



mROY® XT & XW

Metering Pump IOM Manual

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PRECAUTIONS

The following precautions should be taken when working with metering pumps.
Please read this section carefully prior to installation.

Protective Clothing



ALWAYS wear protective clothing, face shield, safety glasses and gloves when working on or near your metering pump. Additional precautions should be taken depending on the solution being pumped. Refer to Material Safety Data Sheets for the solution being pumped.

Hearing Protection



It is recommended that hearing protection be used if the pump is in an environment where the time weighted average sound level (TWA) of 85 decibels is exceeded (as measured on the A scale slow response).

Electrical Safety



- Remove power and ensure that it remains off while maintaining pump.
- **DO NOT FORGET TO CONNECT THE PUMP TO EARTH**
- Electric protection of the motor (Thermal protection or by means of fuses) is to correspond to the rated current indicated on the motor data plate.

Liquid Compatibility



Verify if the materials of construction of the wetted components of your pump are recommended for the solution (chemical) to be pumped.

Pumps Water “Primed”



All pumps are tested with water at the factory. If your process solution is not compatible with water, flush the Pump Head Assembly with an appropriate solution before introducing the process solution.

Plumbing and Electrical Connections



Always adhere to your local plumbing and electrical codes.

Line Depressurization



To reduce the risk of chemical contact during disassembly or maintenance, the suction and discharge lines should be depressurized before servicing.

Over Pressure Protection



To ensure safe operation of the system it is recommended that some type of safety/pressure-relief valve be installed to protect the piping and other system components from damage due to over-pressure.

Lifting



This manual should be used as a guide only - Follow your company's recommended lifting procedures. It is not intended to replace or take precedence over recommendations, policies and procedures judged as safe due to the local environment than what is contained here”
Use lifting equipment that is rated for the weight of the equipment to be lifted.



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SECTION 1 - GENERAL DESCRIPTION

1.1 INTRODUCTION

The mRoy pump is a highly reliable controlled volume pump of hydraulically actuated diaphragm design. The XT and XW family of mRoy pumps are described in this manual.

1.2 GENERAL

The mRoy pump capacity is adjustable while the pump is running or stopped. Capacity adjustment can be made by manually turning the control knob. Repetitive accuracy of the metered discharge volume is maintained within a $\pm 1\%$ range at constant conditions of pressure, temperature and pump capacity adjustment setting.

The mRoy pump is a reliable, compact, controlled volume diaphragm pumps for normal corrosive or toxic chemicals and light slurries with viscosities up to 200 S.S.U. (40 cps).

A plunger, reciprocating at a fixed stroke, displaces a fixed volume of hydraulic fluid which actuates a flexible, chemically inert PTFE diaphragm to create pumping action. High quality ball check valves are used on the suction and discharge to insure consistent metering accuracy. Capacity control is established by adjusting the volume of hydraulic fluid which bypasses the diaphragm cavity.

Metering with repetitive accuracy is possible only if the volume of the hydraulic oil in the displacement chamber is maintained constant for each stroke. This is accomplished by mechanically opening the displacement chamber to the oil reservoir for a short period at the end of every suction stroke and the beginning of each pressure stroke. During this period air or vapor is bled from the system, lost oil is replenished, and allowances are made for the expansion or contraction of the oil due to temperature change. For more information, refer to 1.3

1.3 PRINCIPLE OF OPERATION (FIGURE 1)

Pumping action is developed and controlled by three basic components as follows (Figure 1):

1. The pump plunger reciprocates with a constant stroke length and displaces oil into and out of the diaphragm chamber.
2. The flexible diaphragm is a movable partition between the plunger oil and fluid being pumped.
3. An oil bypass circuit from the plunger by-pass ports to the reservoir.

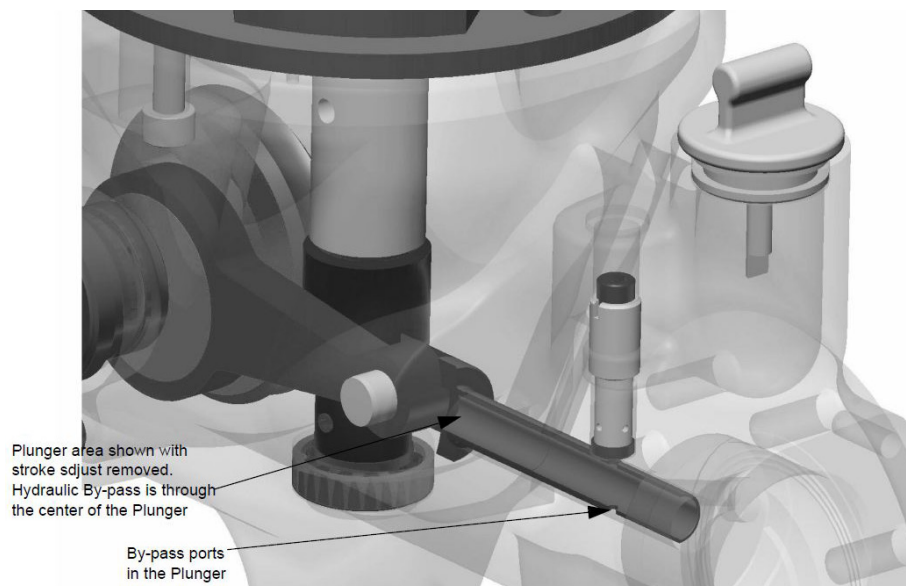


Figure 1. Pumping Action

SECTION 1 - GENERAL DESCRIPTION

In operation, on the discharge stroke, the pump plunger and the capacity adjustment spool work to regulate the amount of oil (Figure 1), which is bypassed to the oil reservoir. The plunger moves over the control spool which closes off the by-pass ports. The place where this occurs is dependent on the capacity setting. Then the balance of the plunger displacement is imposed on the flexible diaphragm that moves and displaces the fluid being pumped through the discharge ball check.

On the suction stroke, the pump plunger is pulled away from the diaphragm cavity which decreases the pressure of the hydraulic fluid. When the pressure is decreased below that of the process fluid, the process fluid is pushed through the suction ball check, which then moves the flexible diaphragm.

When the by-pass ports reach the end of the control rod, the hydraulic cavity is opened to the reservoir and the balance of the plunger oil displacement can be supplied from the reservoir through the by-pass passages.

The discharge capacity is adjusted from 0-100% by rotating the adjustment knob which moves the control spool so that the bypass port is closed at the desired percentage of the total plunger stroke. When the control spool is adjusted to 100% capacity the bypass port will be positioned so that it is opened at the very end of the suction stroke. Then on the pressure stroke, the by-pass ports are immediately closed so the entire plunger displacement is imposed upon the flexible diaphragm.

With the control spool adjusted for 50% capacity the by-pass ports will be positioned so that they are opened when the plunger has completed one-half of the suction stroke. On the next pressure stroke, the oil displaced by the pump plunger will be bypassed through the open ports to the reservoir for the first 50% of the stroke before the by-pass ports are closed by the control plunger. The remaining 50% of the plunger displacement will then be imposed on the flexible diaphragm so that fluid is discharged for only 50% of the plunger travel. A similar analysis would apply for 0% capacity setting on the control valve where all the plunger oil displacement is by-passed to the reservoir.

1.4 MODEL CODING

The model code can be found on the data plate (Figure 2) attached to the pump. For a general description of the mRoy pump you have purchased, compare your model number to the product codes shown on page 5.



Figure 2. Data Plate

SECTION 1 - GENERAL DESCRIPTION

1.5 SPECIFICATIONS

Plunger Diameters:

mRoy XT : 11/32" (9 mm)

mRoy XW : 1/2" (13 mm)

Max Pressures:

3000 psi (207 bar)

Liquid End Type:

Hydraulically Actuated Disc Diaphragm

Flow Range:

mRoy XT : 2.2 gph (8.3 liter/hr)

mRoy XW : 9.2 gph (34.8 liter/hr)

Materials of Construction:

Head : 316 SS

XT Seals : PTFE + Nitrile

XW Seals : PTFE, Nitrile, Viton

XT Diaphragm : Gylon

XW Diaphragm : PTFE

(Custom Materials Available)

Flow Rates and Pump Model Coding

See www.miltonroy.com

Data Sheets for Download - mRoy Bulletin

3300

Steady State Accuracy/Turndown Ratio:

+/-1% steady state accuracy over 10:1 turndown ratio (with constant speed drive).

Capacity Adjustment:

Hydraulic bypass from 0 to 100% of rated capacity while stopped or running.

Liquid Temperature:

Metallic Heads:

20°F (-7°C) to 200°F (93°C)

Internal Relief Valve:

Adjustable (Standard).

Hydraulic Fluid:

(Standard) MOBIL SHC 629

(Food Grade Equivalent: Nevastane SL100)

Coating System:

Polyester TGIC Powdercoating

Average Shipping Weight:

XT : 75 lbs (34 kg)

XW : 95 lbs (43 kg)

Stroke Length:

XT : 0.7" (17.8 mm)

XW : 1.5" (38 mm)

1.6 ROUTINE MAINTENANCE KIT

(Includes diaphragm, O-rings, and check valves for pumps without leak detection)

XT : RPM088 (Single Ball Only)

XW : RPM032

NOTE:

XT pumps made prior to 5/2001 - Notify Milton Roy and order kit by serial number.

Metric Units

0 to 34.8 liters/hour - 206.8 BAR maximum

SERIES	GEAR RATIO CODE	STROKES PER MINUTE		METALLIC LIQUID ENDS						
				L/hr at 138 BAR		L/hr at 172 BAR		L/hr at 207 BAR		
		60HZ	50HZ	60HZ	50HZ	60HZ	50HZ	60HZ	50HZ	
mRoy XT 11/32” (9 mm) Plunger	77	23	19	1.04	0.87	0.97	0.81	0.90	0.75	Requires 0.37 kW (1/2 HP) minimum
	48	37	30	1.67	1.39	1.55	1.29	1.44	1.20	
	24	73	60	3.30	2.75	3.00	2.50	2.80	2.33	
	15	117	96	5.2	4.3	4.8	4.0	4.5	3.8	
	10	185	152	8.3	6.9	7.7	6.4	7.2	6.0	
mRoy XW 1/2” (13 mm) Plunger	38	48	40	10.6	8.8	10.1	8.4	9.3	7.8	Requires 0.75 kW (1 HP) minimum
	25	72	60	16.2	13.5	15.1	12.6	14.2	11.9	
	19	96	80	21.9	18.3	20.4	17.0	18.9	15.8	
	12	144	120	34.8	29.0	32.5	27.1	30.3	25.2	Requires 1.1 kW (1 1/2 HP) minimum

English Units

0 to 9.2 GPH - 3000 psi maximum

SERIES	GEAR RATIO CODE	STROKES PER MINUTE		METALLIC LIQUID ENDS						
				GPH at 2000PSI		GPH at 2500PSI		GPH at 3000PSI		
		60HZ	50HZ	60HZ	50HZ	60HZ	50HZ	60HZ	50HZ	
mRoy XT 11/32” (9 mm) Plunger	77	23	19	0.27	0.23	0.26	0.21	0.24	0.20	Requires 1/2 HP minimum
	48	37	30	0.44	0.37	0.41	0.34	0.38	0.32	
	24	73	60	0.87	0.73	0.80	0.67	0.74	0.62	
	15	117	96	1.37	1.14	1.27	1.06	1.19	0.99	
	10	185	152	2.2	1.8	2.1	1.7	1.9	1.6	
mRoy XW 1/2” (13 mm) Plunger	38	48	40	2.8	2.3	2.6	2.2	2.5	2.1	Requires 1 HP minimum
	25	72	60	4.3	3.6	4.0	3.3	3.8	3.1	
	19	96	80	5.8	4.8	5.4	4.5	5.0	4.2	
	12	144	120	9.2	7.7	8.6	7.2	8.0	6.7	Requires 1 1/2 HP minimum

Table 1: Capacity / Pressure Table

MODEL CODE SELECTION

Additional options are available. Consult with your representative

End Item Code X 1 1 -

Option Select Number

Series Number Heads Material Code Gear Ratio Motor Mount Connection Code Capacity Control Rupture Detection & Base Check Valve

Series Code	Description
T	T Frame
W	W Frame

Gear Ratio

XTCode	SPM @ RPM	
	1725	1425
77	23 spm	19 spm
48	37 spm	30 spm
24	73 spm	60 spm
15	117 spm	96 spm
10	185 spm	152 spm

XWCode	SPM @ RPM	
	1725	1425
38	47 spm	39 spm
25	72 spm	60 spm
19	95 spm	79 spm
12	144 spm	120 spm

Motor Mount Code	Description
FR (XT & XW)	API Flange NEMA 56C
F4 (XT & XW)	API Flange NEMA 143/145C
F8 (XW)	API Flange IEC Frame 80 B5 Flange
F9 (XW)	API Flange IEC Frame 90 B5 Flange
SR (XT)	Close Coupled NEMA 56C
SS (XT)	Close Coupled IEC Frame 71, B5 Flange
FS (XT)	API Flange IEC Frame 71, B5 Flange
MD (XT)	API Flange IEC Frame 80, B5 Flange

Connection Code

Metallic Heads

Code	Description
NN	NPT Female (STANDARD)
11	ANSI 150# RF 1/2" Threaded
33	ANSI 300# RF 1/2" Threaded
AA	ANSI 150# RF 1/2" Socket Welded
BB	ANSI 300# RF 1/2" Socket Welded
EE	ANSI 1500# RF 1/2" Socket Welded
66	ANSI 600# RF 1/2" Threaded

Capacity Control

Code	Description
M1	316 SS Manual Micrometer (STANDARD)
E1	Electronic - NEMA 4, 4-20 mA, 115 Volt
E2	Electronic - NEMA 4, 4-20 mA, 220 Volt
EA	Electronic - Ex Proof, 4-20 mA, 115 Volt
EB	Electronic - Ex Proof, 4-20 mA, 220 Volt

*When using control other than manual, derate pump capacity by 5%.

EE Mountless ECC

Rupture Detection & Base

Code	Description
NN	None (STANDARD)
C5	Rupture Detection with Base & Gauge
SN	Rupture Detect with Base, Gauge, & NEMA 4 Switch
S7	Rupture Detect with Base, Gauge, & Ex Proof Switch

*When using rupture detection, derate pump capacity by 5%.

Check Valve

Code	Description
NN (XT)	Single Ball Checks (STANDARD)
NN (XW)	Double Ball Checks (STANDARD)
22 (XT)	Double Ball Checks

2.1 UNPACKING/INSPECTION

Units are shipped Ex Works, Ivyland, Pa. and the title passes to the customer when the carrier signs for receipt of the unit. In the event that damages occur during shipment, it is the responsibility of the customer to notify the carrier immediately and to file a damage claim. Carefully examine the shipping crate upon receipt from the carrier to be sure there is no obvious damage to the contents. Open the crate carefully so accessory items fastened to the inside of the crate will not be damaged or lost. Examine all material inside the crate and check against the packing list to be sure that all items are accounted for and intact.

 **CAUTION** THE FOLLOWING PROCEDURE SHOULD BE FOLLOWED WHEN A PUMP IS NOT PUT INTO SERVICE UPON RECEIPT.

2.2 STORAGE

2.2.1 Short Term Storage (Less than 6 Months)

It is preferable to store the material under a shelter in its original package to protect it from adverse weather conditions. In condensing atmospheres, follow the long term storage procedure.

2.2.2 Long Term Storage (Longer than 6 Months)

The primary consideration in storage of pump equipment is to prevent corrosion of external and internal components. This corrosion is caused by natural circulation of air as temperature of the surroundings change from day to night, day to day, and from season to season. It is not practical to prevent this circulation which carries water vapor and other corrosive gasses, so it is necessary to protect internal and external surfaces from their effects to the greatest extent possible.

When the instructions given in this section are completed, the equipment is to be stored in a shelter; protected from direct exposure to weather. The prepared equipment should be covered with a plastic sheet or a tarpaulin, but in a manner which will allow air circulation and prevent capture of moisture. Equipment should be stored 12 inches or more above the ground.

If equipment is to be shipped directly from Milton Roy into long term storage, contact Milton Roy to arrange for factory preparation.

2.2.3 Pump Drive and Gearboxes

1. Flood the gearbox compartment with a high grade lubricating oil/rust preventative such as Mobil Oil Corporation product Mobilarma 524. Fill the compartment completely to minimize air space and water vapor condensation. After storage, drain this material and refill the equipment with the recommended lubricant for equipment commissioning.
2. Remove drive motors and mounting adapters, and brush all unpainted metal surfaces with multipurpose grease (NLGI grade 2 or 3). Store these unattached.

2.2.4 Pump Liquid Ends

1. Flood the front compartment of the pump housing (if the model has a front compartment) with a high grade Lubricating Oil/Rust Preventative such as Mobil Oil Corporation product "Mobilarma 524."
 - a. If the pump has a diaphragm style liquid end, fill the pump-housing compartment all the way to minimize airspace and water vapor condensation.

SECTION 2 - INSTALLATION

- b. Most of the liquid ends themselves are constructed of inherently corrosion resistant materials and require no applied corrosion inhibitor. If they are NOT naturally resistant (test the threaded or flanged inlet and outlet connections - if they have little or no magnetic property, they are resistant) they should be flush filled with a corrosion inhibiting and non-freezing liquid which is compatible with the final pumped process chemical. Flush and fill with inhibitors such as "Mobilarna 524" or with a commercial automotive antifreeze coolant. The pump head contains one way check valves, so flush in a direction into the suction (bottom) connection, and out the discharge (top) connection.
2. Cap or plug all openings to capture the inhibiting fluid, and to prevent animals and insects from building nests.

