse (Ampere)	Class K1 or J Fuse (Ampere)	Inverse–Time Circuit Breaker (Ampere)
Single Phase		Three Phase							
115v	230v	208v	250v	600v					
⅓	1	1½	1½	2	00	600	10	15	15
						250	12	15	15
1	2	3	3	5	0	600	20	30	20
						250	25	30	35
2	3	7½	7½	10	1	600	30	60	40
						250	40	60	60
–	–	10	15	25	2	600	60	100	80
						250	60	100	90
–	–	25	30	50	3	600	100	200	125
						250	125	200	150

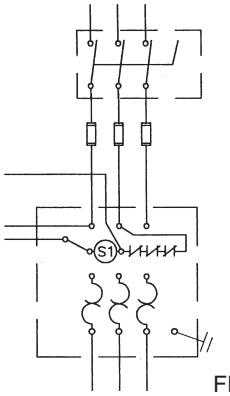


FIGURE 2

Confirm that the nameplate data on the control panel[s] of the furnished unit match the supply current. If the nameplate data does not match the power source, consult factory.

Wire in accordance with the National Electrical Code, state and local codes where applicable.

Short Circuit Protection:

According to the National Electrical Code, branch circuit over current protection must be provided for each contactor or starter. The following table is provided as a guide. DO NOT EXCEED MAXIMUM PROTECTIVE DEVICE RATINGS.

Lubrication Maintenance — Motor:

Maintenance should include:

a) Checking general state of motor and motor bearings

b) Cleaning and lubrication

General Inspection:

Inspect the motor at regular intervals. Typical recommended intervals are approximately every 500 hours of operation or every 3 months, whichever occurs first. However, interval recommendations vary by manufacturer.

Keep the motor clean and the ventilation openings clear. If motor is not properly ventilated, overheating can occur and cause early motor failure.

Motor noise should be measured at regular intervals of one to four months depending on the local operating conditions. A well-tuned ear is perfectly capable of distinguishing unusual noises, even with rudimentary tools such as screwdriver, etc., without recourse to sophisticated listening aids. A uniform hum is a sign that a bearing is running perfectly.

Bearing temperature control is also part of routine maintenance. The temperature of bearings should not exceed 158°F. Constant temperature control is possible with external thermometers or by embedded thermal elements. Bearings should be lubricated to avoid metallic contact of the moving parts, and also for protection against corrosion and wear. Lubricant properties deteriorate in the course of time and mechanical operation. Also, all lubricants are subject to contamination under working conditions. Therefore, lubricants must be renewed and replaced from time to time.

Lubrication Schedule:

Refer to motor manufacturer maintenance specification.

Rotation:

The pump must rotate CLOCKWISE when viewed from the motor end.

Startup: Putting the Pump into Service:

(See Steps 1-3 below) **WARNING** Electrical Hazard

Disconnect and lock-out/tag-out power before connecting or servicing. Failure to follow these directions could result in serious injury or death.

(See Steps 4-5 below) **WARNING** Heat/Hot Surface

Pump bypass line and suction housing may contain HOT condensate. Take proper precautions to avoid serious injury (i.e., severe burns) or death.

(See Step 6 below) **CAUTION** Hazard

Reverse rotation can cause severe damage to pumps. Jog the motor to test for proper direction of rotation.

Failure to follow these directions could result in minor or moderate injury or property damage.

1. Make sure the unit is piped in accordance with system design.
2. Check power leads in accordance with wiring diagrams.
3. Check motor wiring in accordance with available voltage.
4. Avoid freezing conditions after receiver of unit has been filled.
5. Prime pump with fluid to prevent possible damage to pump seals. Use the bleed port valve to purge air from the pump, suction, discharge, seal flush and recirculation lines.
6. Check for proper rotation of all three-phase motors. **Rotation must be clockwise** looking down on the motor as indicated by directional arrows on pump. If pump runs backwards (i.e., counterclockwise), interchange two wires on three-phase motors.
7. With no other downstream restrictions, throttle the discharge flow control valve until desired discharge pressure is achieved.

Both the manual balancing and the automatic flow control valves are used to set pump discharge pressure at the design operating conditions (i.e., flow rate and discharge pressure) to prevent motor overload and cavitations.

Special Startup Considerations:

a. *Filling "Cold" Boiler With Feed Pumps:* When centrifugal pumps are being used on either a boiler feed unit or deaerator, the pumps should not be used to fill a high pressure (i.e., operating pressure of 15 PSIG or higher) with water when the boiler is cold. When boiler is started up, there is no back-pressure on the pump. Without any back-pressure, the pump will "run out the curve" causing pump cavitations that will severely damage the pump.