2.2.5 Pneumatic, Electrical and Electronic Equipment

1. Motors should be prepared in the manner proscribed by their manufacturer. If information is not available, dismount and store motors as indicated in step "2" below.
2. For all pneumatic and electrical equipment, place packets of Vapor Phase Corrosion Inhibitor (VPCI) inside of the enclosure, then place the entire enclosure, with additional packets, inside a plastic bag. Seal the bag tightly closed. Contact Milton Roy Service Department for recommended VPCI materials.

2.3 SAFETY PRECAUTIONS

⚠ WARNING WHEN INSTALLING, OPERATING, AND MAINTAINING THE XT OR XW PUMP, KEEP SAFETY CONSIDERATIONS FOREMOST. USE PROPER TOOLS, PROTECTIVE CLOTHING, AND EYE PROTECTION WHEN WORKING ON THE EQUIPMENT AND INSTALL THE EQUIPMENT WITH A VIEW TOWARD ENSURING SAFE OPERATION. FOLLOW THE INSTRUCTIONS IN THIS MANUAL AND TAKE ADDITIONAL SAFETY MEASURES APPROPRIATE TO THE LIQUID BEING PUMPED. BE EXTREMELY CAREFUL IN THE PRESENCE OF HAZARDOUS SUBSTANCES (E.G., CORROSIVES, TOXINS, SOLVENTS, ACIDS, CAUSTICS, FLAMMABLES, ETC.).

⚠ CAUTION THE PERSONNEL RESPONSIBLE FOR INSTALLATION, OPERATION AND MAINTENANCE OF THIS EQUIPMENT MUST BECOME FULLY ACQUAINTED WITH THE CONTENTS OF THIS MANUAL.

⚠ CAUTION ANY SERVICING OF THIS EQUIPMENT MUST BE CARRIED OUT WHEN THE UNIT IS STOPPED AND ALL PRESSURE HAS BEEN BLED FROM THE LIQUID END. SHUT-OFF VALVES IN SUCTION AND DISCHARGE SIDES OF THE LIQUID END SHOULD BE CLOSED WHILE THE UNIT IS BEING SERVICED. ACTIONS SHOULD BE TAKEN TO ELIMINATE THE POSSIBILITY OF ACCIDENTAL START-UP WHILE SERVICING IS TAKING PLACE. A NOTICE SHOULD BE POSTED BY THE POWER SWITCH TO WARN THAT SERVICING IS BEING CARRIED OUT ON THE EQUIPMENT. SWITCH OFF THE POWER SUPPLY AS SOON AS ANY FAULT IS DETECTED DURING OPERATION (EXAMPLES: ABNORMALLY HIGH DRIVE TEMPERATURE, UNUSUAL NOISE, DIAPHRAGM FAILURE).

2.4 MOUNTING / LOCATION

The XT / XW pump can be mounted on any surface that is flat and level for the pump base. Three mounting bolt holes are provided in the XT pump base (Figure 3) and the XW pump (Figure 4) for use when the pump is to be firmly anchored to a foundation surface.

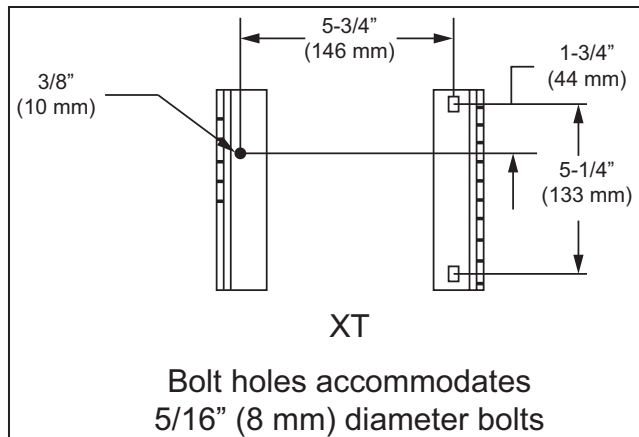


Figure 3. XT Bolt Hole Dimensions

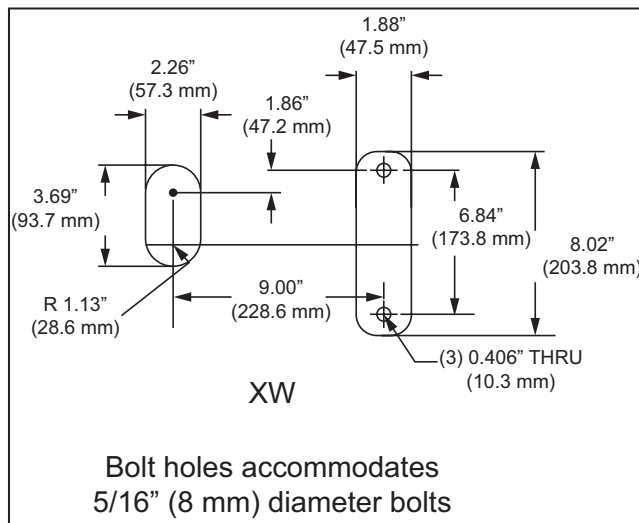


Figure 4. XW Bolt Hole Dimensions

Increased reliability can be expected if pump locations are avoided which are subjected to high ambient temperatures (above 100°F (38°C) with poor free-air circulation over the pump assembly.

Outdoor Installations

The XT and XW pump is designed as a totally enclosed unit suitable for installation either indoors or outdoors. However, for outdoor installations the pump mounting area should be selected to provide protection against environmental extremes:

1. Operation with continuous exposure to tropical or subtropical sunshine with ambient temperatures above 90°F (32°C), which would cause higher oil temperatures and affect lubricity should be avoided. Good installation practice would dictate providing a sun shade cover over the pump with open sides to obtain the best air circulation around the pump.
2. Frequent start-up where the pump has been idle in an ambient temperature below 30°F (-1°C) is not recommended. Provide a removable, insulated enclosure over the pump and mounting base with provisions for an electrical heater (100 watt light, heat lamp, heater tape etc.) to maintain the pump oil temperature above 30°F (-1°C).

2.5 MOTOR MOUNTING: DIRECT MOUNTED AND API FLANGED MOUNTED

Direct mounted motors have an extended shaft with worm gear and bearing attached (Figure 9).

If an API flange mounted motor option was selected for the XT / XW pump, a factory or customer supplied motor mounts to the API flange, using a coupling (Figure 10).

SECTION 2 - INSTALLATION

2.6 ELECTRICAL CONNECTIONS

Check to be sure that the electrical supply matches the pump motor nameplate electrical characteristics. Motor rotation must be counter clockwise when viewed from the top end of the motor.

CAUTION ON SINGLE-PHASE PUMP MOTORS THE ROTATION WILL BE DETERMINED AT THE FACTORY AND MUST NOT BE CHANGED. ON THREE-PHASE PUMP MOTORS THE ROTATION MUST BE DETERMINED AT THE TIME OF INSTALLATION AND PRIOR TO START-UP. OPERATION WITH THE WRONG ROTATION WILL DAMAGE THE PUMP AND MOTOR AND VOID THE WARRANTY. SHAFT ROTATION CAN BE OBSERVED BY REMOVING THE COVER PLATE OVER THE ELECTRICAL CONNECTIONS.

2.7 MOTORS

Adequate power is provided to the simplex XT pump by the standard 1/2 HP (0.37 KW) motor (XW pump by the standard 1 HP (0.75 KW) or 1.5 HP (1.1 KW) motor.) The motor is normally a totally enclosed non-ventilated, type, which is mounted on a 56C face flange or IEC Frame 71 flange. The gear reducer (worm shaft) fits onto the standard motor without using a coupling.

The normal temperature rise for these motors is 50°C above ambient temperature, and it can be expected that these motors will appear to operate at higher temperatures than are normally experienced. However, there is no cause for worry if the following precautions are observed:

1. The motor is placed where there is adequate ventilation and is protected against excessive radiation from steam pipes and other heat sources.
2. The overload heater in the starting device should be correctly sized for motor full load current rating as shown on the motor data plate.

2.8 PUMP LUBRICATION

CAUTION CAREFULLY TWIST AND PULL TO REMOVE OIL RESERVOIR CAP. DO NOT APPLY PRESSURE TO JOG CAP FROM SIDE TO SIDE OR DIP STICK MAY BREAK.

Oil is supplied for the average installation (ambient temperature above 50°F (10°C)). See recommendation below for lower temperature. Fill pump and gear box by slowly pouring the proper oil through the reservoir opening until the oil level in the reservoir is level with the oil level mark on outside surface of reservoir. Level can also be checked with dipstick on oil reservoir cap. Recheck while pump is operating.

CAUTION DO NOT OVER FILL AS MOTOR DAMAGE CAN RESULT.

Recommended Oil

(Any equivalent oil is acceptable)

XT/XW gear ratios OTHER than 9.5:1 (model code 10) use:

Oil Type

Mobil SHC	629
ISO Grade	150

XT: gear ratio 9.5:1 (model code 10) use:

Oil Type

AGMA Spec	No. 2 EP
Zurn Oil Co	No. EP 35
ISO Grade	68

Nominal Oil Capacity

Pump Model	Simplex
XT	1-1/4 Qts. (1.2 liters)
XW	3-1/4 Qts. (3 liters)

2.9 PIPING

2.9.1 General

Refer to Figure 6 for a diagram of a typical recommended piping system. Support all piping connections to the pump so that no stress is placed on pump fittings. In no case should the piping be sprung to make the connections to the pump. The suction and discharge cartridge pipe connections can be positioned within an arc of approximately 150° to facilitate piping to pump.

Flush and blow out all pipelines before connecting the pump. This eliminates any foreign matter that might seriously damage the internal working parts of the liquid end. Install a 20 mesh Y-type strainer that is sized to remove foreign particles with minimum pressure drop in the suction line of the pump.

Install shut-off valves, with unions on the pump side of the valves, in the suction and discharge lines to facilitate servicing.

2.9.2 Suction Piping

The suction piping must be absolutely tight and leak-free. For the XT/XW pump operating on water-like solutions we recommend that the suction pipe be 3/4" minimum diameter (much larger than the connection size) and a maximum of 6 feet (2 meters) long. The intent is that the piping must be designed to provide an adequate net positive suction head (NPSH). Obtain our NPSH Calculation software at the Milton Roy Web site (miltonroy.com). If assistance in determining NPSH is needed, contact the Milton Roy Aftermarket Service Department.

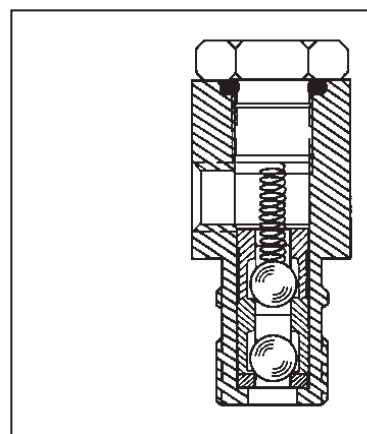


Figure 5. Back Pressure Spring Installation

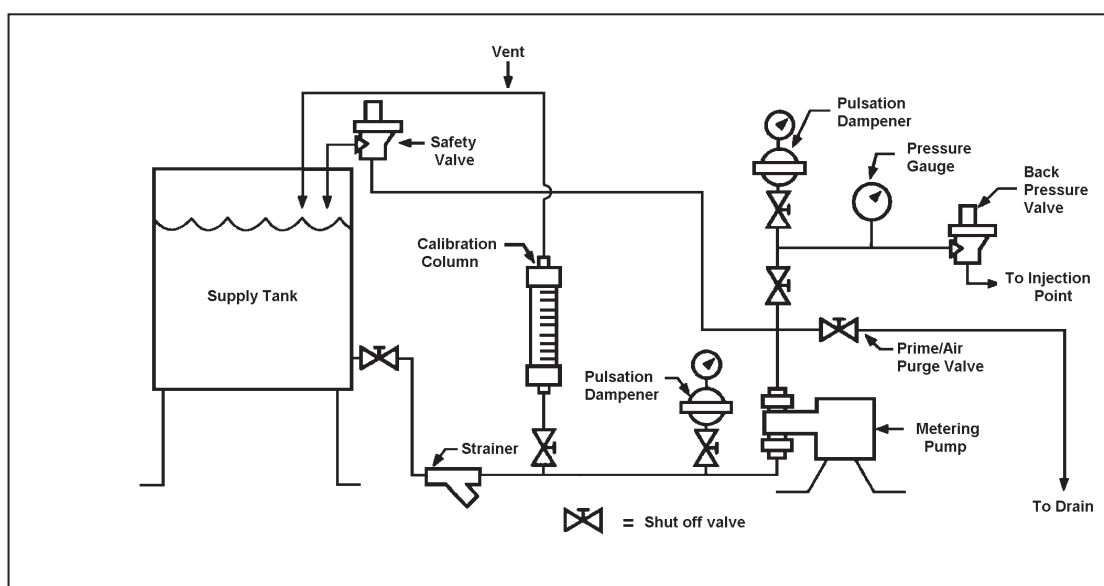


Figure 6. Typical Piping System

SECTION 2 - INSTALLATION

A flooded suction is recommended for optimum service life and maintenance-free operation. However, the XT/XW pump can operate with less than flooded suction if necessary, in accordance with the following schedule shown in the chart below.

Model Number	M" NPSH (PSIA)	Max. Lift (Ft. (meter) H ₂ O)
XT	9	10 (3)
XW	9	10 (3)

Refer to paragraph 2.11 "Operation with Suction Lift", which outlines limiting conditions if suction lift requirements are anticipated.

For more NPSH information, refer to Milton Roy web site (www.miltonroy.com) for aid in evaluating applications for this liquid end.

The supply tank should incorporate a low-level switch to cut off the pump motor circuit before the suction intake is exposed to air. Otherwise, the pump may occasionally run dry.

NOTE:

Maximum safety and reliability may be ensured by protecting liquid ends and piping with an external relief valve installed in the system discharge line.

2.9.3 Discharge Piping

The installation of an external Safety Valve is recommended, since the pump's internal relief valve is not intended to protect the piping system. Refer to "Relief Valve Setting" in Section 3, for further relief valve discussion. (Milton Roy offers a complete line of back pressure and safety valves).

For satisfactory metering and capacity control, the discharge pressure at the pump must be 50 PSIG (3.5 Bar) Minimum. Therefore, when the pump is to discharge into an open system, a back pressure device must be installed in the pump discharge cartridge or line.

2.10 OPERATION WITH SUCTION LIFT

It is desirable that the mRoy pump operate with a flooded suction; however, operation with net positive suction head (NPSH) less than atmospheric pressure is possible.

NPSH is the head available, above the vapor pressure of the liquid being pumped, to feed the liquid into the pump suction port. NPSH minimum is the head below which the pump cavitates.

Both values are calculated at the suction port of the pump. In controlled volume pump applications, two conditions must be considered in the selection of a pump to meet the NPSH minimum requirements:

1. At the start of the suction stroke, the liquid in the suction line has no velocity and NPSH minimum depends on the force necessary to accelerate the liquid in the suction pipeline.
2. At the peak of the suction stroke there is no acceleration factor and NPSH minimum depends on friction losses as calculated from standard flow equations. With all viscous fluids and in pilot plants and other places where unusual numbers of fittings and valves are used, the second condition that includes friction losses should be considered. For water-like fluids, the first condition will define the limiting configuration.

For Static NPSH (Condition 1)

Available NPSH = $P_a \pm P_h - P_v$ (must be equal to or greater than minimum NPSH as listed under Installation Instructions).

$$\text{Required NPSH min} = \frac{\text{Sp. Gr. (0.0925) } L_p D}{D_p^2}$$

For Dynamic NPSH (Condition 2)

Available NPSH = $P_a \pm P_h - P_f L_e$ (must be equal to or greater than minimum NPSH as listed under Installation Instructions).

D = Plunger Diameter (inches)

D_p = Pipe Diameter (inches)

L_p = Actual Length of suction pipe (feet)

L_e = Equivalent length of suction pipe including allowance for fittings (feet)

P_a = Ambient pressure above liquid (PSIA)

P_h = Head of liquid column above (+) or below (–) center line of plunger (PSIA) equals Head in feet x (0.435) (Sp.Gr.)

P_v = Vapor pressure of liquid (PSIA)

P_f = Friction loss per foot of pipe calculated from Reynold Number evaluation (PSIA) (Use 3.2 times average velocity for calculating friction losses when referring to a standard pipe losses table)

Minimum NPSH = Minimum hydraulic pressure at plunger (listed under Installation Instructions).

When operating the pump with a NPSH of less than atmospheric pressure (negative suction head or suction lift), special attention should be given to keep the suction line strainer clean and prevent other system conditions that might inadvertently decrease the NPSH available.

NOTE:

Obtain our NPSH calculation software at the Milton Roy web site (miltonroy.com). If assistance in determining NPSH is needed, contact the Milton Roy Aftermarket Service Department.

SECTION 3 - OPERATION

3.1 PUMP START-UP PROCEDURE

Before initial start up of the pump, check the following:

⚠ WARNING FAILURE TO CHECK ALL METALLIC HEAD BOLTS PRIOR TO STARTUP AND AFTER ONE WEEK OF OPERATION MAY EXPOSE OPERATING PERSONNEL TO HAZARDOUS LIQUIDS.

⚠ CAUTION DO NOT RUN THE MOTOR UNTIL ALL START UP STEPS HAVE BEEN COMPLETED. YOU COULD DAMAGE THE PUMP IF YOU RUN THE MOTOR BEFORE ALL OF THE STEPS HAVE BEEN COMPLETED. IT MAY BE NECESSARY TO TEST THE MOTOR OFF THE PUMP TO INSURE PROPER DIRECTION AND OPERATION. THE MOTOR DIRECTION IS CRITICAL. WIRE THE MOTOR SO THAT IT ROTATES IN THE DIRECTION OF THE ARROW CAST ON THE MOTOR MOUNT FLANGE. CONSULT MANUFACTURER DOCUMENTATION FOR MOTOR START UP RECOMMENDATIONS.

1. Check the torque on all metallic head bolts prior to startup. Recheck torque on all metallic head bolts after pump has been operating for one week. Torque the head assembly screws in a crosswise pattern as follows:
 - a) mRoy Model XT Heads: 60-70 “ lbs. (7-8 N-m) bolting torque.
 - b) mRoy Model XW Heads: 75-85 “ lbs. (8.5-9.6 N-m) bolting torque, tie down nuts - 25 “ lbs. (3 N-m).
2. Oil level in air bleed filler reservoir up to or slightly above the indicated oil level.
3. Set the capacity control knob to approximately 30- 40% of maximum capacity.
4. Make certain that the suction line, liquid end and discharge cartridge are filled with water or system fluid.

5. Relieve all back pressure in the discharge line and pump hydraulic system to allow air to purge. Reduce pressure on the oil relief valve until air is purged. Refer to “Start-Up after the Suction System has Run Dry” section.
6. If practical, install a temporary discharge line piped back to the suction tank incorporating a 100 PSI (7 Bar) relief valve to facilitate establishing performance during first hours of operation.

On initial start-up, run the pump for 10–20 seconds, then stop for 20–30 seconds. Repeat a few times in order to fill the diaphragm oil cavity. Check for proper motor rotation as described in general installation instructions. During these short runs listen for any abnormal motor or crank noises, and if present, refer to Section 5, Troubleshooting.

Run pump for 1/2 to 1-1/2 hours to warm up oil. Check discharge line for indication of flow.

Increase capacity adjustment setting to 100% of capacity and operate for 10–20 minutes.

⚠ CAUTION DO NOT SET THE CAPACITY ADJUSTMENT KNOB IN EXCESS OF 100% BECAUSE ERRATIC OR REDUCED METERING WILL DEVELOP.

Reduce capacity adjustment setting to 30–40% of maximum capacity and operate for several minutes, then increase capacity adjustment back to 100% for approximately 10 minutes. Repeat several times to insure that the air is bled from the pump displacement chamber and the liquid end. (As a general rule, to bleed air or vapor from the pump oil displacement chamber reduce the capacity adjustment to the 20 to 40% range, and to bleed air or vapor from the liquid end increase capacity to 100%, or if possible reduce the discharge pressure to atmospheric pressure for 30 seconds to one minute.)

The pump is now ready for “on-line” service. Calculate what the desired capacity as a percentage of either the maximum capacity rating on the pump data plate, or the nominal capacity at the required system pressure. Each pump is tested at the factory to confirm that the performance meets these capacity-pressure requirements (when tested with water). (Milton Roy offers a complete line of calibration columns for calibrating the pump.)

3.1.1 Start-Up with Back Pressure Spring in Discharge Cartridge

The start-up procedure with the back pressure spring installed is identical to the above procedure; however, the back pressure device will hold air in the liquid end. It is necessary to make certain that the liquid end is filled with fluid, either by removing the discharge cartridge and filling liquid end and inlet lines before start up, or by backing out the discharge cartridge cap approximately seven (7) turns to remove the spring load on the ball check permitting the air in the liquid end to be discharged.

3.1.2 Start-Up after the Suction System has Run Dry

In applications where the suction tank does not have a low level cutoff interconnected into the pump motor circuit, the pump may occasionally run dry. This should be avoided to insure full integrity of the diaphragm. Running the pump dry occasionally will not harm the diaphragm or the pump. When the pump is repeatedly allowed to run dry, especially for long periods of time, the diaphragm is fatigued and could fail before the next scheduled replacement. Before restarting a pump that has run dry, provisions should be made for filling the liquid end with liquid by opening the discharge line to atmospheric pressure to either refill liquid end with flooded suction pressure or start pump with open discharge and run for a short period of time (up to 2 minutes) that will ‘prime’ the liquid end if the ball checks are wet. If these steps fail, remove

the discharge cartridge and fill liquid end with liquid through the top discharge opening in the head. After establishing flow, return to the regular discharge system configuration.

3.2 RESETTING THE RELIEF VALVE DESCRIPTION

The mRoy XT/XW pump incorporates an internal relief valve that is preset at the factory to relieve when the hydraulic fluid pressure exceeds 3200 PSI (220.6 Bar). This setting can be readjusted as required up to 15% above the maximum rated pressure of the pump. Resetting the internal relief valve will change the potential discharge pressure of the pump.

Refer XT Figure 7 (Sheet 2) XW for a pictorial description of the mechanism.

Examination of these drawings will reveal a small passage connecting the oil side of the diaphragm head cavity with the oil reservoir. This passage is stopped off by a ball, XT pump and poppet, XW pump that is held in place by a spring secured by a set screw. A plastic screw plug keeps the adjusting threads free of dirt.

In operation, the spring-loaded ball, XT pump and poppet, XW pump is held against the seat in the housing until the pressure in the oil side of the diaphragm cavity exceeds the pressure for which the valve has been set. When this occurs, the ball or poppet is forced off its seat, permitting the oil to flow from the diaphragm cavity through the mechanical passage to an opening (Figure 7 or 14) in the side of the oil reservoir. The resilient material of the poppet permits the XW relief valve to actuate without erosion of the poppet or seat surface.

SECTION 3 - OPERATION

Relief Valve Setting

Pump must be at operational pressure and capacity set at 95%.

1. Remove yellow plastic plug located at top of pump next to the oil fill hole.
2. Using a 3/16" hex. key (mRoy XT), or a 5/16" hex. key (mRoy XW) as required for different models, turn adjusting screw clockwise to increase cracking pressure until pump ceases to bypass through relief valve at desired working pressure. When relieving has stopped, adjust screw clockwise up to one full turn beyond this point to set a reasonable buffer zone between operating pressure and relief pressure. To determine if relieving is taking place, insert your index figure into the oil reservoir opening and place it against the bypass opening where the oil pulse from the relief valve can be determined.
3. Reinstall the plastic screw plug.

NOTE:

No moving parts are present in the oil reservoir in this location.

CAUTION

WHEN RELIEVING IS TAKING PLACE, OIL MAY BE EJECTED AT HIGH VELOCITY FROM THE BYPASS PORT. NORMAL PRECAUTION SHOULD BE OBSERVED TO PREVENT THIS FROM SPLASHING THE SURROUNDING AREA.

NOTE:

This relief is intended primarily for pump protection in the event that the discharge or suction system is blocked while the pump is in operation. It is a good practice to install a high-grade chemical type relief valve in the pump discharge line as close to the pump as possible, and always between the pump and any shut-off valve. Pipe the outlet of the system relief valve back to the suction tank, with the open end of the pipe visible at all times. In this way, relief valve leakage may be easily detected.

CAUTION

FOR SAFETY REASONS, A CHECK VALVE IS RECOMMENDED FOR USE IN THE DISCHARGE LINE NEAR THE POINT WHERE THE LINE ENTERS A HIGH PRESSURE PROCESS VESSEL.

3.3 OPERATION

The mRoy pump is designed for reliable, unassisted operation. During normal operation, a periodic check of the pump is recommended every 24 or 48 hours to visually confirm satisfactory operation:

1. Make sure the oil level in the air bleed filler reservoir is above the oil level mark.
2. Inspect the pump liquid end for indication of leakage or seepage.

If anything seems to be amiss, refer to Section 4, Maintenance.

4.1 SPARE PARTS

To avoid excessive downtime in the event of a parts malfunction, the spare parts shown below should be maintained in your stores to support each mRoy pump. For your convenience, these parts can be purchased either separately or packaged in the form of Routine Preventive Maintenance (RPM) Kits. RPM kit numbers are listed in Section 1.

Double quantities required for duplex pumps. Two diaphragms are required for double diaphragm simplex liquid ends; four are required for double diaphragm duplex liquid ends.

4.2 RPM KIT COMPONENTS (WITHOUT LEAK DETECTION)

mRoy XT Metallic Liquid End

- 1 Suction 1/4" Single Ball Check Valve Assy
- 1 Discharge Single Ball Check Valve Assy
- 1 Diaphragm GYL, 2.84 Dia
- 1 Back Up Ring
- 1 O-Ring
- 1 O-Ring
- 1 O-Ring
- 1 O-Ring

mRoy XW Metallic Liquid End

- 1 Suction Check Valve, DBL Ball
- 1 Discharge Check Valve, DBL, Ball
- 1 Diaphragm
- 2 Back Up Ring
- 1 Back Up Ring
- 2 O-Ring
- 1 O-Ring
- 1 O-Ring
- 1 O-Ring

Parts Orders Must Include The Following Information:

1. Quantity required (in this manual)
2. Part number (in this manual)
3. Part description (in this manual)
4. Pump model no. (on pump nameplate)
5. Pump product code (on pump nameplate)
6. Pump serial no. (on pump nameplate)

Always include the serial number, product code, and model number in all correspondence regarding the unit.

4.3 RETURNING UNITS TO THE FACTORY

Pumps will not be accepted for repair without a Return Material Authorization Form, available from the Aftermarket Department. Process liquid must be flushed from the pump liquid end, and oil should be drained from the pump housing before the pump is shipped. Label the unit clearly to indicate the liquid being pumped.

NOTE:

Federal law prohibits handling of equipment that is not accompanied by an OSHA Safety Data Sheet (SDS). A completed SDS must be packed in the shipping crate with any pump returned to the factory. These safety precautions will aid the troubleshooting and repair procedure and preclude serious injury to repair personnel from hazardous residue in the pump liquid end.

All inquiries or parts orders should be addressed to your local Milton Roy representative. Representatives can be found on our website (www.miltonroy.com).

SECTION 4 - MAINTENANCE

4.4 ROUTINE MAINTNANCE

The mRoy XT / XW pump is designed for reliable service with a minimum amount of maintenance required. However, a yearly tune-up is recommended, during which the check valves and diaphragm are replaced. For convenience, these parts are available in a Routine Preventative Maintenance (RPM) Kit from your local representative. RPM kit numbers are listed in Section 1, Paragraph 1.6.

4.5 SEMI ANNUAL OIL CHANGE

The oil in the main housing should be drained twice a year, using the drain plug provided, and new oil installed. This can usually be scheduled to coincide with the change from winter to summer grade lubricants and vice versa. Refer to "Pump Lubricants" in Section 2, Installation, Paragraph 2.8 for information on recommended oil and oil capacity.

NOTE:

When adding oil, pour in a thin, slow stream to avoid overflow.

4.6 CHECK VALVE CARTRIDGES

Milton Roy recommends that check valves be replaced on an annual basis. If highly corrosive material (acids, slurries, etc.) is being pumped, some applications may require more frequent replacement.

In general, poor or reduced pump performance indicates that the check valves need to be replaced (*refer to Section 5, Troubleshooting*).

Complete instructions for replacing worn check valve assemblies is given in the "Corrective Maintenance" section.

The mRoy check valves are complete assemblies manufactured at the factory and should not be disassembled in the field.

To determine if the check valves need replacement, with the pump off and pressure removed from

system unscrew the check valve from the liquid end and peer through the hole in the check valve seat. The ball should appear perfectly round and free of pits, mars, or scratches. If the ball and or seat is excessively damaged, the replacement schedule should be shortened accordingly. If the ball and seat are both in good condition, the replacement schedule can be lengthened.

4.7 DIAPHRAGM(S)

The mRoy PTFE diaphragm is extremely durable and often lasts for many years. As a preventative measure, however, Milton Roy recommends that the mRoy diaphragm be replaced yearly to coincide with check valve replacement. Also whenever the head is removed freeing the diaphragm, the diaphragm must be replaced. Refer to the instructions in the "Corrective Maintenance" section for diaphragm replacement.

4.8 CORRECTIVE MAINTENANCE

CAUTION

BEFORE CARRYING OUT ANY SERVICING OPERATION ON THE METERING UNIT OR PIPES, DISCONNECT ELECTRICAL POWER FROM THE PUMP. TAKE THE NECESSARY STEPS TO ENSURE THAT ANY HARMFUL LIQUID IN THE PUMP OR PIPING SYSTEM CANNOT ESCAPE OR COME INTO CONTACT WITH PERSONNEL. SUITABLE PROTECTIVE EQUIPMENT MUST BE PROVIDED. CHECK THAT THERE IS NO PRESSURE BEFORE PROCEEDING WITH DISMANTLING.

4.8.1 XT & XW Diaphragm Replacement

NOTE:

This section contains procedures for disassembly and assembly of the pump, and check valves, plus procedures for preventive and corrective maintenance. To maintain the reliability, durability, and performance of your pump assembly and related components, it is essential to follow these procedures exactly and carefully. For consistent, reliable performance, replace any O-rings, or other seals that you remove. Order replacement seal kits with detailed instructions from your Milton Roy. Whenever you disconnect any fluid piping, cover all open ports in the pump assembly to prevent dirt from entering.

Disassembly

1. Remove drain plug (XT, Item 350, Figure 9, 10, 11 or XW, Item 60, Figure 14) at bottom of pump housing, and drain pump of all oil.
2. Using appropriate wrenches, remove suction check valve (XT, Item 240, Figure 8 or XW, Item 600, Figure 15), discharge check valve (XT, Item 180, Figure 8 or XW, Item 510, Figure 15), and bleeder plug (XT, Item 190, Figure 8 or XW, Item 335, Figure 15).
3. Using a 3/8" hex wrench, remove 8 bolts (XT, Item 220, Figure 8 or XW, Item 350, Figure 15) which attaches diaphragm head (XT, Item 230, Figure 8 or XW, Item 330, Figure 15) to pump.
4. Remove contour plates (XT, Item 210, Figure 8 or XW, Item 280, Figure 15), O-ring (XT, Item 195, Figure 8 or XW, Item 215, Figure 15), and diaphragm (XT, 200 or XW, 290). (When equipped with leak detection remove two diaphragms (XT, 290 or XW, 291), leak detection ring A (287), leak detection ring B (288), and leak detection ring spacer (287). Leak detection ring A, leak detection ring B, and leak detection ring spacer can be reused). Do not remove roll pins (XT, Item 215, Figure 8 or XW, item 281, Figure 15), which will remain attached to contour plates.
5. Clean all components with an appropriate solvent. Contact Milton Roy for a recommended solvent. Inspect all parts and replace them if they are worn.

NOTE:

The diaphragm (XT, 200 or XW, 290) must be replaced each time the liquid end is removed.

Reassembly

1. Insert inner contour plate (XT, Item 210, Figure 8 or XW, Item 280, Figure 15) into pump housing, being sure that roll pin (XT, Item 215, Figure 8 or XW, item 281, Figure 15) inserts into guide hole in housing. Contour plate should be flush with housing.
2. Lay the diaphragm (XT, 200 or XW, 290) in recessed groove of housing, using some grease to hold it in place. (When equipped with leak detection install two diaphragms (XT, 290 or XW, 291), leak detection ring A (287), leak detection ring B (288, and leakdetection ring spacer (287) removed previously. Apply a small amount of mineral oil between diaphragms. Stacked diaphragms and rings maybe aligned using three small holes as a guide).
3. Insert second contour plate (XT, Item 210, Figure 8 or XW, Item 280, Figure 15) into diaphragm head (XT, Item 230, Figure 8 or XW, Item 330, Figure 15), being sure that roll pin (XT, Item 215, Figure 8 or XW, item 281, Figure 15) inserts into guide hole in diaphragm head. Contour plate should be flush with diaphragm head.
4. Insert O-ring (XT, Item 195, Figure 8 or XW, Item 215, Figure 15) into diaphragm head, using some grease to hold it in place.
5. Align diaphragm head (XT, Item 230, Figure 8 or XW, Item 330, Figure 15) so bleeder plug hole is oriented toward top of pump. Carefully align diaphragm head with bolt holes, being sure O-ring and diaphragm remain in their grooves. Insert 8 bolts (XT, Item 220, Figure 8 or XW, Item 350, Figure 15) and tighten XT/XW pump bolts to a torque of 60 ft-lbs (81 N-m). Be sure to use an alternating tightening pattern when torquing bolts.
6. Install discharge check valve (XT, Item 180, Figure 8 or XW, Item 510, Figure 15), and suction check valve (XT, Item 240, Figure 8 or XW, Item 600, Figure 15), being sure to apply thread sealing compound and PTFE pipe thread tape to all connections. Make sure end of suction check valve with internal hex is screwed into diaphragm head.

NOTE:

The XT/XW suction and discharge check valves are NOT interchangeable.

SECTION 4 - MAINTENANCE

7. Insert bleeder plug (XT, Item 190, Figure 8 or XW, Item 335, Figure 15) into hole in diaphragm head and tighten it snugly with a wrench.
8. Insert drain plug into housing, using thread sealing compound. Discard old oil and fill pump with oil specified.

4.8.2 Motor and Worm Components:

NOTE:

The motor must be removed in order to replace or inspect the motor or the gears.

Disassembly

1. Remove oil drain plug and drain oil.
2. Remove screws that attach motor to pump.
3. When removing a direct motor unit (XT only); worm shaft may come out as well. If motor separates from worm shaft, use care not to lose shaft key.
4. When removing an API mounted motor, the entire motor, mount and coupling can be removed as a unit if separation is made by removing lower bolts (XT, Item 400, Figure 10 and 11 or XW, Item 770, figure 13).
5. Remove worm assembly.
6. Inspect components and replace any that are worn.