However, if boiler feeds are used to fill a boiler, then the pump must be manually balanced to keep the pump at the design operating conditions and prevent pump cavitations. Manual balancing is required even if the pump is fitted with an automatic flow control valve. The automatic flow control valve is rated for a particular pressure range that allows the operating pressure in the boiler to fluctuate. However, the difference in operating pressure between boiler startup and the design operating pressure typically will exceed the pressure range of the automatic flow control valve rendering it ineffective at startup.

b. *Chemical Injection:* Any chemicals injected into the steam system should be added after the pumps—preferably into the pump discharge piping. Otherwise, chemical residuals will contribute to the premature failure of a pump's mechanical seal. This scenario frequently occurs on boiler feed and deaerator applications.

c. *Freezing Conditions*: Avoid freezing conditions after receiver of unit has been filled with condensate. Frozen water may cause the suction housing to crack.

Operation and Maintenance:

WARNING
Hazard

Failure to follow these directions could result in serious injury or death, including property damage.

Operators must be familiar with all sections of this manual to understand the operation of the unit.

Hot water or condensate, steam and electricity can be very dangerous and deadly.

While a properly installed unit should function unattended for long periods of time, periodic checks should be made to assure proper operation.

Problems such as overflow, noise, leaks, vibrations, etc., in a unit must be corrected immediately.

If pump is installed on a boiler feed unit, the pump must be operational and maintained to avoid jeopardizing the entire boiler and system operation.

Troubleshooting Checklist:

Pump Will Not Run:

1. Power supply has been interrupted. Disconnect switch is open or selector switch improperly positioned.
2. Improper voltage supplied to motor. Check voltage and wiring with motor characteristics.
3. Incorrect starter coil for power supply.
4. Overload relays in starter have tripped out and must be reset. Ambient temperature may be excessive.
5. Wiring to power source is incorrect or connections may be loose.
6. Control devices are in "open position."

GPM Capacity Is Reduced:

1. Pump is running backwards. **Rotation should be clockwise** looking down upon motor toward the pump. Rotation of three-phase motors can be corrected by interchanging any two of the three wires. (Note: a qualified electrician should perform any electrical service.)
2. Pump flow rate is not balanced to the pump design operating conditions.
3. Total pressure at pump discharge is greater than that for which the pump was designed. Check pressure requirements such as system back pressure, and friction and static head.
4. Excessive suction lift, incorrect piping or undersized discharge and/or suction piping.
5. A valve in the pump suction line or discharge line is closed too much. Check if valve in the pump discharge piping is installed backwards.
6. The eye of the impeller is blocked with trash or debris.
7. Pump is undersized for the system.
8. A strainer is dirty, causing a reduction in flow.
9. Pump has lost its prime. Release trapped air in the pump and reprime.
10. Steam traps are blowing through, causing the condensate to return at excessive temperatures. Depending on the unit and type of pump furnished, this could greatly reduce the capacity of the pump below its stated rating. Traps should be repaired or replaced.
11. Excessive temperatures. Capacity of pump may be reduced below its rating. Use applicable SHIPCO® pumps for low Required NPSH conditions.

Excessive Pump Noise:

1. Pump is running backwards. Check rotation by bumping the motor. Rotation should be clockwise while looking down at the rear of the motor.
2. Pump is working against a lower pressure than it was designed for—the pump is not balanced. Install a balancing valve, plug cock, or steam cock in the discharge line following the gate valve. Refer to piping diagram in Figure 1. (Note: Do not use a gate valve as a balancing valve. The seats in the gate valve will wear over time, causing the pump to lose its capability to balance the flow rate at the design operating conditions.) Adjust the balancing valve until the operating pressure at the pump discharge approaches the rated pump pressure.
3. Magnetic hum or bearing noise in motor. Consult the motor manufacturer's authorized service technician.
4. Starter chatters. Trouble is caused by low line voltage, poor connections, defective start coil or burned contacts.
5. Excessive ambient temperature. Correct the system conditions.
6. Entrained air. Release the trapped air pocket.
7. Boiler feed pumps loosing prime. Service check valves.

Representative Servicing:

If trouble occurs that cannot be rectified, contact your local SHIPCO® representative who will need the following information in order to give you assistance:

1. Provide all information on pump and motor from SHIPCO® nameplate (see examples below).
2. Suction and discharge pipe pressure gauge readings.
3. Ampere draw of the motor.
4. A sketch of the pump hook-up and piping.