Reassembly

1. Reinstall by reversing steps 1 through 4.

4.8.3 Worm Gear

Disassembly

1. Remove motor assembly, following instructions shown in "Motor and Worm Components" section.
2. Remove worm gear shaft.
3. Lift worm gear (XT, Item 320, Figures 9, 10, and 11 or XW, Item 120, Figure 13) up and out of pump housing.

4.8.4 Connecting Rod

Disassembly

NOTE:

The worm gear must first be removed.

1. Lift connecting rod up and back to disengage piston from bore.
2. Use arbor press or hammer and brass punch to remove wrist pin from connecting rod and plunger.
3. To assure proper installation, note position of oil hole in connecting rod (bottom).

Reassembly

1. Reverse steps 1 through 3 above. Be sure oil hole in connecting rod is on bottom, as noted in step 3.

4.8.5 Stroke Adjuster (XT, Figure 7)

1. Remove drain plug at bottom of XT pump, and drain pump of all oil.
2. Unscrew and remove stroke locking knob (Item 70, Figure 7). Remove e-clip (Item 90) and adjuster knob (Item 100).
3. Using a 1/16" hex wrench, remove set screw (Item 60) from stroke adjuster seal cap (Item 40). Remove control rod (Item 80).
4. Using a 1-3/8" wrench, unscrew stroke adjuster seal cap (Item 40). Remove O-rings (Items 130, and 30) and back-up ring (Item 120) from seal cap.
5. Clean all components with an appropriate solvent. Contact Milton Roy for a recommended solvent. Inspect all parts and replace them if they are worn.

Reassemble the XT Stroke Adjuster as Follows:

1. Slide O-rings (Items 130 and 30) and backup ring (Item 120) into appropriate grooves in stroke adjuster seal cap (Item 40). Apply O-ring lubricant (or equivalent grease) to outside surface of O-rings.
2. Carefully screw stroke adjuster seal cap into pump housing, so O-ring (Item 30) does not fall out of recess in face.
3. Tighten stroke adjuster seal cap (Item 40) until snug.
4. Apply O-ring lube (or equivalent grease) to outside surface of control rod (Item 80) and insert it into seal cap.
5. Apply a removable thread-locking adhesive to set-screw (Item 60). With slot in control rod vertical and rod fully inserted in seal cap, thread set-screw into stroke seal cap so set screw goes into slot preventing rotation. Screw set-screw into stroke adjuster body until it contacts control rod (Item 80), then back set-screw out 1 turn.
6. Insure cal ring (Item 110) is attached to stroke adjuster knob (100) and screw onto stroke adjuster seal cap (Item 40) until knob bottoms out. Adjust cal ring to 0 degree position.
7. Press e-clip (Item 90) into groove of control rod (Item 80) so it retains knob.
8. Adjust control knob (Item 100) to desired setting and thread on locking knob (Item 70). Locking knob will prevent accidental changes during operation, and can be loosened by hand.
9. Insert drain plug into housing, using thread sealing compound. Discard old oil and fill pump with specified oil.
10. Refer to appropriate sections for startup and operation procedures.

4.8.6 Stroke Adjuster (XW, Figure 14)

1. Remove drain plug at bottom of XW pump, and drain pump of all oil.

2. Remove e-clip (Item 230 Figure 14) and remove control knob (Item 210) with a adjustable wrench. Calibration ring (Item 200) is attached to control knob.
3. Using a 1/16" hex wrench, remove set screw (Item 180) from seal cap (Item 225). Remove control rod (Item 230).
4. Using a 1-3/4" wrench, unscrew seal cap (Item 225). Remove the O-rings (Items 215 and 216) and back-up ring (Item 217) from seal cap.
5. Clean all components with an appropriate solvent. Contact Milton Roy for a recommended solvent. Inspect all parts and replace them if they are worn.

Reassemble the XW Stroke Adjuster as Follows:

1. Slide O-rings (Items 215 and 216) and backup ring (Item 217) into appropriate grooves in seal cap. Apply O-ring lubricant (or equivalent grease) to outside surface of O-rings.
2. Carefully screw seal cap into pump housing, so O-ring (Item 215) does not fall out of recess in face.
3. Tighten seal cap until snug with 1-3/4" wrench.
4. Apply O-ring lube (or equivalent grease) to the outside surface of the control rod and insert it into the seal cap (Item 230).
5. Apply a removable thread-locking adhesive to set-screw (Item 180). With slot in control rod vertical and rod fully inserted in seal cap, thread set-screw into stroke seal cap so that set screw goes into slot preventing rotation. Screw set-screw into stroke adjuster body until it contacts control rod (Item 230), then back set-screw out 1 turn.
6. Insure calibration ring (Item 200) is attached to control knob. Screw control knob onto seal cap (Item 225) until knob bottoms out using an

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adjustable wrench. Calibration ring should be set at zero degrees.

7. Press e-clip (Item 220) into groove of control rod so that it retains knob.
8. Insert drain plug into housing, using thread sealing compound. Discard old oil and fill pump with specified oil.
9. Refer to appropriate sections for startup and operation procedures.

4.8.7 Relief Valve XT, Figure 7



CAUTION

LOOSEN THE ADJUSTMENT SCREW SO THAT PRESSURE IS REMOVED FROM THE SPRING BEFORE THE RELIEF VALVE SUBASSEMBLY IS REMOVED FROM THE PUMP.

Disassembly

1. Remove plastic plug (Item 249) which covers relief valve and using 5/32" hex wrench loosen adjustment screw to remove pressure on spring.
2. Unscrew and remove relief valve subassembly.
3. Using a 5/32" hex wrench, remove adjustment screw (Item 250) and dump out spring (Item 260), ball holder (Item 280) and ball (Item 300). The ball will probably stick inside ball holder—if this is the case, keep parts together. Do not separate sleeve (Item 290) from seat (Item 280).
4. Remove O-ring (Item 310) from bottom end of cartridge.
5. Clean all components with an appropriate solvent. Contact Milton Roy for a recommended solvent. Inspect all parts and replace them if they are worn.

Reassembly

1. Insert ball (Item 300) into ball holder (Item 270). Slide ball holder onto spring (Item 260).
2. While holding spring vertical such that ball and ball holder are on top, slide sleeve subassembly—consisting of components 280 and 290—over ball holder and spring.
3. Flip subassembly over and insert adjustment screw (Item 250). Using a 5/32" hex wrench, tighten adjustment screw until it clears notch in sleeve.
4. Insert O-ring (Item 310) into end of seat (Item 280).
5. Insert relief valve subassembly into pump, and using a flat head screwdriver tighten it snugly.
6. Follow adjustment procedure (Paragraph 3.2).

4.8.8 Relief Valve XW, Figure 14

⚠ CAUTION LOOSEN THE BRASS ADJUSTMENT SCREW SO THAT PRESSURE IS REMOVED FROM THE SPRING BEFORE THE RELIEF VALVE SUBASSEMBLY IS REMOVED FROM THE PUMP.

Disassembly

1. Remove plastic screw plug when required and using a 5/16" hex wrench loosen brass adjustment screw to remove pressure on spring.
2. Unscrew and remove relief valve subassembly.
3. Using a hex wrench, remove brass adjustment screw (Item 50) and dump out spring (Item 40) and poppet (Item 30). The seat (Item 255) is pressed in to the bottom of the sleeve (Item 254), keep parts together. Do not separate sleeve from seat.
4. Remove O-ring (Item 256) from bottom end of cartridge.
5. Clean all components with an appropriate solvent. Contact Milton Roy for a recommended solvent. Inspect all parts and replace them if they are worn.

Reassembly

1. Insert poppet (Item 50) and spring (Item 40) into sleeve (Item 254).
2. While holding spring vertical insert brass adjustment screw and just start screw.
3. Insert the O-ring (Item 256) into end of seat (Item 255).
4. Insert relief valve subassembly into pump and using an adjustable wrench tighten it snugly.
5. Follow adjustment procedure (Paragraph 3.2).

4.8.9 Relief Valve Completion

1. Replace plastic hole plug.
2. Insert drain plugs into housing, using thread sealing compound. Discard old oil and fill pump with oil specified in section 2.
3. Refer to appropriate startup and operation procedures.

4.9.10 Cleaning and Lubrication:

Whenever pump is disassembled: Clean all inside and outside surfaces with an approved solvent, and blow them dry with compressed air.

⚠ CAUTION TO PREVENT DAMAGE TO THE PUMP WHEN YOU CLEAN IT, USE A SOLVENT THAT IS COMPATIBLE WITH THE PROCESS FLUID AND THAT WILL NOT DAMAGE PUMP SEALS. CONTACT THE MILTON ROY FOR A RECOMMENDED SOLVENT.

SECTION 5 - TROUBLESHOOTING

SYMPTOMS	REMEDIES
Pump motor won't operate.	• No power. Supply correct power in accordance with motor nameplate. • Blown fuse. Check for short circuit or overload. • Open thermal overload device in starter. Reset overload. • Broken wire. Locate and repair. • Low voltage. Check for too thin wiring. • Low liquid level (where low level cutoff is used). Fill tank. • Oil is frozen in pump. Thaw out. • Bad motor. Replace motor.
Pump doesn't deliver rated capacity.	• Starved suction. Replace suction piping with larger size, or increase suction head. • Leaky suction piping. Repair or replace defective piping. • Excessive suction lift. Rearrange equipment location to reduce suction lift. • Liquid too close to boiling point. Lower temperature or increase suction pressure. • Air in hydraulic or reagent system. Bleed system. • Air or gas trapped in oil or pumpage. Decrease capacity to 20% for 5 mins. then increase to 100% for 5 mins. • Worn or dirty valves or seats. Clean or replace cartridges. • Viscosity of liquid too high (cps). Reduce viscosity by heating or other means, or increase size of suction piping, or increase suction pressure. • Insoluble materials; crystallization of liquid; settling of solids. Limit solution strength to proper value. Flush and clean solution tank periodically. Suction connection should be 2" to 4" from bottom of solution tank. • Relief valve being actuated. Refer to symptom marked with an *.
Erratic delivery.	• Leaky suction line. Repair or replace piping. • Worn or dirty valves or seats. Clean or replace cartridges. • Excessive excursion of ball valves from seats (indicated by ball chatter). Replace cartridges. • Insufficient suction pressure. Increase suction pressure by raising tank level or pressurizing suction tank. • Liquid too close to boiling point. Reduce temperature or raise suction pressure. • Leaky system relief valve. Repair or replace relief valve.

SECTION 5 - TROUBLESHOOTING

SYMPTOMS	REMEDIES
Motor overheats thermal overload switches.	• Power supply does not match motor characteristics. Check power supply against motor nameplate data. • Overload caused by operating pump above its discharge pressure. Check operating pressure against pump manufacturer's data plate max. rating and correct the cause of the pressure abnormality.
Noisy operation of pump liquid end.	• Pump valves must move to open and close, and they will make a clicking noise as they operate. These noises are sometimes amplified by natural resonances in the piping system. They are usually indications of normal valve functioning.
*Noisy operating in drive casing (pounding noise at high discharge pressure).	• Fluid compressibility causes reversal load on gears at end of pressure stroke. Not considered detrimental. No action needed. • Pump internal relief valve actuating, caused by excessive suction lift conditions. Lower pump or raise level of liquid. • Pump internal relief valve actuating, caused by insufficient suction pressure. Correct poor suction condition. • Pump internal relief valve actuating, caused by clogged or partially blocked filter or strainer in suction line. Clean strainer. • Pump internal relief valve actuating, caused by clogged or fouled suction or discharge check valves. Clean or replace. • Pump internal relief valve actuating, caused by blocked discharge line. Remove blockage. • Pump internal relief valve actuating, caused by insufficient discharge pressure. Install back pressure valve or device to create back pressure at pump discharge connection (see Discharge Piping, in Section II).
Improper oil level in reservoir increases and overflows.	• Flexible diaphragm punctured by foreign material. Replace diaphragm.
Pump delivery is not adjustable.	• System pressure too low. Install a back pressure valve in the discharge line (preferred method), or install a back pressure spring (provided) into discharge cartridge.
Pump does not develop required pressure.	• Refer to symptom marked with an *, or check to see if system pressure exceeds rated capacity on data plate. • Pump internal relief valve actuating, caused by excessive suction lift conditions. Lower pump or raise level of liquid. • Pump internal relief valve actuating, caused by insufficient suction pressure. Correct poor suction condition.

SECTION 6 - PARTS

6.1 GENERAL

This section gives information regarding replaceable components for the Model XT and Model XW Pumps. When ordering parts, please refer to the parts ordering instructions listed under “Recommended Spare Parts” in the Maintenance Section (*Section 4*). Be sure to include all required information with your parts order, or Milton Roy may be unable to process your order.

NOTE:

All drawings in this manual represent standard configured pumps. Notify Milton Roy for all special configured pumps.

6.2 ILLUSTRATED PARTS LIST

1. Figure and Item Number Column

- a) The item numbers shown in the detailed parts list correspond to the item numbers appearing on the exploded view illustration. To find an unknown part number, locate the part on the illustration and note the item number. Look for the item number on the detailed parts list. The part number is on the same line. A dash (-) precedes non-illustrated item numbers.

2. Description Column

- a) The name of the item is in the description column.

3. Part Number Column

- a) The supplier's part number is listed in the part number column.

4. Quantity Column

- a) The numbers appearing in the quantity column are the total quantity of the listed part required in its immediate assembly.

5. Reference Code Column

- a) This column is used to denote assembly and detail part variations among similar components (models) covered by this publication. When the symbol “A”, “B”, “C”, etc. is entered in this column, the part is used only in the model (liquid end and material codes, see Data Sheets (Referenced Section 1) and pump data plate at which the symbol appears. If the column is blank, the part is used in all models.

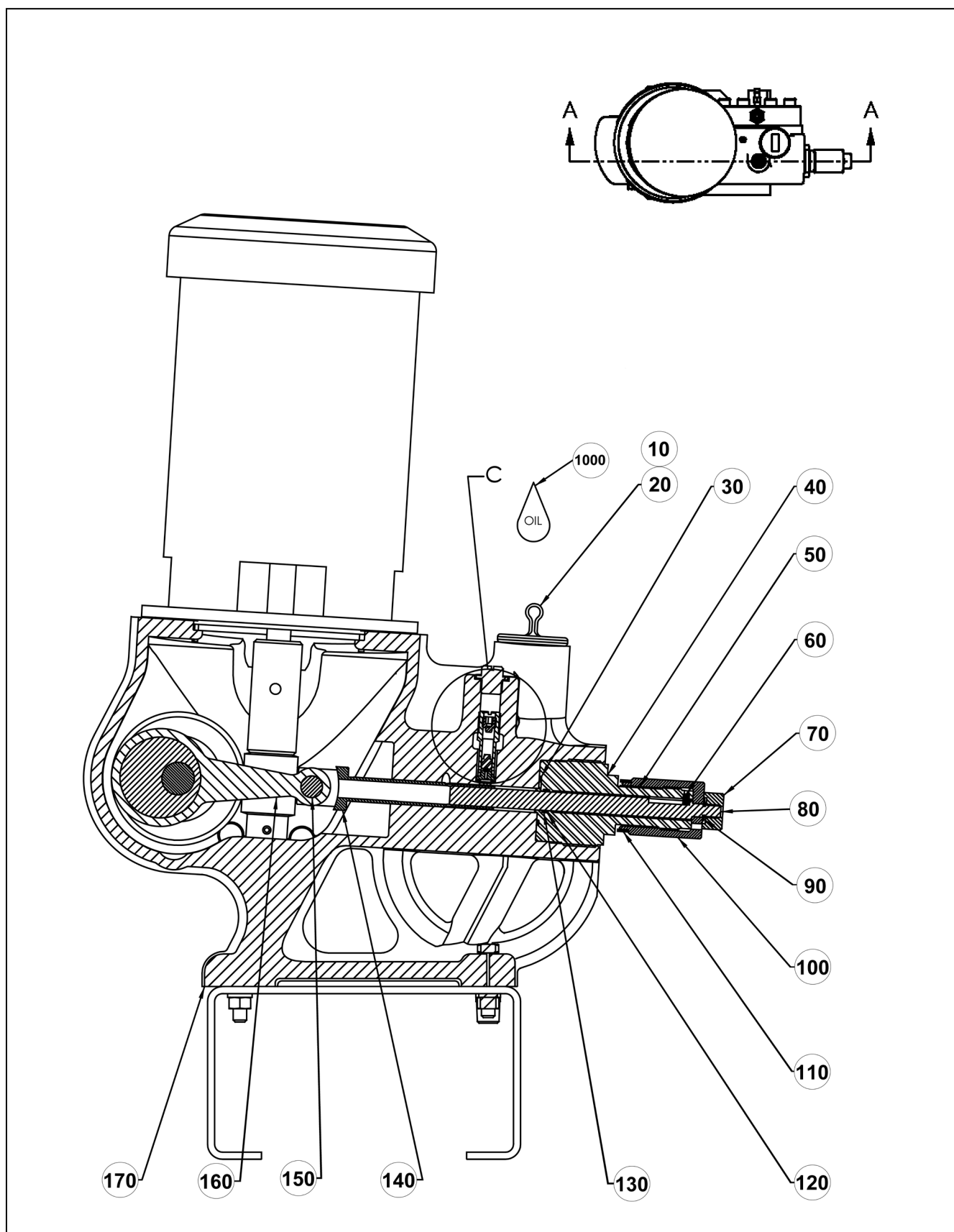


Figure 7. XT Assembly Drawing (Sheet 1 of 2) (DWG 102-2633-000)