SHIPCO®

Manufactured in USA
WWW.SHIPCOPUMPS.COM
(717) 532-7321

Serial	#####		
Part No	##################		
Imp Dia	# #/#		in.
Model	########		
PEI_{CL}	0.##	PEI_{VL}	0.##

← CW Rotation ←

300 psig Max. Do Not Deadhead. Do Not Run Dry.

Certified QC Passed

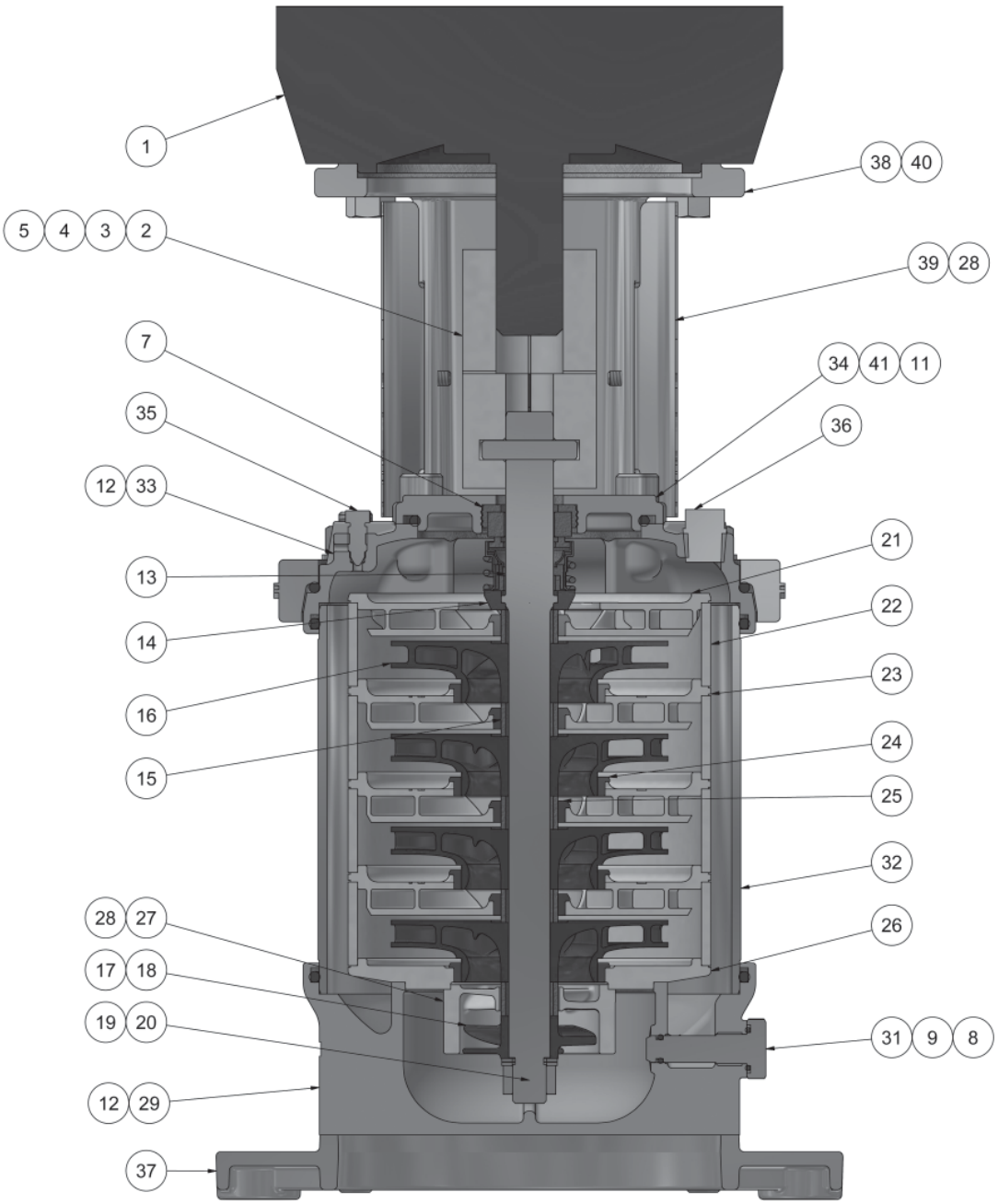
Model QM Pump Parts List

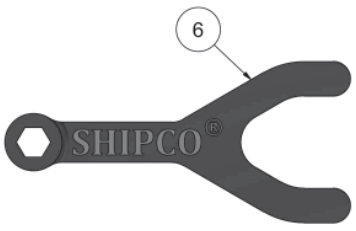
Kit	Item	Description	Item Code				Material	Qty
Pump & Motor								
	1	Motor 56C, 143-215TC	-				-	1
Coupler Kit			QMA-063 56C	QMB-063 143-45TC	QMC-063 182-84TC	QMD-063 213-15TC		
	2	Shaft Coupler	QMSC-063-063	QMSC-063-088	QMSC-063-113	QMSC-063-138	Alum. 6061	1
	3	Shaft Pin	QM03804				Stainless 304	1
	4	Fan Blade	QM03821-200		QM03821-250		Plastic	1
	5	5/16 UNC Socket Head Bolt - 7/8	5KS0031C-0088-2				Stainless 18-8	4
Liquid End								
Seal Kit			QM1-063 Carbon-Ceramic-EPDM		QM2-063 Carbon-Ceramic-Viton			
	6	Clearance Shim	QM00000		QM00000		Plastic	1
	7	5/8" Mechanical Seal	SDPS00067		SDPS00067-SV		-	1
	8	O-Ring 010	OR-010-E		OR-010-V		-	1
	9	O-Ring 013	OR-013-E		OR-013-V		-	1
	10	O-Ring 223	OR-223-E		OR-223-V		-	2
	11	O-Ring 233	OR-233-E		OR-233-V		-	1
	12	O-Ring 254	OR-254-E		OR-254-V		-	3
Stack Kit			5QMXX Standard		5QMXX-L Low NPSHr			
	13	Pump Shaft	QM00001-XX				Stainless 304	1
	14	Step Washer	QM00401				Stainless 304	1
	15	Shaft Spacer (Impeller)	QM00421				Stainless 304	N
	16	Impeller	QM01001				Stainless 17-4	N
	17	Shaft Spacer (Inducer)	QM00422		QM00421		Stainless 304	1
	18	Inducer	-		QM01401		Stainless 17-4	1
	19	7/16 Lock Washer	LOCK-S6-044				Stainless 316	1
	20	7/16 UNC Hex Nut	HS8-0044C-2				Stainless 18-8	1
	21	Diffuser Top	QM02021-A				Stainless 17-4	1
	22	Stage Chamber	QM02001				Stainless 304	N
	23	Diffuser Stage	QM02021				Stainless 17-4	N-1
	24	Wear Ring	QM02401				Carbon	N
	25	Journal Bearing	QM00423				Carbon	N
	26	First Stage Plate	QM02041				Stainless 304	1
	27	Inducer Diffuser	-		QM02061		Stainless 17-4	1
	28	#10 UNC Socket Head Bolt - 3/8	-		5KS0010C-0038-2		Stainless 18-8	2
Housing Parts			56C-145TC Motor		182-215TC Motor			
	29	Pump Base	QM03001				Stainless 17-4	1
	30	Pump Union	QM04801				Stainless 17-4	2
	31	Drain Plug	QM03801				Stainless 304	1
	32	Housing	QM03601-XX				Stainless 304	1
	33	Pump Head	QM03201				Stainless 17-4	1
	34	Seal Cover	QM03401				Stainless 17-4	1
	35	Bleed Plug	QM03803				Stainless 304	1
	36	1/4 NPT Plug	SLD-S-0025				Stainless 304	1
	37	Lag Plate	QM04001				Alum. 356 T6	1
	38	Motor Pedestal	QM04201		QM04202		Alum. 356 T6	1
	39	Coupling Guard	QM04601		QM04602		Stainless 304	2
	28	#10 UNC Socket Head Bolt - 3/8	5KS0010C-0038-2				Stainless 18-8	4
	40	(3/8 or 1/2) UNC Hex Bolt - 1	HS80038C-0100-2		HS80050C-0100-2		Stainless 18-8	4
	41	3/8 UNC Socket Head Bolt - 3/4	5KS0038C-0075-2				Stainless 18-8	8
	42	7/16 UNC Stay Bolt	QM04401-XX				Stainless 18-8	4
	43	7/16 Washer	S8-047-088-006				Stainless 18-8	4
	20	7/16 UNC Hex Nut	HS8-0044C-2				Stainless 18-8	4

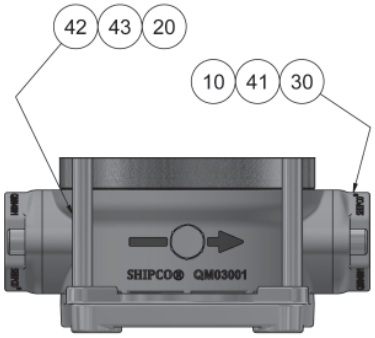
Notes:

- Quantity (Qty) with “N” refers to the number of impeller stages.
- Part numbers with “XX” are dependent on the number of stages (e.g., 6 stages listed as “06”).
- A Pump & Motor consists of a Motor, a Coupler Kit and a Liquid End.
- A Liquid End consists of a Seal Kit, a Stack Kit and Housing Parts.
- Standard pumps can be retrofitted with an Inducer Kit 5QM-IND.