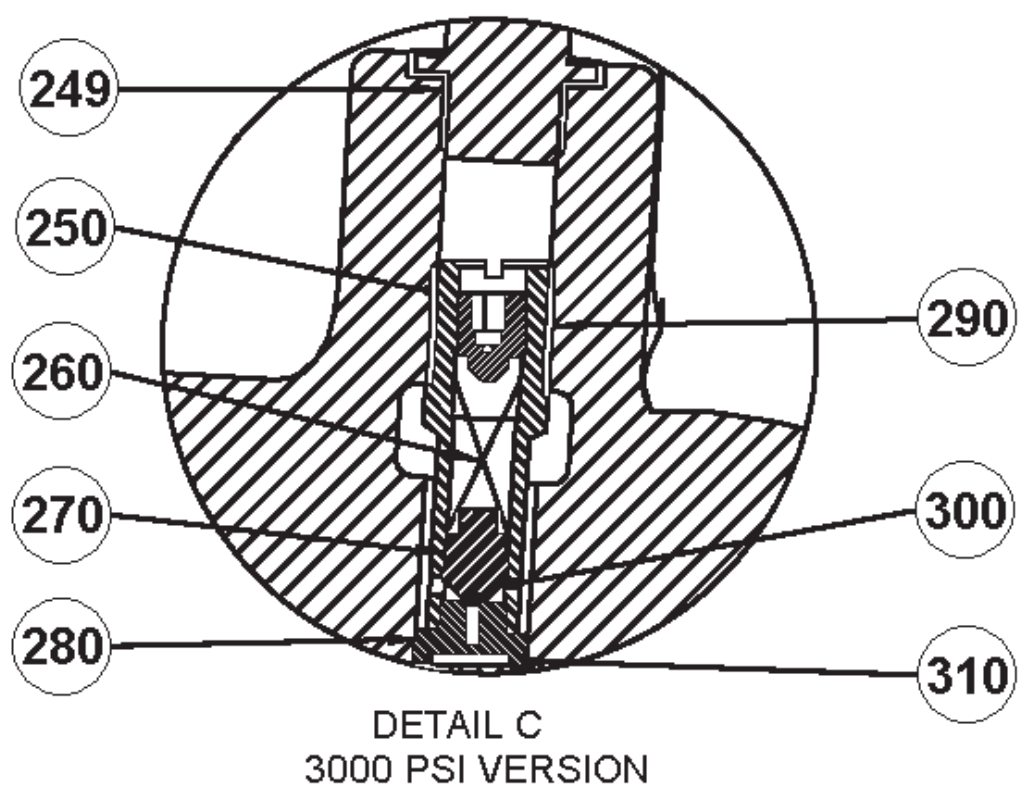


Figure 7. XT Assembly Drawing (Sheet 2 of 2) (DWG 102-2633-000)

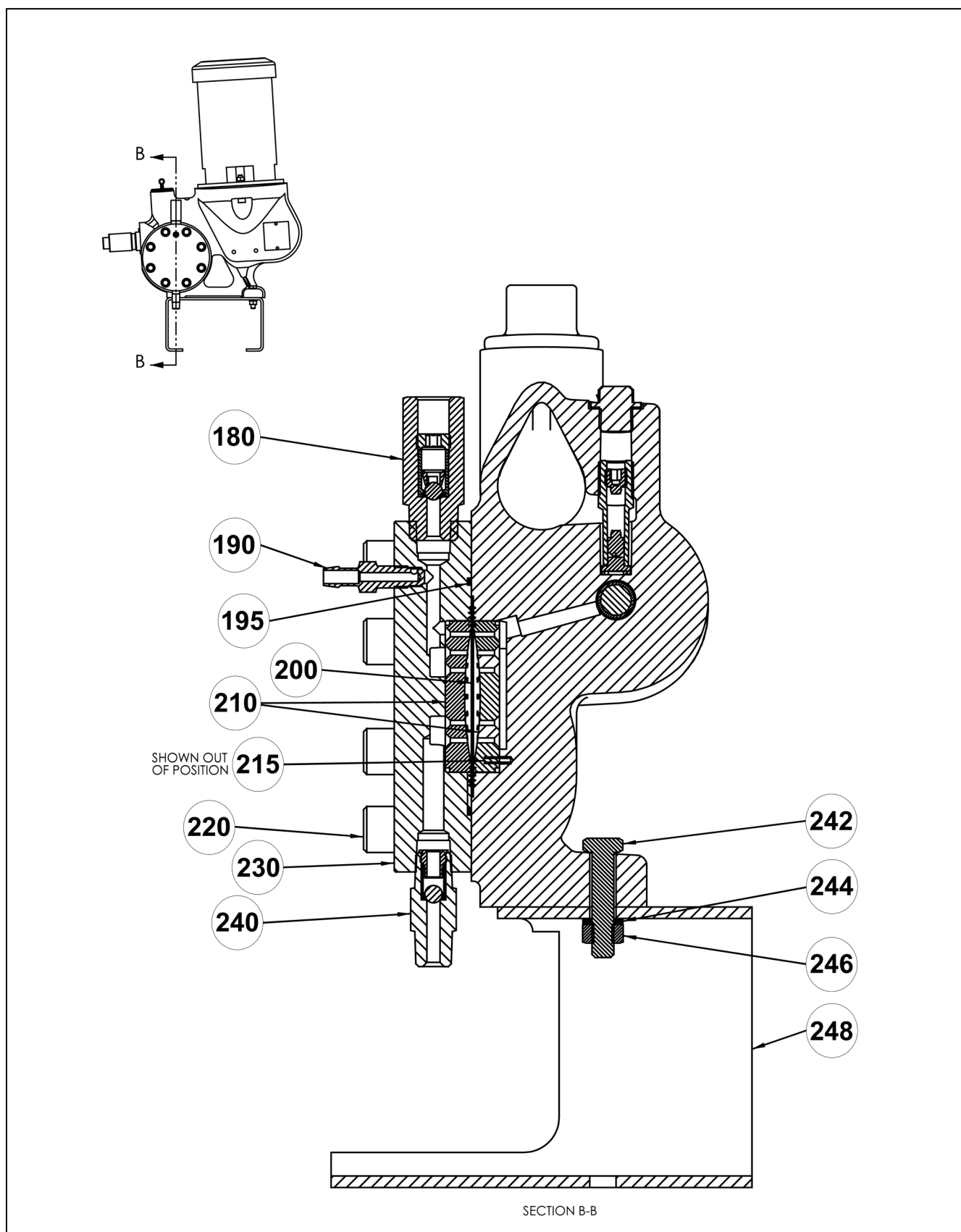


Figure 8. XT Liquid End and Base Parts Drawing (DWG 102-2633-000)

6.3 XT ASSEMBLY, LIQUID END AND BASE PARTS

FIGURE NUMBER	ITEM NUMBER	DESCRIPTION	PART NUMBER	QTY	REFERENCE CODE
7, 8	10	Oil Reservoir Cap	20183	1	
	20	O-Ring, Parker 2-216 BUNA N	4080095071	1	
	30	O-Ring, 2-022, Nitrile, 90 Duro	40336	2	
	40	Cap, Seal	21163	1	
	50	Cap Plate %, Aluminum	2530015062	1	
	60	Screw, Soc Set, #6-32NC X 1/4	4050039035	1	
	70	Knob, Locking	21162	1	
	80	Rod, Control	21161	1	
	90	Clip, 1/4", External E-Ring	4040124096	1	
	100	Knob, Control, Stroke Adj.	20926	1	
	110	Ring, Calibration, PVC	2530024071	1	
	120	Ring, Back Up, 8-013, Nitrile	4080126101	1	
	130	O-Ring, 2-013, Nitrile, 90 Duro	40312	1	
	140	Plunger, 9/16"	20342	1	
	150	Pin, Wrist, Steel	2110030006	1	
	160	Connecting Rod, Aluminum	2140025062	1	
	170	Housing, 9/16" Bore	21170	1	
	180	Single Ball Check Valve Assy, Discharge	CV202265	1	
	180	Double Ball Check Valve Assy, Discharge	21342	1	
	190	Plug, Bleeder	BV202139	1	
	195	O-Ring, 2-042, Nitrile, 70 Duro	40673	1	
	200	Diaphragm, Gyl. 2.84" Dia.	20407	1	
	210	Contour Plate	22039	2	
	215	Pin, Spring, 3/32" X 3/8", 420 SS	40315	2	
	220	Screw, Soc Head, 7/16"-14" X 1-3/4", STL	4050030154	8	
	230	Faceplate, Diaphragm Head	20936	1	
	235	Bushing, Reducer, 1/2 - 1/4, NPT	40732	1	
	240	Single Ball Check Valve Assy, Suction	CV202270	1	
	240	Double Ball Check Valve Assy, Suction	2210264002	1	
	242	Screw, Hex Head, 5/16"-18" X 1-1/2", GR5	4050017149		
	244	Washer, Spring Lock, 5/16" Z PI	4040040028	3	
	246	Nut, Hex, 5/16"-18NC, 18.8 SS	4050065013	3	
	248	Base, Simplex	2010441006	1	
	249	Plug, 1/2-20 THD	40895	1	
	250	Screw, Adjustment Relief Valve	20934	1	
	260	Spring, Lee, LC-040C-10 MW	40670	1	

- Parts Not Illustrated

FIGURE NUMBER	ITEM NUMBER	DESCRIPTION	PART NUMBER	QTY	REFERENCE CODE
7, 8	270	Holder, Ball, Relief Valve	40687	1	
	280	Seat, Relief, Steel	20348	1	
	290	Sleeve, Relief Valve	20930	1	
	300	Ball, 0.0833 Dia.	40317	1	
	310	O-Ring, 2-009, Nitrile, 90 Duro	40313	1	
	-	Socket Weld,150# , 1/2" RF Flange Flange & Nipple, 316 SS	1791544166	2	
	-	Elbow, Street, 1/4, 6000#, 316 SS, Discharge	41008	1	
	-	90 Degree Elbow, 2000#, THRD 1/4, 316 SS, Suction	4020018023	1	
	-	Socket Weld,300# , 1/2" RF Flange Flange & Nipple, 316 SS	1791544816	2	
	-	Elbow, Street, 1/4, 6000#, 316 SS, Discharge	41008	1	
	-	90 Degree Elbow, 2000#, THRD 1/4, 316 SS, Suction	4020018023	1	
	-	Socket Weld,1500# , 1/2" RF Flange Flange & Nipple, 316 SS	20850	2	
	-	NIPTHRDSCH80, 1/4x3, 316 SS, Discharge	4020050223	1	
	-	90 Degree Elbow, 2000#, THRD 1/4, 316 SS, Suction	4020018023	1	
	-	Threaded, 150#, 1/2 RF Flange NIPTHRDSCH80, 1/4x3, 316 SS,	4020050223	2	
	-	Flange, 150#, THD, 1/2 X 1/4, 316 SS	4020313023	2	
	-	Elbow, Street, 1/4, 6000#, 316 SS, Discharge	41008	1	
	-	90 Degree Elbow, 2000#, THRD 1/4, 316 SS, Suction	4020018023	1	
	-	Threaded, 300#, 1/2 RF Flange NIPTHRDSCH80, 1/4x3, 316 SS,	4020050223	2	
	-	Flange, 300#, THD, 1/2 X 1/4, 316 SS	4020361023	2	
	-	Elbow, Street, 1/4, 6000#, 316 SS, Discharge	41008	1	
	-	90 Degree Elbow, 2000#, THRD 1/4, 316 SS, Suction	4020018023	1	
	-	Threaded, 600#, 1/2 RF Flange NIPTHRDSCH80, 1/4x3, 316 SS,	4020050223	2	
	-	Flange, 600#, THD, 1/2 X 1/4, 316 SS	4020629023	2	
	-	Elbow, Street, 1/4, 6000#, 316 SS, Discharge	41008	1	
	-	90 Degree Elbow, 2000#, THRD 1/4, 316 SS, Suction	4020018023	1	

- Parts Not Illustrated

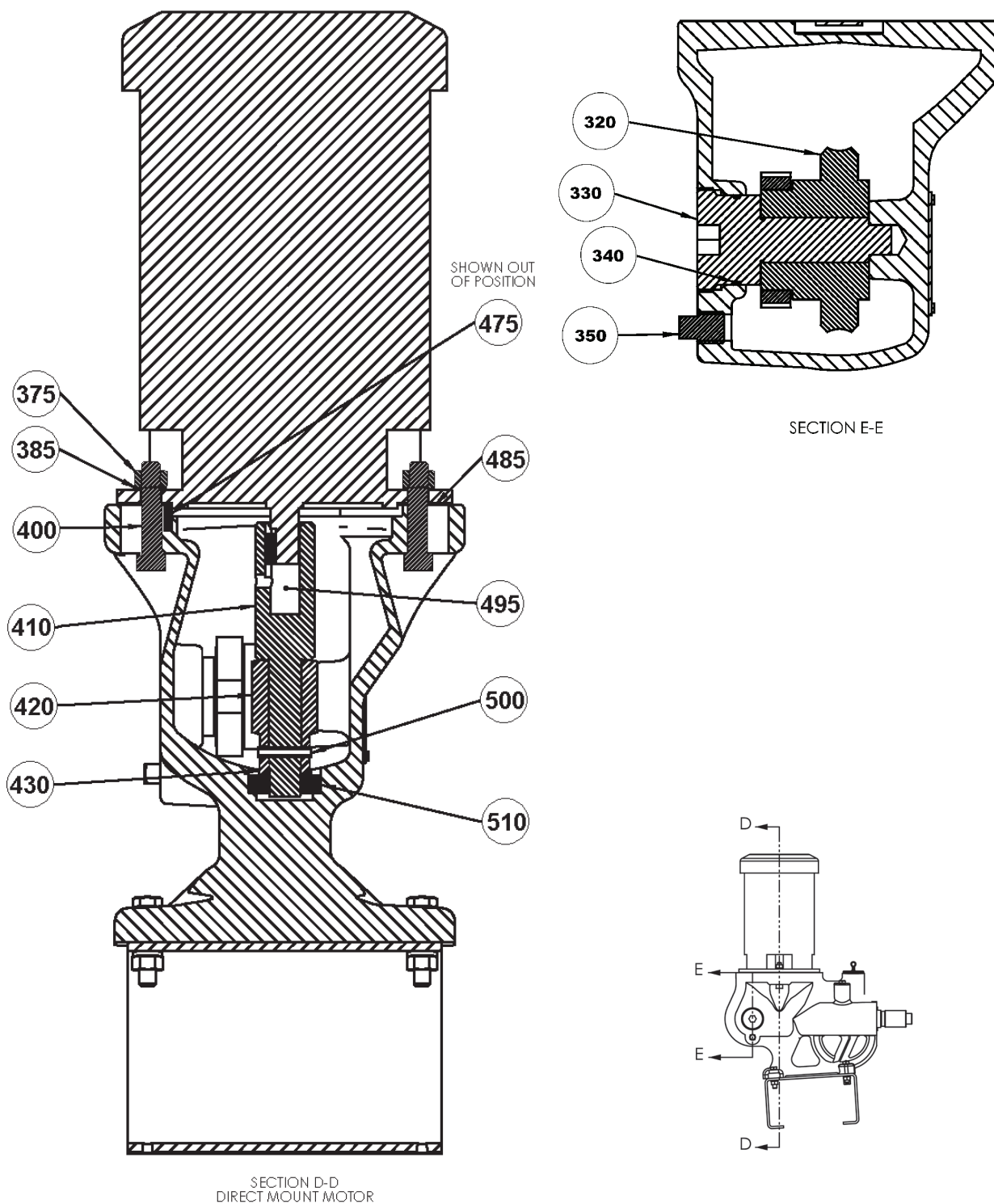


Figure 9. XT Direct Mount Motor / Mount / Gear Shaft (DWG 102-2633-000)

- Parts Not Illustrated

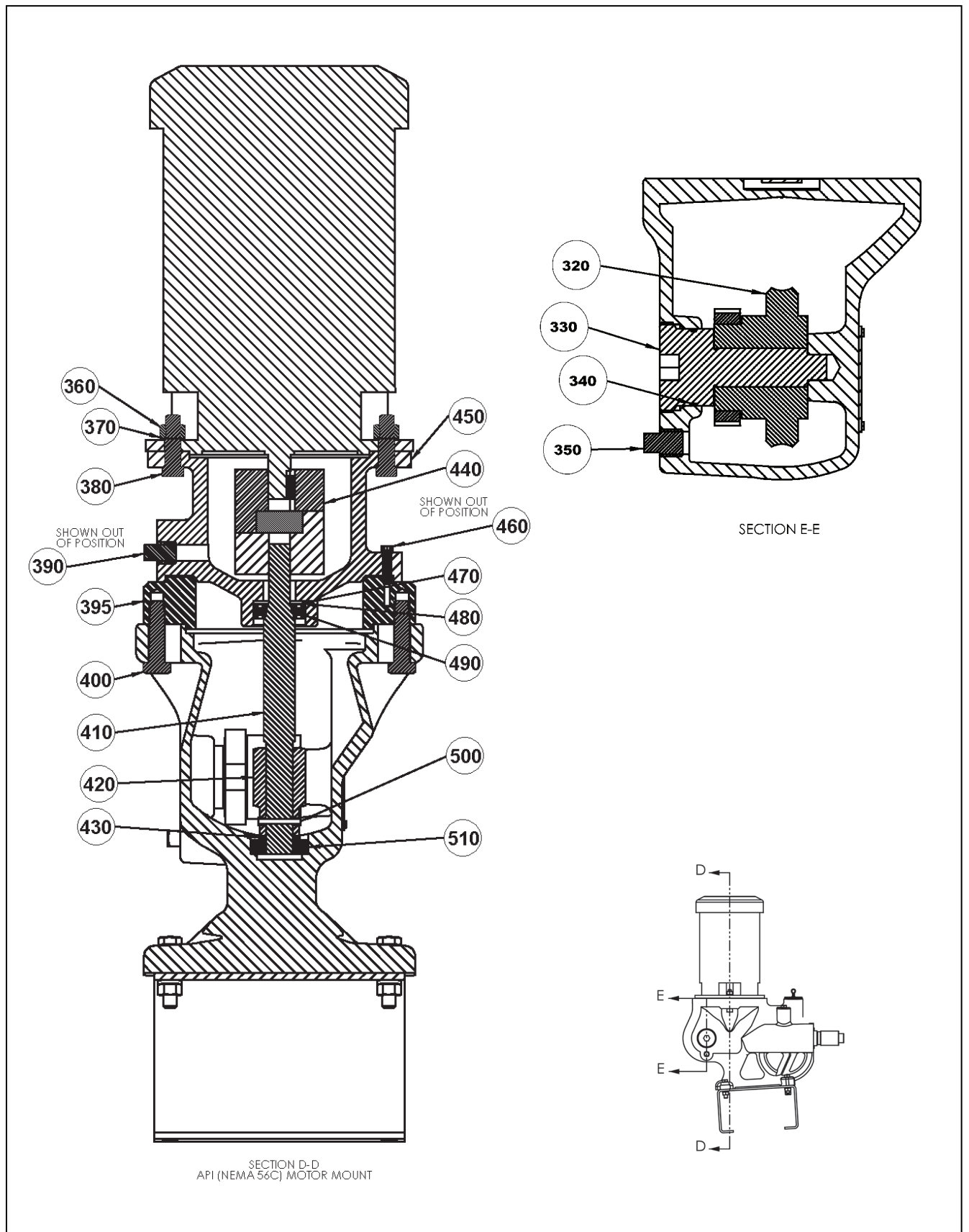


Figure 10. XT API (NEMA 56C) Motor / Mount / Gear Shaft (DWG 102-2633-000)

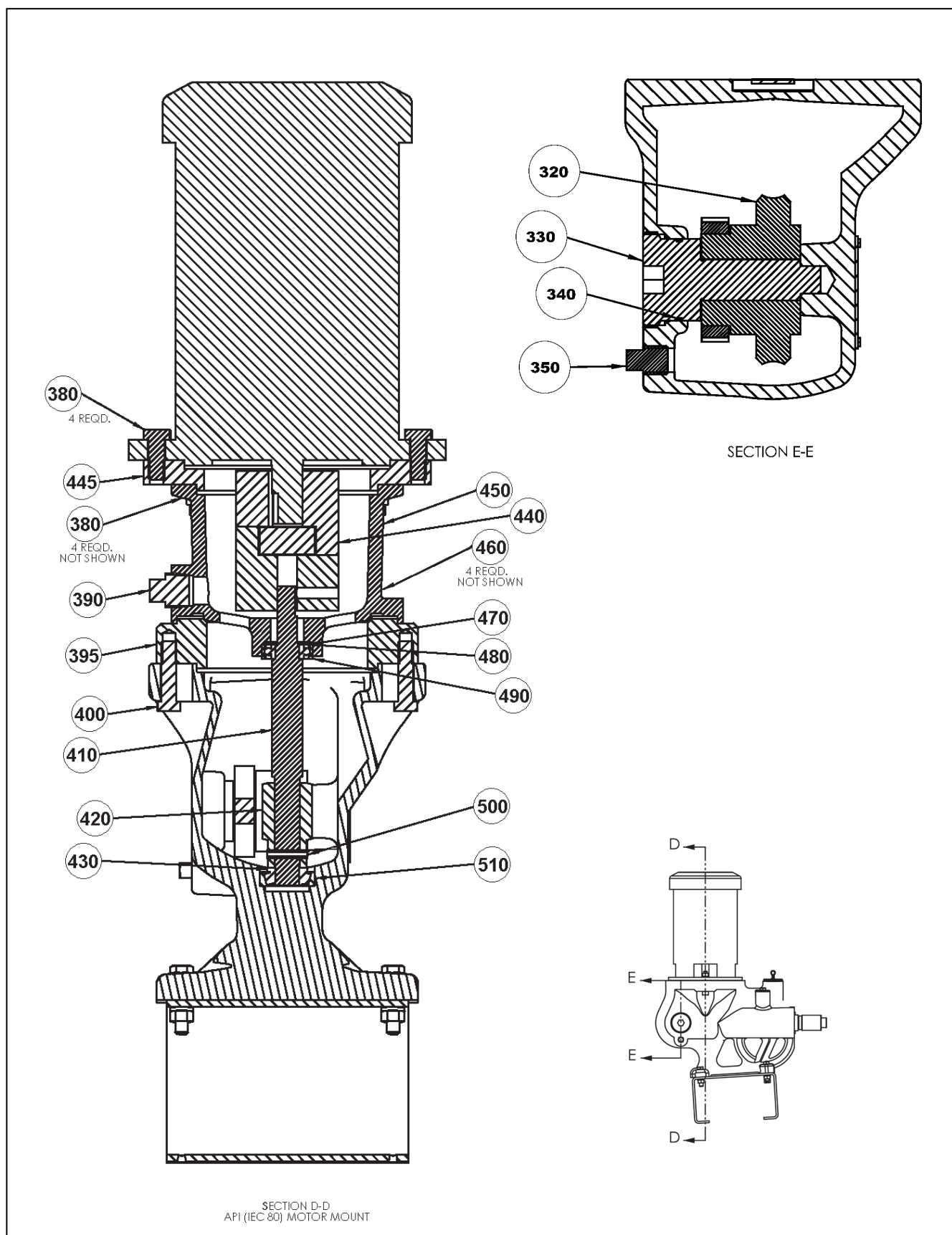


Figure 11. XT API (IEC 80) Motor / Mount / Gear Shaft (DWG 102-2633-000)

6.4 PARTS LIST FOR XT MOTOR / MOUNT

Model:

Description:

Close Coupled Flange, NEMA 56C
 Close Coupled Flange, IEC Frame 71, B5
 API Flange Mount, NEMA 56C
 API Flange Mount, NEMA 143TC
 API Flange Mount, IEC Frame 71, B5
 API Flange Mount, IEC Frame 80, B5

Reference Code:

SR
 SS
 FR
 F4
 FS
 MD

FIGURE NUMBER	ITEM NUMBER	DESCRIPTION	PART NUMBER	QTY	REFERENCE CODE
9, 10, 11	320	Gear, Worm, 9.5:1, 185 SPM@ 1725 RPM	2520086201	1	
	320	Gear, Worm, 15: 1, 117 SPM@ 1725 RPM	2520019200	1	
	320	Gear, Worm, 24:1, 73 SPM@ 1725 RPM	2520090201	1	
	320	Gear, Worm, 48:1, 37 SPM@ 1725 RPM	2520052001	1	
	320	Gear, Worm, 77:1, 23 SPM@ 1725 RPM	2520125001	1	
	330	Shaft, Worm Gear, Steel	20341	1	
	340	O-Ring, 2-028, Nitrile, 70 Duro	40310	1	
	350	Plug, 1/4" NPT Sq Head, 18.8 SS	4020009116	1	
	360	Nut, Hex, 5/16 - 18NC 18.8 SS	4050065013	4	FS
	370	Washer, Spring Lock, 5/16"	4040040028	4	FS
	375	Nut, Hex, M8, Class 8, SS	4350000042	2	SS
	380	Screw, Hex Head, 3/8"- 16" X 1" GR5 ULTRA	4050018119	4	FR, F4
	380	Screw, Hex Head, 5/16"- 18" X 1-1/4" GR5	4050017139	4	FS
	380	Screw, Hex Head, M10 X 25MM Steel	4350001732	8	MD
	385	Washer, Spring Lock, 5/16"	4040040028	2	SS
	390	Plug, Pipe 1/2" NPT	4020009137	1	FR, F4, MD
	390	Plug, 1/4", 18-8 SS	4020009116		FS
	395	Adapter, Flange, API	20864	1	FR, F4, FS, MD
	400	Screw, Hex Head, 3/8"- 16" X 1-1/2" 18.8 SS	4050018143	2	SR, FS, MD
	400	Screw, Socket Head, 8MM X 1.25 THD	40322	2	SS
	400	Screw, Hex Head, 3/8"- 16" X 1-1/2" 18.8 SS	4050018143	4	FR, F4

- Parts Not Illustrated

FIGURE NUMBER	ITEM NUMBER	DESCRIPTION	PART NUMBER	QTY	REFERENCE CODE
9, 10, 11	410	Shaft, Worm	2520157006	1	SR
	410	Shaft, Worm	2520167006	1	SS
	410	Shaft, Worm	20863	1	FR, F4, FS, MD
	420	Worm, 9.5:1	2520086106	1	
	420	Worm, 15:1	2520019100	1	
	420	Worm, 24:1	2520090106	1	
	420	Worm, 48:1	2520051006	1	
	420	Worm, 77:1	2520126006	1	
	430	Bearing, Cone	4090064010	1	
	440	Coupling, 1/2" x 5/8 "	4100127040	1	FR
	440	Coupling, 7/8" X 1/2", LOVEJOY	4100064120	1	F4
	440	Coupling, 1/2" X 14MM, LOVEJOY	40202	1	FS
	440	Coupling, L-100, LOVEJOY	40244	1	MD
	445	Adapter Plate, Motor	60199	1	MD
	450	Adapter, Motor	2720090001	1	FR, F4, MD
	450	Adapter, Motor	2720146001	1	FS
	460	Screw, Socket Head, #8-32NC x 3/4" STL	4050132031	4	FR, F4, FS,
	470	Washer, Finger Spring, 0.563"	4030121006	2	FR, F4, FS, MD
	475	Pin, Spring, 1/8 x 1/2	4010003031	3	SS
	480	Washer, Flat	2190030006	1	FR, F4, FS, MD
	485	Gasket, Motor	2250115099	1	SR, FR, F4, MD
	485	Gasket, Motor	2250121099	1	SS, FS
	490	Bearing, Ball	4090094020	1	FR, F4, FS, MD
	495	Spring	4030166011	1	SR
	495	Spring	60059	1	SS
	500	Pin, Spring, 3/16" X 1"	4010005091	1	
	510	Cup - Race	4090064020	1	

- Parts Not Illustrated

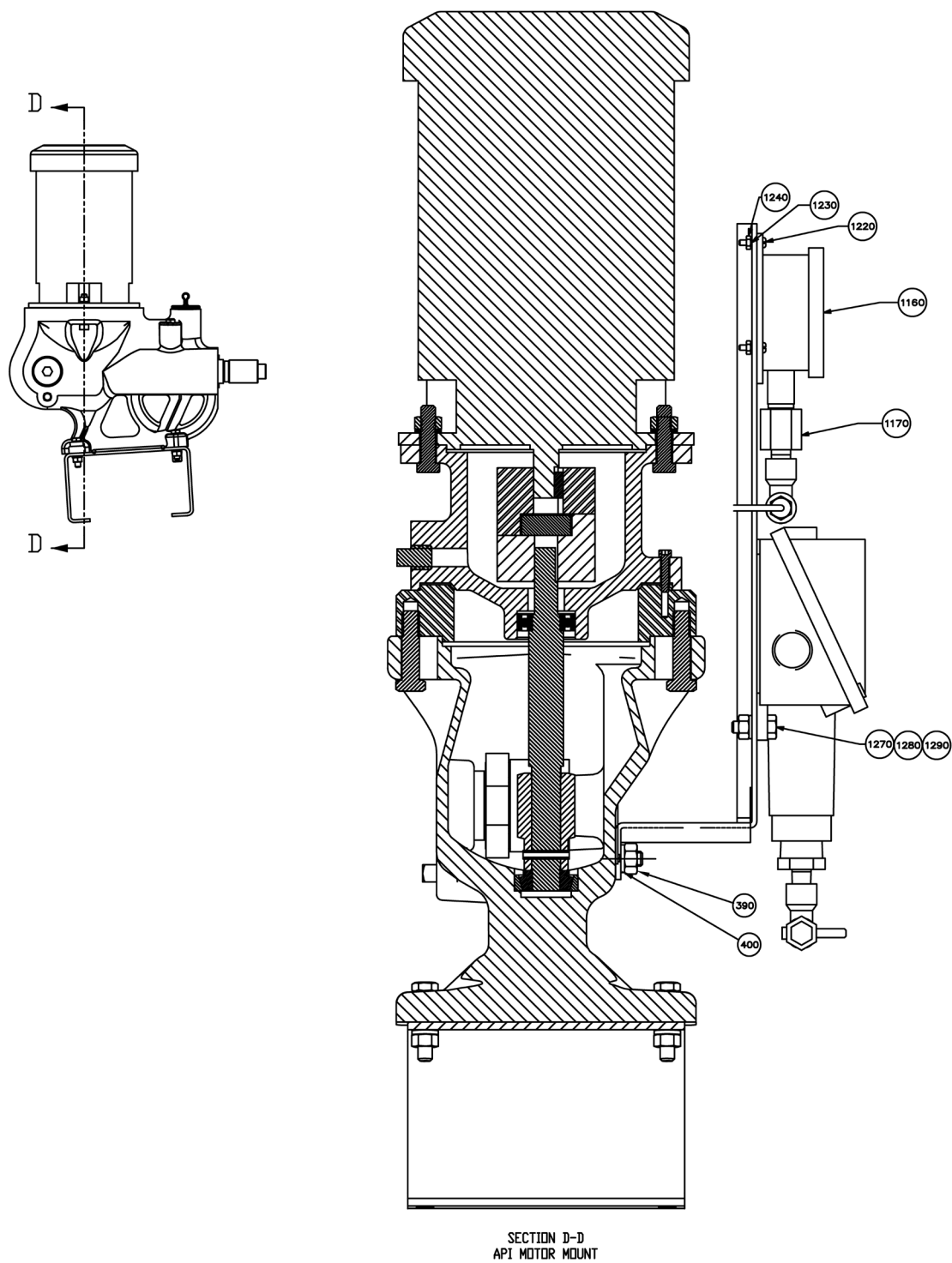


Figure 12. XT With Rupture Detection (Sheet 1 of 2) (DWG 102-2633-000)

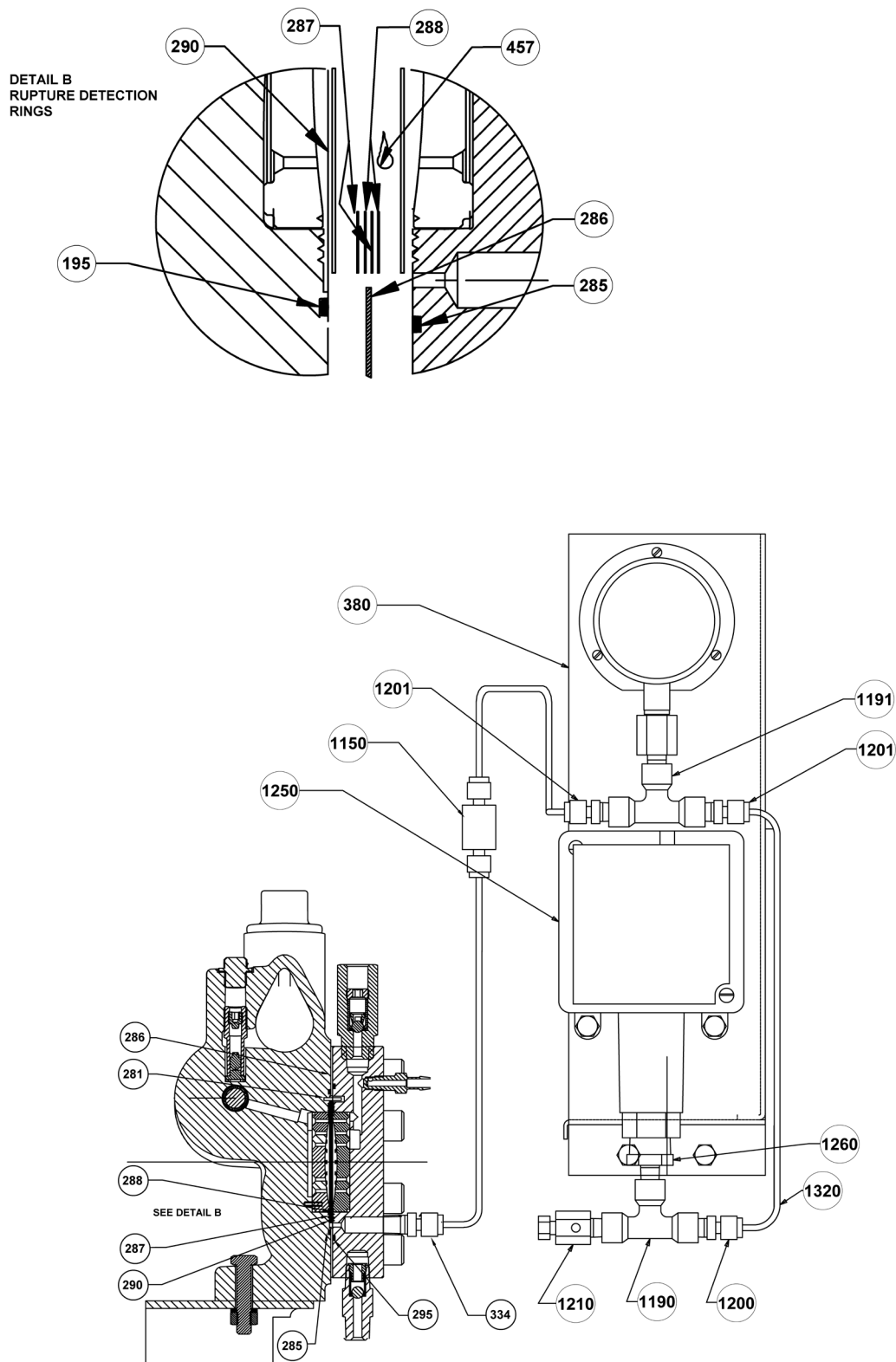


Figure 12. XT With Rupture Detection (Sheet 2 of 2) (DWG 102-2633-000)