Model QM Pump Parts List (continued)







Seal Replacement:

Pumps are equipped with mechanical seals. Mechanical seals must be clean, free of debris, grease, or oil, and water lubricated to work properly. Failure to prime a pump with water will cause seal failure.

Tools

- Lock-Out Tag-Out Devices
- Gloves / PPE
- 5/32 Allen Key
- 1/4 Allen Key
- 9/16 Hex Wrench
- Seal Lubricant (Pac-Ease or detergent)
- O-Ring Lubricant (Silicone Spray, Pac-Ease, or detergent)
- Clearance Shim
- Replacement Seal Kit

Procedure

1. Disconnect the power supply to the motor using necessary lock-out tag-out procedures.
2. Isolate the pump from the system by closing the suction, discharge, and recirculation isolation valves and using necessary lock-out tag-out procedures. Fluid and surfaces may be hot. Use necessary PPE.
3. Drain the pump by removing the plug on the pump base (#29) and the bleed bushing on the pump head (#33).
4. Remove the coupling guards (#39).
5. Remove the shaft coupler (#2), Shaft Pin (#3), and Fan Blade (#4).
6. Remove the seal cover (#34) and discard the old O-Ring (#11).
7. Remove the old mechanical seal rotating element (#7) from the pump shaft (#13) and clean the pump shaft.
8. Remove the old mechanical seal stationary face (#7) from the seal cover (#34) and clean the seal cover.
9. Lubricate and replace the Seal Cover O-Ring.
10. Lubricate the new mechanical seal with Pac-Ease or a light detergent solution. Do NOT use grease or oil based lubrication on mechanical seals. Do NOT use Silicone or PTFE gasket lubrication on mechanical seals.
11. Press the new stationary face into the seal cover and slide the new rotating element onto the pump shaft. Ensure that the running faces are clean from debris, grease, or fingerprints. They should be fully seated and perpendicular to the pump shaft.
12. Replace the Seal Cover.
13. Using the Clearance Shim (#6), replace the Shaft Coupler, Shaft Pin, and Fan blade. Be sure to tighten the coupler bolts evenly to prevent misalignment.
14. Remove the Clearance Shim and rotate the shaft by hand. The shaft should rotate freely without tight spots or misalignment.
15. Replace the Coupling Guards.
16. Lubricate and replace the O-Rings for the drain plug and bleed bushing. Then replace the drain plug and bleed bushing.
17. Open the isolation valves on the suction, discharge, and recirculation lines.
18. Prime the pump by opening the bleed plug (#35). Close the bleed plug once air has stopped sputtering and there is a steady stream of water.
19. Reconnect the power supply to the motor.

Stack Replacement:

Pumps are equipped with mechanical seals. Mechanical seals must be clean, free of debris, grease, or oil, and water lubricated to work properly. Failure to prime a pump with water will cause seal failure.

Tools

- Lock-Out Tag-Out Devices
- Gloves / PPE
- 5/32 Allen Key
- 1/4 Allen Key
- 9/16 Hex Wrench
- 11/16 Hex Wrench
- Seal Lubricant (Pac-Ease or detergent)
- O-Ring Lubricant (Silicone Spray, Pac-Ease, or detergent)
- Clearance Shim
- Replacement Seal Kit
- Replacement Stack Kit
- Overhead Hoist (depending on size)

Procedure

1. Disconnect the power supply to the motor using necessary lock-out tag-out procedures. Check for voltage then disconnect motor leads.
2. Isolate the pump from the system by closing the suction, discharge, and recirculation isolation valves and using necessary lock-out tag-out procedures. Fluid and surfaces may be hot. Use necessary PPE.
3. Drain the pump by removing the plug on the pump base (#29) and the bleed bushing on the pump head (#33).
4. Remove the coupling guards (#39).
5. Remove the shaft coupler (#2), Shaft Pin (#3), and Fan Blade (#4).
6. Remove the hex nuts from the Stay Bolts (#42) then lift the Motor and Motor Pedestal (#1, #38) off the pump.
7. Remove the Pump Head and Housing (#33, #32) and discard the old O-Rings.
8. Remove the seal cover (#34) and discard the old O-Ring.
9. Remove the old Stack Kit and install the new Stack Kit. Ensure that it is fully seated and square to the pump base.
10. Lubricate and replace the O-Rings in the Pump Head and Pump Base. Then replace the Housing and Pump Head.
11. Remove the old mechanical seal stationary face (#7) from the seal cover (#34) and clean the seal cover.
12. Lubricate and replace the seal cover O-Ring.
13. Lubricate the new mechanical seal with Pac-Ease or a light detergent solution. Do NOT use grease or oil based lubrication on mechanical seals. Do NOT use Silicone or PTFE gasket lubrication on mechanical seals.
14. Press the new stationary face into the seal cover and slide the new rotating element onto the pump shaft. Ensure that the running faces are clean from debris, grease, or fingerprints. They should be fully seated and perpendicular to the pump shaft.
15. Replace the Seal Cover.
16. Replace the Motor and Motor Pedestal. Finger tight the hex nuts onto the Stay Bolts then use a crisscross pattern to tighten nuts evenly. WARNING: Unevenly tightening Stay Bolts will cause the stationary pump elements to be out of concentric with the rotating elements which can lead to binding, over-amping, and property damage.
17. Using the Clearance Shim (#6), replace the Shaft Coupler, Shaft Pin, and Fan blade. Be sure to tighten the coupler bolts evenly to prevent misalignment.
18. Remove the Clearance Shim and rotate the shaft by hand. The shaft should rotate freely without tight spots or misalignment.
19. Replace the coupling guards.
20. Lubricate and replace the O-Rings for the drain plug and bleed bushing. Then replace the drain plug and bleed bushing.
21. Open the isolation valves on the suction, discharge, and recirculation lines.
22. Prime the pump by opening the bleed plug (#35). Close the bleed plug once air has stopped sputtering and there is a steady stream of water.
23. Rewire the motor leads then reconnect the power supply to the motor.

TERMS AND CONDITIONS OF SALE

AGREEMENT

By entering your order or requesting a quote, you confirm that the following terms and conditions of sale are the legal agreement governing your purchase, and that no changes or additional or different terms will apply unless you have previously established a different written contract for these purchases with Shippensburg Pump Company, Inc., hereafter referred to as the Seller.

ORDER ACCEPTANCE

All orders are subject to acceptance by Seller at its general office in Shippensburg, Pennsylvania. Acceptance will be evidenced by Seller issuing its Sales Acknowledgement Form. The Sales Acknowledgement Form, together with any documents incorporated therein, shall constitute the entire agreement and may not be changed except in writing signed by Seller and Buyer. Publication and circulation of current price lists, catalogues and related literature by Seller shall not be deemed an offer to sell, but rather an invitation for offers to buy. Acceptance by Seller of the Buyer's order is expressly limited to the Terms and Conditions stated herein; any additional, inconsistent or different terms and conditions contained in the Buyer's purchase order or other documents supplied by Buyer are expressly rejected.

PAYMENT TERMS—PRICES

Payment terms are as follows: If the Buyer is a Credit Card Customer, the Buyer agrees to pay at the time of purchase the price, shipping and handling charges, taxes and duties quoted by the Seller. If the Buyer is an Account Holder, the Buyer agrees to pay invoices with payment terms of net thirty (30) days after date of invoice unless otherwise specifically agreed to in writing. If the Seller believes that the Buyer's financial condition requires it, the Seller reserves the right to require full or partial payment prior to manufacture or shipment. If the Buyer fails to make any payment when due, (1) the seller reserves the right to suspend performance and the Buyer agrees that any charges incurred prior to the suspension will be assessed to the Buyer and payable to the Seller; (2) the Buyer further agrees to pay a charge on the amount past due at the rate of 1½% per month (18% per year) or the maximum lawful rate, whichever is less. In the event of non-payment, the Buyer agrees to pay the Seller reasonable attorney's fees and court costs, if any incurred by the Seller to collect payment and interest charges. These terms shall apply to partial, as well as complete shipments of Product. Published prices are subject to change without notice and the right is reserved to invoice at prevailing prices at time of shipment unless otherwise specifically agreed to in writing. All quotations are conditional on 30 days acceptance unless stipulated otherwise in writing and to approved credit rating or reference, otherwise payment terms are cash with order or C.O.D.

DELIVERY—DELAYS

Shipping dates represent estimates only and are based on projected production schedules and commitments by suppliers. Seller shall not be liable for failure or delay in manufacturing or shipping Products, nor shall such failure or delay constitute grounds for cancellation if such failure or delay is directly or indirectly due to shortages of fuel or energy; acts of omissions of the Buyer; acts of God; war, riot, civil disturbances; labor difficulties; accident; inability to reasonably obtain materials; acts of transportation companies; or other causes of any kind whatever beyond the control of Seller. In the event of such delays, Seller reserves the right to make adjustments in price and delivery schedules.

FREIGHT TERMS

Prices are f.o.b. factory unless otherwise stated. Seller's responsibility ceases upon delivery to the transportation company at shipping point. It is the Buyer's responsibility to examine shipment upon arrival to ascertain if in good order. Any shortage or damage claims must be pursued by the Buyer. All weights shown on price sheets and literature are approximate. All packaging is standard domestic boxing, slat and wire crating and/or skidding. An additional charge will be made for full wooden crating or special packaging when specified on the order.

Seller will make every effort to consolidate orders and backorders wherever possible. Seller will not be responsible for excess charges due to their inability to consolidate shipments.

When requested by Buyer, shipments may be routed using premium carriers such as express or airfreight or the Buyer may specify the method or route of shipment. In such cases the shipment will be made on a "collect" basis and where applicable the freight allowance will appear as a separate line item on the product invoice, Seller reserves the right to select the transportation company where freight is allowed.

TAXES

In addition to the price stated, the amount of any present or future sales, use, excise or other similar tax applicable to the production, sale, use or transportation of the Products shall be paid by Buyer. In lieu of paying such taxes to Seller, Buyer may furnish Seller a Tax Exemption Certificate or Certificates acceptable to appropriate taxing authorities at any time prior to Seller's shipment of the Products.

CANCELLATIONS

Any order placed with Seller may be cancelled by the Buyer only upon payment of reasonable cancellation charges that shall include but not be limited to expenses already incurred, as well as material and labor commitments made by Seller.

SHIPMENT—TITLE—RISK OF LOSS

Shipment terms are f.o.b. Seller's facility, unless otherwise specifically agreed to in writing. Notwithstanding the granting of any allowances for shipping, title to and risk of loss for Products will pass to the Buyer when delivered to the Common carrier at the Seller's facility.

BACK CHARGES

All invoices shall be due and payable when submitted for payment in accordance with the provision entitled "Payment Terms—Prices." No withholding of funds, back charges, or credits against amounts otherwise due Seller will be permitted unless specifically agreed to in writing by Seller. Settlement of any amounts due Buyer will be negotiated as separate items and not as offsets against amounts otherwise due Seller from Buyer for Products sold hereunder.

RETURNED GOODS

Unused material of current manufacture can only be returned for credit with the written consent of Seller, under return goods policies existing at the date of the return. Products that are obsolete or made to special order are not returnable.

PATENT INDEMNITY

a. Patent Indemnity by Seller to Buyer

Seller agrees to indemnify and hold harmless the Buyer from and against all legal expenses which may be incurred, as well as all damages and costs (except all consequential and special damages and costs) which may be finally assessed against Buyer in any action for infringement of any United States Letters Patent by the Products delivered to Buyer hereunder; provided that the Buyer shall give Seller prompt written notice of any action, claim or threat of patent infringement suit, either oral or written, or of the commencement of any patent infringement suit against Buyer relating to Products sold by Seller to Buyer hereunder; and provided Buyer shall give Seller opportunity to elect to take over, settle, or defend any such claim, action or suit through counsel of Seller's own choice and under its sole direction, and at its sole expense, and provided that in the event Seller elects to take over, defend or settle same. Buyer will make available to Seller all defenses against any such claim, action, suit or proceeding known to or available to Buyer; and provided further that Seller shall have the right to substitute for any such Product or any part thereof claiming to infringe the patent right of others, non-infringing Products which will give equally good service. If the use of any such Product or any part thereof should be enjoined, Seller shall have the right at its own expense, to take any of the following courses of action:

i. To procure for Buyer the right to continue using such Product;
ii. To replace said Product with a non-infringing Product;
iii. To modify the Product so that it becomes non-infringing; or
iv. To remove said Product and refund the purchase price, transportation costs and installation costs thereof.

b. Limitation

The foregoing provisions as to patent protection by Seller to Buyer shall not apply to any of the following:

i. To any Product manufactured to the design or specification furnished by the Buyer;
ii. To orders for special non-commercial Products which Seller has not sold or offered for sale to the public on the open commercial market;
iii. To any infringement occasioned by modification by Buyer of any Product without Seller's written consent, or any infringement arising from the use of a Product with any adjunct or device added by the Buyer without Seller's written permission.

c. Patent Indemnity by Buyer to Seller

To the extent that Products delivered hereunder are manufactured pursuant to detailed designs furnished by Buyer, Buyer agrees to indemnify Seller and hold Seller harmless from all legal expenses which may be incurred, as well as all damages and costs, which may finally be assessed against Seller in any action for infringement of any United States Letters Patent by such Products delivered hereunder. Seller agrees to promptly inform the Buyer of any claim for liability made against Seller with respect to such Products and Seller agrees to cooperate with the Buyer in every way reasonably available to facilitate the defense against any such claim.

GOVERNING LAW

The validity, interpretation and performance of any order shall be governed by the Uniform Commercial Code ("UCC") as adopted by the state in which the Products are manufactured by Seller.

WARRANTY AND LIMITATION OF LIABILITY

Seller warrants for a period of eighteen (18) months from date of shipment from its factory or one (1) year from date of installation, whichever occurs first, that all Products furnished by it are free from defects in materials and workmanship.

Seller's liability for any breach of this Warranty shall be limited solely to replacement or repair, at the sole option of Seller, of any part or parts found to be defective during the Warranty period providing the Product is properly installed and is being used as originally intended. Buyer must notify Seller of any breach of this Warranty within the aforementioned Warranty period; defective parts must be shipped by Buyer to Seller, transportation charges prepaid.

IT IS EXPRESSLY AGREED THAT THIS SHALL BE THE SOLE AND EXCLUSIVE REMEDY OF THE BUYER. UNDER NO CIRCUMSTANCES SHALL SELLER BE LIABLE FOR ANY COSTS, LOSS, EXPENSE, DAMAGES, SPECIAL DAMAGES, INCIDENTAL DAMAGES OR CONSEQUENTIAL DAMAGES ARISING DIRECTLY OR INDIRECTLY FROM THE DESIGN, MANUFACTURE, SALE, USE OR REPAIR OF THE PRODUCT WHETHER BASED UPON WARRANTY, CONTRACT, NEGLIGENCE OR STRICT LIABILITY. IN NO EVENT WILL LIABILITY EXCEED THE PURCHASE PRICE OF THE PRODUCT.

THE WARRANTY AND LIMITS OF LIABILITY CONTAINED HEREIN ARE IN LIEU OF ALL OTHER WARRANTIES AND LIABILITIES, EXPRESSED OR IMPLIED. ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED BY SELLER AND EXCLUDED FROM THIS WARRANTY.

Seller neither assumes, nor authorizes any person to assume for it, any other Warranty obligation in connection with the sale of the Product. This Warranty shall not apply to any Product or parts of Products which (a) have been repaired or altered outside of Seller's facilities; or (b) have been modified or damaged through misuse, abuse, accident, neglect or mishandling by Purchaser or Purchaser's customer, erroneous voltage, modification, acts of God, or any other act not specifically stated; or (c) have been used in a manner contrary to Seller's instructions.

Products covered by this warranty are for the intended uses as described in the corresponding seller's instructions. Before using for any other application, user shall determine the suitability of the product for its intended use and user assumes all risk and liability in connection therewith.

No oral statement made by the seller, its agents, employees, or other representatives, concerning the product, its value, description, condition, design, specifications, performance, capability, durability, adaptability, or accuracy, shall be relied upon by the purchaser and is specifically and expressly excluded and invalidated as the basis for any bargain or warranty.

In the case of Products not manufactured by Seller, there is no Warranty from Seller, but Seller will extend to the Buyer any Warranty of Seller's supplier of such Products.

FORCE MAJEURE

Seller shall have no liability in respect of failure to deliver or perform, or delay in delivering or performing any obligations due to causes such as acts of omissions of Buyer; acts of God, fire, flood, war and civil disturbances; riot, acts of governments, currency restrictions, labor shortages or disputes, unavailability of materials, fuel, power, energy or transportation facilities, failures of suppliers or subcontractors to deliver on time and every other circumstance outside the reasonable control of Seller.

MODIFICATIONS

Unless otherwise provided, Seller reserves the right to modify the specifications of Products ordered by the Buyer providing that the modification will not materially affect the performance.

STORAGE CHARGE

If Buyer is unable to accept products in accordance with the applicable shipping schedule then Seller may arrange to store ordered Products and the cost of storage will be charged to Buyer.

ENTIRE CONTRACT

These provisions constitute all the terms and conditions agreed upon by the parties and shall replace and supersede any provisions on the face and reverse side of Purchase Order and any attachment thereto, or any prior general agreement inconsistent with the provisions hereof except that orders by Representatives with whom Seller has an Agreement shall be subject to the provisions of the Agreement. No modification hereof shall be valid unless in writing and duly signed by a person authorized by Seller. The provisions hereof shall not be modified by any usage of trade, or any course of prior dealings or acquiescence in any course of performance.