6.5 PARTS LIST FOR XT PUMP WITH RUPTURE DETECTION

Model:

Liquid End:

XT --

XT --

XT --

Material:

316 SS ---

316 SS ---

316 SS ---

Reference Code:

C5 Rupture Detection with Gauge

SN Rupture Detection with Gauge & NEMA 4 Switch

S7 Rupture Detection with Gauge & NEMA 7 Switch

FIGURE NUMBER	ITEM NUMBER	DESCRIPTION	PART NUMBER	QTY	REFERENCE CODE
12	195	O-Ring, 2-042, Nitrile, 70 Duro	40673	1	
	230	Faceplate	20936	1	
	248	Base, Leak Detection	2010626000	1	
	281	Pin, Spring, 1/16 X 3/8"	4010001041	3	
	285	O-Ring, 2-041, BUNA-N	40828	1	
	286	Ring, Spacer, 316 SS	21238	1	
	287	Ring, Intermediate, A	21029	2	
	288	Ring, Intermediate, B	21031	2	
	290	Diaphragm, GYLON, 0.030 Thick	40741	2	
	295	O-Ring, 2-042, NITRILE	40673	1	
	380	Leak Detection MTG Bracket	21682	1	
	390	Screw, Hex Head, 5/16" - 18 X 1/2"	4050017071	2	
	400	Lock Washer, Spring, 5/16"	40409	2	
	457	Mineral Oil	4070317020	1OZ	
	1150	Check Valve 1/8" Tube	40065	1	
	1160	Gauge, Press, 0-5000 PSI	40405	1	SN, S7
	1170	Adapter, Reducer, 1/4" X 1/8" NPT, 316 SS	40067	1	
	1190	Tee, 1/8" NPT Female, 316 SS	40062	1	
	1191	Tee, 1/8" NPT Female, 316 SS	40062	1	SN, S7
	1200	Connector, Tube, 1/8" Tubex 1/8" NPT 316 SS	40061	2	
	1201	Connector, Tube, 1/8" Tubex 1/8" NPT 316 SS	40061		
	1210	Valve, Bleed, 1/8" NPT 316 SS	40063	1	
	1220	Screw, Pan Head, #4-40 X 1/2"	4050263050	3	
	1230	Lock Washer, Spring, #4 18-8 SS	4040095023	3	
	1240	Nut, Hex, #4-40NC, 18.8 SS	4050182012	3	

- Parts Not Illustrated

FIGURE NUMBER	ITEM NUMBER	DESCRIPTION	PART NUMBER	QTY	REFERENCE CODE
12	1250	Switch, Pressure Switch, NEMA 4, 5-30 PSI	4060388001	1	SN
	1250	Switch, Pressure Switch, NEMA 7, 5-30 PSI	4060389001	1	SN
	1260	Nipple, Reducer, Hex, 1/2" X 1/8" NPT, 316 SS	40064	1	SN, S7
	1270	Screw, Hex Head, 1/4" - 20 X 3/4" 18-8 SS	4050016095	2	SN, S7
	1280	Lock Washer, Spring, 1/4" 18-8 SS	4040039022	2	SN, S7
	1290	Nut, Hex, 1/4"-20NC, 18.8 SS	4050064012	2	SN, S7
	1320	Tubing, Gauge to Switch, NEMA 4	2490136016	1	SN
	1320	Tubing, Gauge to Switch, NEMA 7	2490138016	1	S7
	1321	Tube, Mech, 1/8 OD x 0.035 Wall, 316 SS	4020502993	20"	

- Parts Not Illustrated

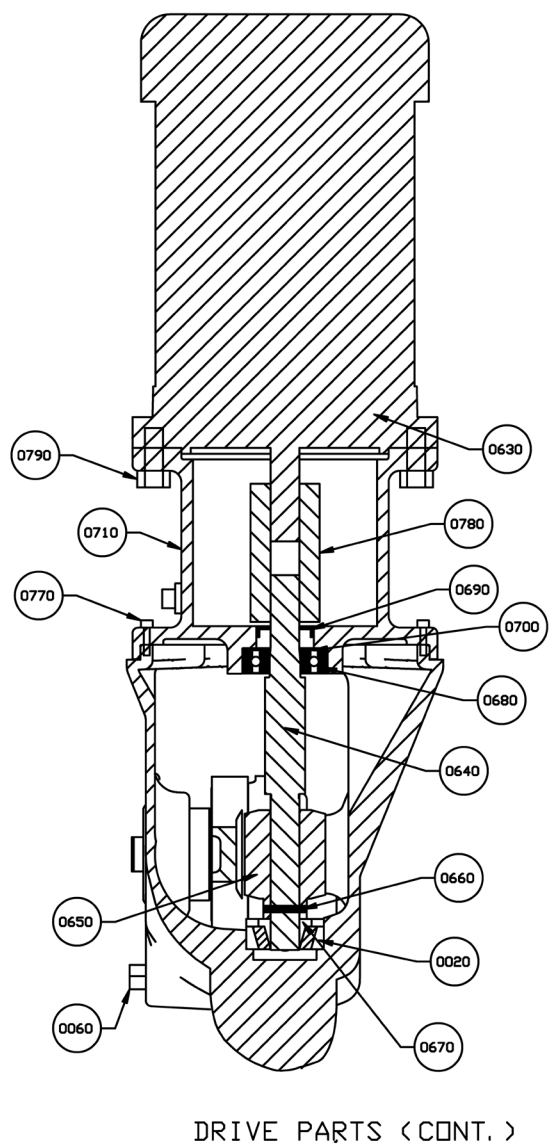
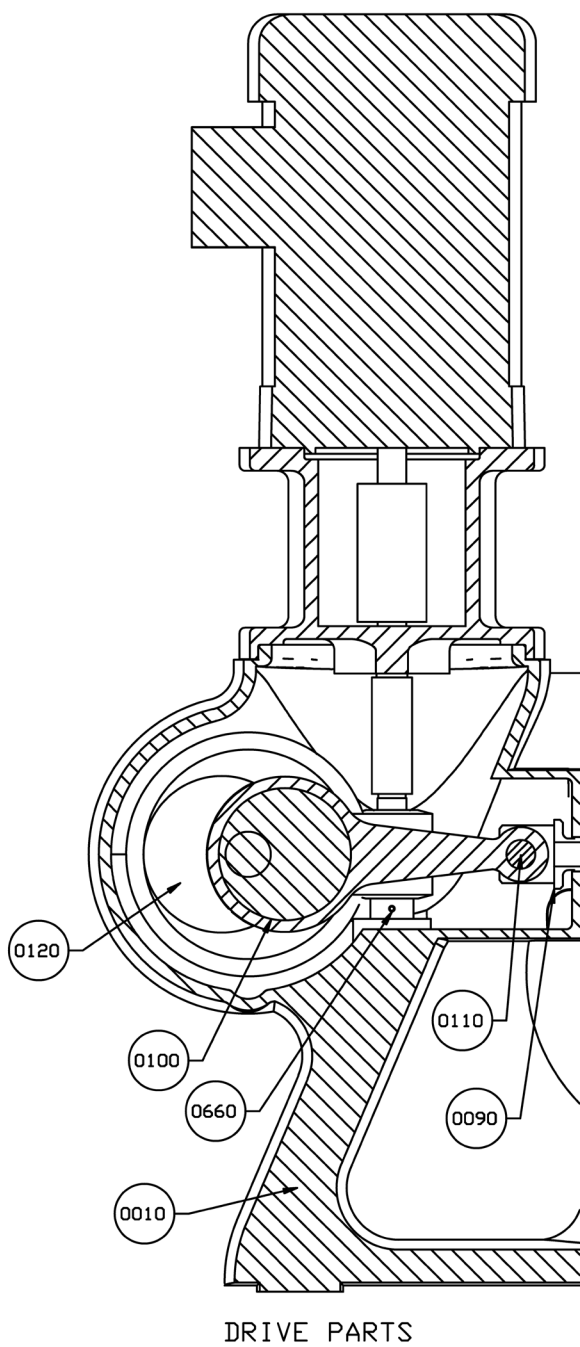
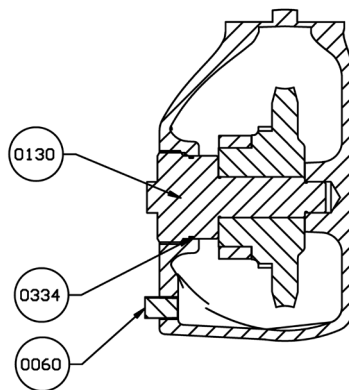


Figure 13. XW Drive (DWG 102-2402-000)



GEAR SHAFT ASSEMBLY

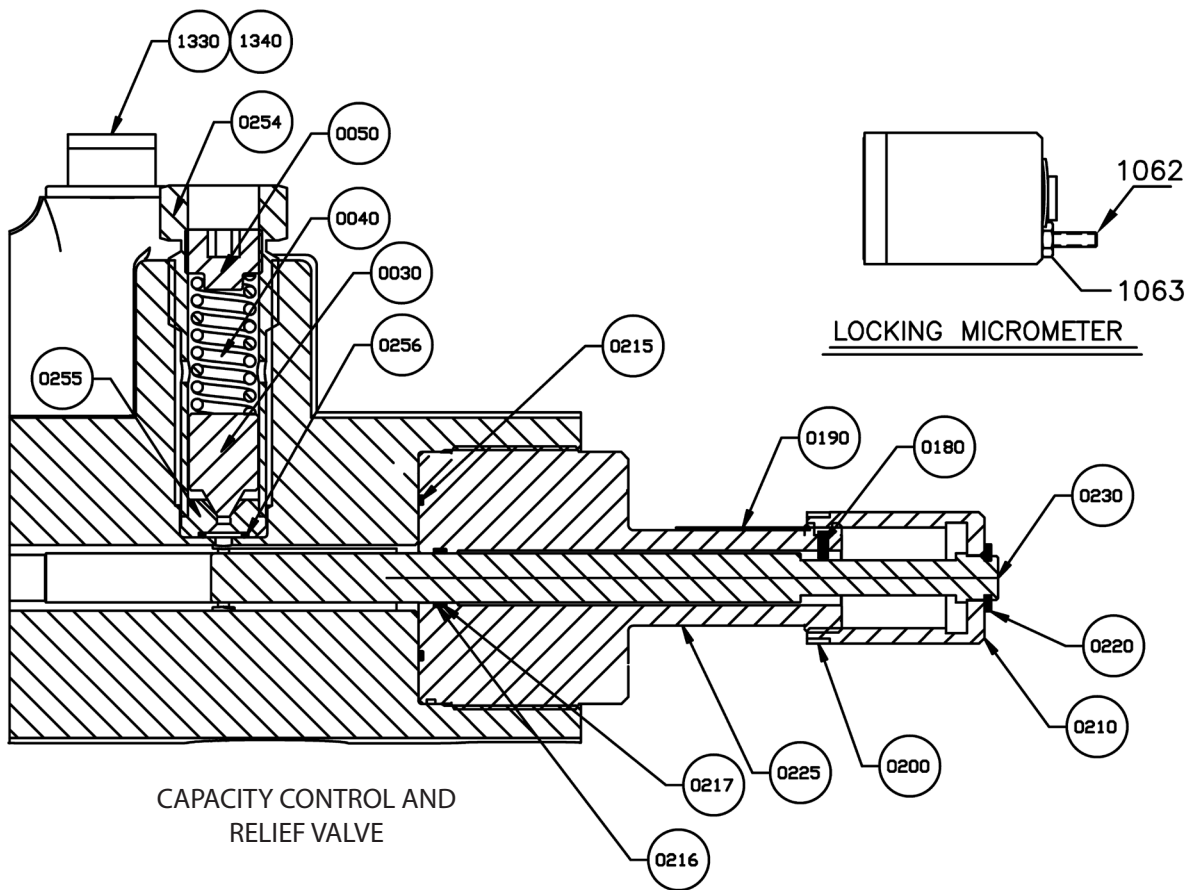


Figure 14. XW Capacity Control, Relief Valve Parts, and Gear Shaft Assembly
(DWG 102-2402-000)

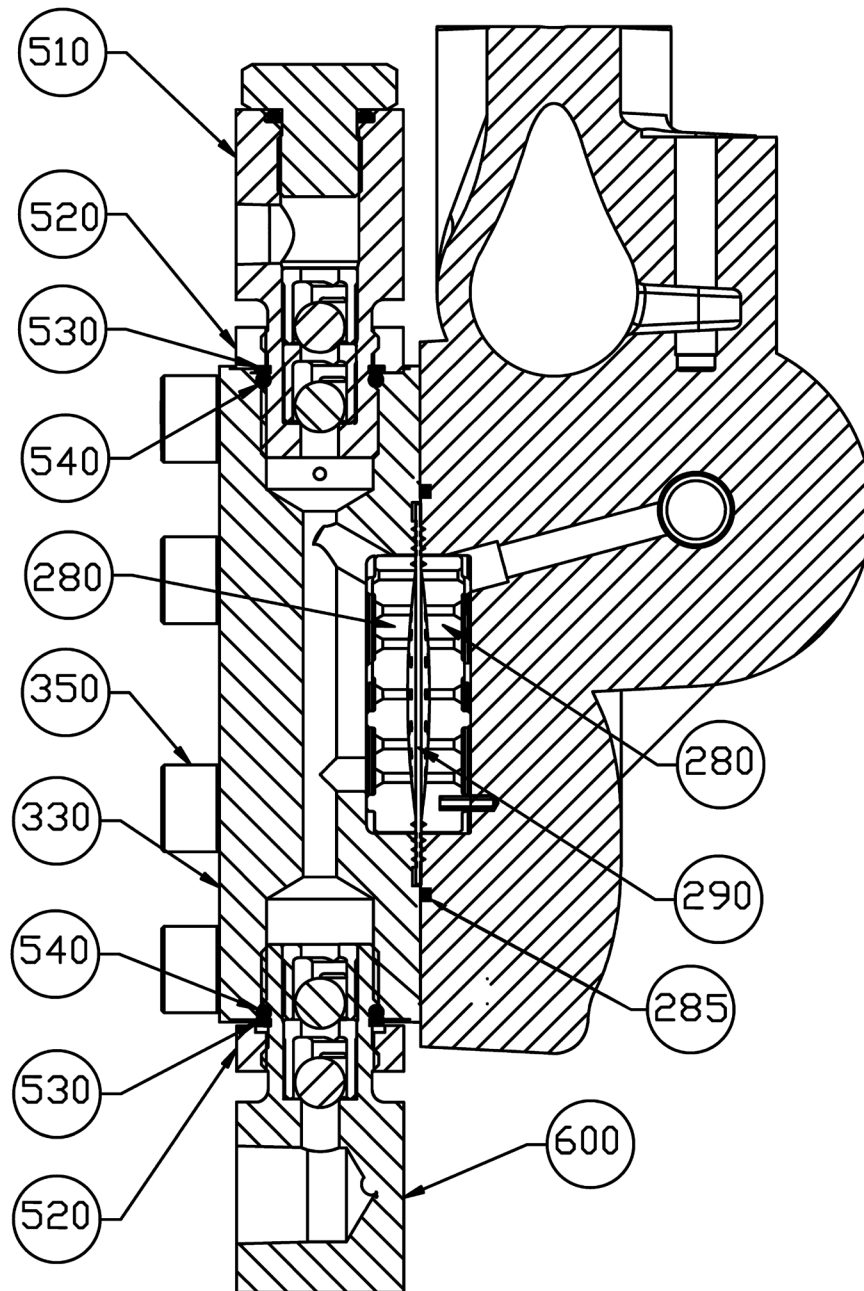


Figure 15. XW Liquid End (DWG 102-2402-000)

6.6 PARTS LIST FOR MROY XW DRIVE / LIQUID END

Model:

Description:

Reference Code:

API Flange Mount, NEMA 56C

FR

API Flange Mount, NEMA 143145C

F4

API Flange Mount, IEC Frame 80, B5

F8

API Flange Mount, IEC Frame 90, B5

F9

FIGURE NUMBER	ITEM NUMBER	DESCRIPTION	PART NUMBER	QTY	REFERENCE CODE
13, 14, 15	10	Housing	21480	1	
	20	Race, Cup, Tapered Roller	4090066020	1	
	30	Poppet, Relief, Steel	20381	1	
	40	Spring	2800046541	1	
	50	Screw, Adjusting, Brass	2560037051	1	
	60	Plug, 1/4" NPT, 18-8 SS	4020009116	1	
	90	Plunger	20372	1	
	100	Rod, Connecting	2140013162	1	
	110	Pin, Wrist, Steel	2110037006	1	
	120	Gear, Worm, 9.5:1	2520088201	1	
	120	Gear, Worm, 12.5:1	2520081201	1	
	120	Gear, Worm, 19:1	2520092201	1	
	120	Gear, Worm, 25:1	2520082201	1	
	120	Gear, Worm, 38:1	2520094201	1	
	130	Shaft, Worm Gear	20382	1	
	140	Plunger, 9/16"	20342	1	
	180	Screw, Soc Set, #6-32NC X 1/4	4050039035	2	
	190	Decal, Capacity	2530026062	1	
	200	Ring, Calibration, Aluminum	2530025062	1	
	210	Knob, Control, 316 SS	2550046016	1	
	215	O-Ring, 2-031, Nitrile, 90 Duro	41064	1	
	216	O-Ring, 2-015, Nitrile, 90 Duro	40334	1	
	217	Ring, Back Up, 8-015, Nitrile	40335	1	
	220	Clip E Ring External	4049983151	1	
	225	Cap, Seal	21497	1	
	230	Rod, Control, Steel	20373	1	
	242	Screw, HEX HD, 3/8-16 X 2 ULTRA GR5	4050018169	3	
	244	Washer, Spring Lock, 3/8 18.8 SS	4040041022	3	
	246	Nut, Hex, 3/8-16NC, 18.8 SS	4050066012	3	

- Parts Not Illustrated

FIGURE NUMBER	ITEM NUMBER	DESCRIPTION	PART NUMBER	QTY	REFERENCE CODE
13, 14, 15	248	Base	21485	1	
	254	Sleeve, Relief, Steel	20379	1	
	255	Seat, Relief, Steel	20378	1	
	256	O-Ring, 2-013, Nitrile, 90 Duro	40312	1	
	280	Contour Plate, 316 SS	22014	2	
	281	Pin, Spring, 3/32" X 3/8"LG, 420 SS	40315	2	
	285	O-Ring, 2-044 Viton, 70 Duro	4080109415	1	
	290	Diaphragm, TEFLON, 3.390" Dia.	2980015075	1	
	330	Diaphragm Head, 316 SS	20376	1	
	331	Pin, Spring, 3/16" X 1/2", Steel	4010005011	1	
	334	O-Ring, 1.864 X 0.070, BUNA N	4080109291	1	
	335	Barb, Air Bleed, 316 SS	20352	1	
	336	O-Ring, 2-007 Viton, 70 Duro	4080109045	1	
	350	Screw, Socket Head Cap, 1/2"-13 X 2-1/4	40337	8	
		4in, Long			
	510	Cartridge, Discharge, Double Ball, 316 SS	2210897216	1	
	520	Nut, Lock	2090020014	2	
	530	Ring, Back Up, Teflon, Solid	40321	2	
	540	O-Ring, 2-116 Viton,	4080068065	2	
	600	Cartridge, Suction, Double Ball, 316 SS	2210896216	1	
Worm and Shaft Assembly includes Stub Shaft (640), Worm (650), Spring Pin (660), Tapered Roller Bearing (670), and Single Roll Bearing (680).					
13, 14, 15		Worm and Shaft Assembly, 12.5:1	2520142100	1	
		Worm and Shaft Assembly, 19:1	2520142300	1	
	640	Worm and Shaft Assembly, 25:1	2520142000	1	
		Worm and Shaft Assembly, 38:1	2520142401	1	
		Shaft, Stub	2520143006	1	
	650	Worm, 12.5:1	2520081106	1	
	650	Worm, 19:1	2520092106	1	
	650	Worm, 25:1	2520082106	1	
	650	Worm, 38:1	2520094106	1	
	660	Pin, Spring, 3/16" X 1", Steel	4010005091	1	
	670	Bearing, Tapered Roller	4090066010	1	

- Parts Not Illustrated

FIGURE NUMBER	ITEM NUMBER	DESCRIPTION	PART NUMBER	QTY	REFERENCE CODE
13, 14, 15	680	Bearing, Single Row	4099994000	1	
	690	Seal, Oil	4089997011	1	
	700	Spring, Finger	4030121009	2	
	710	Adapter, Motor, NEMA 56C/143/145TC	2720051001	1	FR, F4
	710	Adapter, Motor, IEC 80 or 90 B5	60720388001	1	F8, F9
	770	Screw, Socket Head, #10-32 X 3/4", Steel	4050026094	4	
	780	Coupling, 5/8 X 5/8, 3/16 KEY, 56C	4100064020	1	FR
	780	Coupling, 5/8 X 7/8, 3/16 KEY, 143/145TC	4100064090	1	F4
	780	Coupling, 5/8 X 19MM, IEC 80 B5	39238	1	F8
	780	Coupling, 5/8 X 24MM, IEC 90 B5	30459	1	F9
	790	Screw, Hex Head, 3/8 - 16 X 1, GR5, NEMA 56C or 143/145TC	4050018119	4	FR, F4
	790	Screw, Hex Head, 3/8 - 16 X 1-1/4, IEC	4050018136	4	F8, F9
	791	Lock Washer, Spring, 3/8 18.8 SS, IEC	4040041022	4	F8, F9
	792	Nut, Hex, 3/8 - 16NC, 18.8 SS, IEC	4050066012	4	F8, F9
	800	Plug, Pipe, 3/8 316 SS Threaded	4020011033	1	F8, F9
	1015	Decal, Motor Caution	2530021198	1	
	1062	Screw, Socket	40224	1	
	1063	Nut, Hex, #8-32NC, 18-8 SS	4050061017	1	
	1330	Cap, Oil Reservoir	20183	1	
	1340	O-Ring, Parker, 2-216 BUNA N	4080095071	1	
	1350	Plug, Machine Screw, 7/8" -14	4052001021	1	
	1360	Plate, Data	2530186000	1	
	1370	Screw, Stick, 5/32" Steel	4050280000	2	
		150# 1/2", Socket Weld Flange, Discharge, Includes Flange & Nipple Below	1791544116	1	
	-	Flange, 1/2 X 1/4", 150#, 316 SS	4020618022	1	
	-	Nipple, 1/4 X 3, 316 SS	4020236033	1	
		150# 1/2", Socket Weld Flange, Suction, Includes Flange & Nipple Below	1791544316	1	
	-	Flange, 1/2", 150#, 316 SS	4020290033	1	
	-	Nipple, 1/2 X 3, 316 SS	4020240033	1	
		300# 1/2", Socket Weld Flange, Discharge, Includes Flange & Nipple Below	1791544816	1	

- Parts Not Illustrated

FIGURE NUMBER	ITEM NUMBER	DESCRIPTION	PART NUMBER	QTY	REFERENCE CODE
13, 14, 15	-	Flange, 1/2 X 1/4", 300#, 316 SS	4020636032	1	
	-	Nipple, 1/4 X 3, 316 SS	4020237033	1	
		300# 1/2", Socket Weld Flange, Suction, Includes Flange & Nipple Below	1791584116		
	-	Flange, 1/2", 300#, 316 SS	4020632013	1	
	-	Nipple, 1/2 X 3, 316 SS	4020241033	1	
		1500# 1/2", Socket Weld Flange, Discharge, Includes Flange & Nipple Below	20850	1	
	-	Flange, 1/2 X 1/4", 1500#, 316 SS	40619		
	-	Nipple, 1/4 X 3, 316 SS	4020237033	1	
		1500# 1/2", Socket Weld Flange, Suction, Includes Flange & Nipple Below	1791798616		
	-	Flange, 1/2", 1500#, 316 SS	4020376013	1	
	-	Nipple, 1/2 X 3, 316 SS	4020392033	1	
	-	150# 1/2", Threaded Flange, Discharge Flange, 1/2 X 1/4", 150#, 316 SS	4020313023	1	
	-	Nipple, 1/4 X 3, 316 SS	4020050053	1	
		150# 1/2", Threaded Flange, Suction			
	-	Flange, 1/2", 150#, 316 SS	4020013013	1	
	-	Nipple, 1/2 X 3, 316 SS	4020052053	1	
		300# 1/2", Threaded Flange, Discharge			
	-	Flange, 1/2 X 1/4", 150#, 316 SS	4020361023	1	
	-	Nipple, 1/4 X 3, 316 SS	4020050223	1	
		300# 1/2", Threaded Flange, Suction			
	-	Flange, 1/2", 150#, 316 SS	4020014013	1	
	-	Nipple, 1/2 X 3, 316 SS	4020052223	1	
		600# 1/2", Threaded Flange, Discharge			
	-	Flange, 1/2 X 1/4", 150#, 316 SS	4020629023		
	-	Nipple, 1/4 X 3, 316 SS	4020050223		
		600# 1/2", Threaded Flange, Suction			
	-	Flange, 1/2", 150#, 316 SS	4020015013		
	-	Nipple, 1/2 X 3, 316 SS	4020052223		

- Parts Not Illustrated

CIRCLE B
RUPTURE DETECTION
RINGS

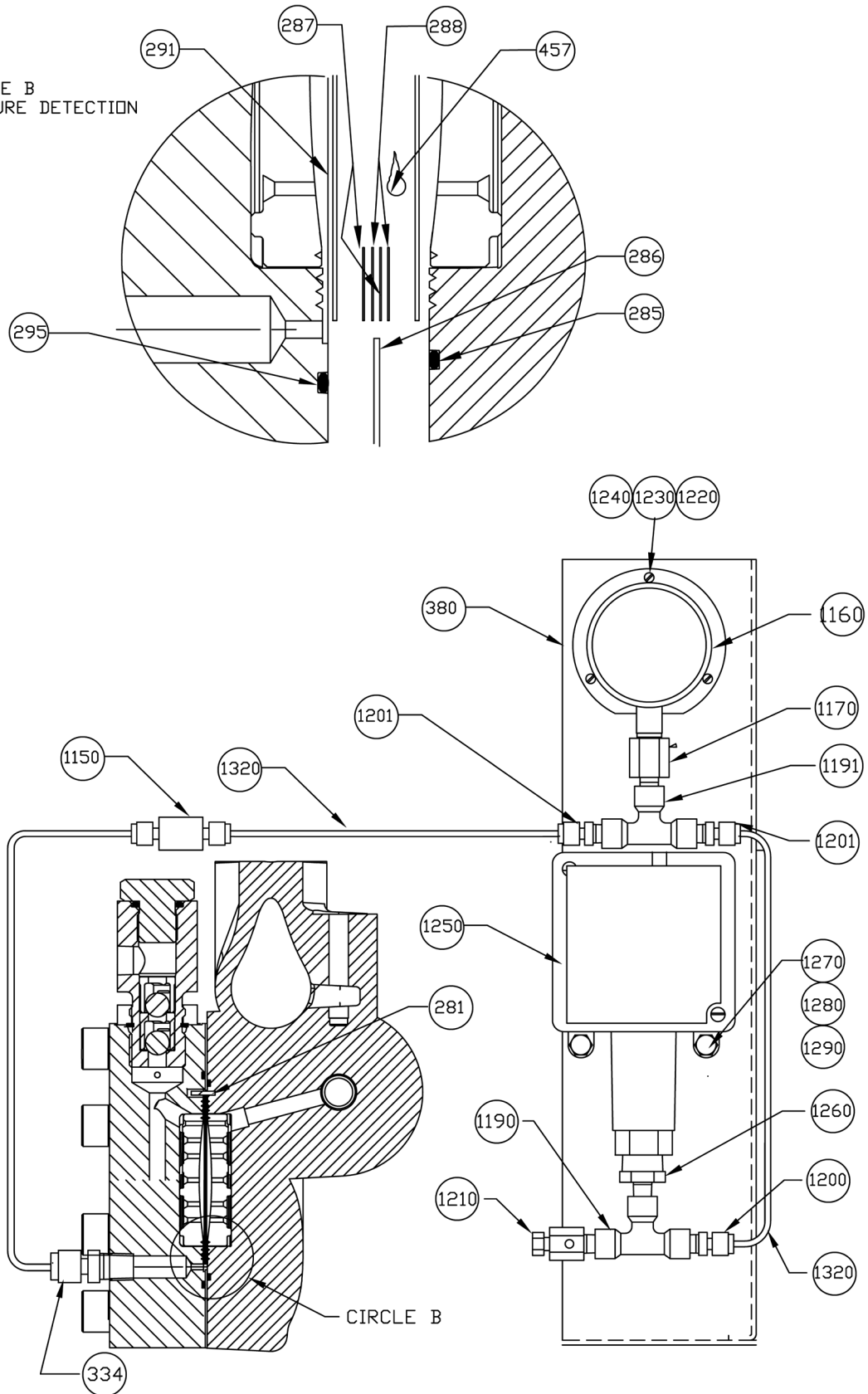


Figure 16. XW Liquid End With Rupture Detection (Sheet 1 of 2) (DWG 102-2402-000)

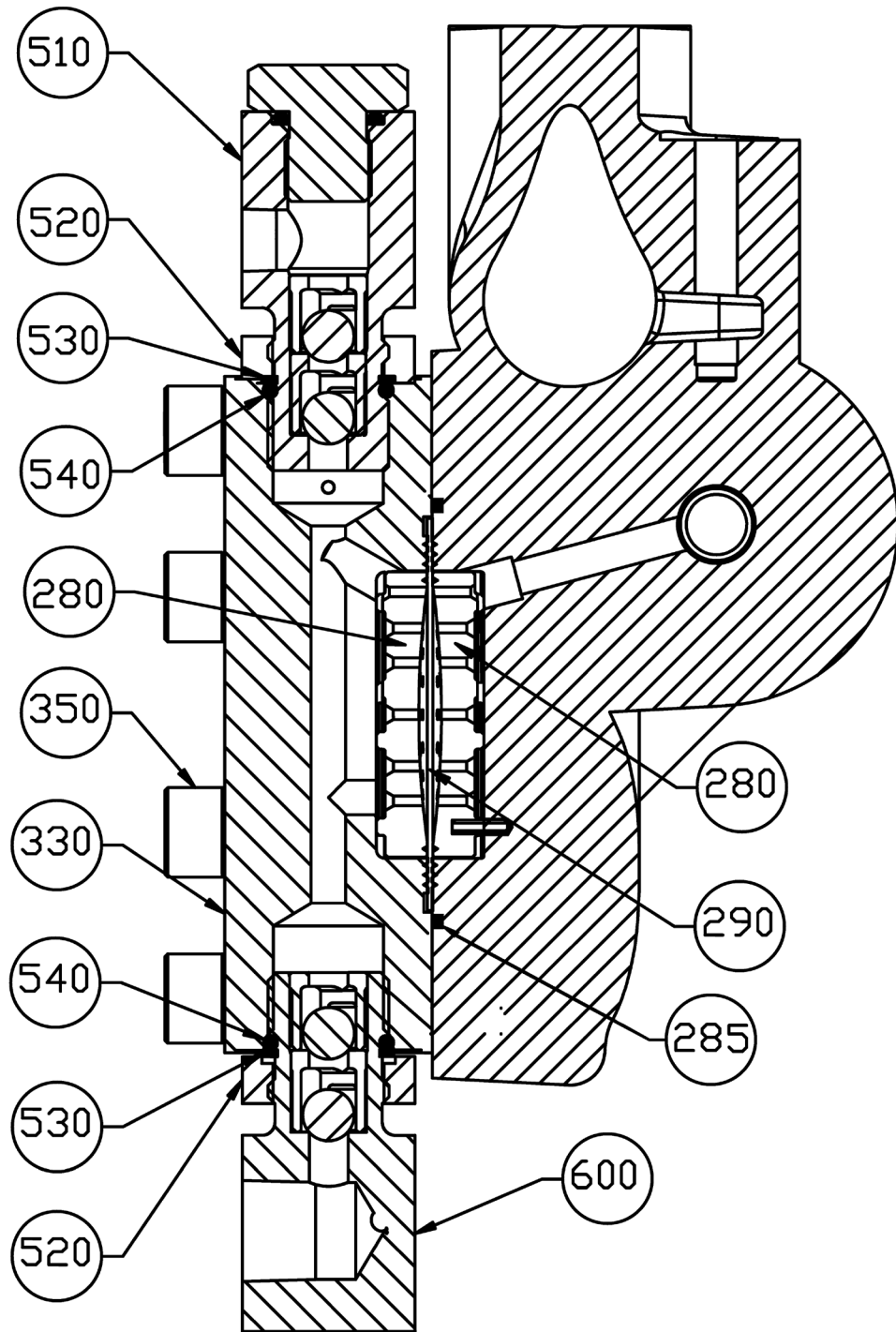


Figure 16. Additional Rupture Detection Parts (Sheet 2 of 2) (DWG 102-2402-000)

6.7 PARTS LIST FOR MROY XW RUPTURE DETECTION

Model:

Liquid End:

Material:

Reference Code:

XW --	316 SS ---	C5 Rupture Detection with Gauge
XW --	316 SS ---	SN Rupture Detection with Gauge & NEMA 4 Switch
XW --	316 SS ---	S7 Rupture Detection with Gauge & NEMA 7 Switch
XW --	316 SS ---	NN None (Standard)

FIGURE NUMBER	ITEM NUMBER	DESCRIPTION	PART NUMBER	QTY	REFERENCE CODE
16	242	Screw, HEX HD, 3/8-16 X 2 ULTRA GR5	4050018169	3	C5, SN, S7
	244	Washer, Spring Lock, 3/8 18.8 SS	4040041022	3	C5, SN, S7
	246	Nut, Hex, 3/8-16NC, 18.8 SS	4050066012	3	C5, SN, S7
	248	Base	21485	1	C5, SN, S7
	281	Pin, Spring, 1/16" X 3/8" STL	4010001041	3	C5, SN, S7
	285	O-Ring, 2-044 Viton, 70 Duro	4080109415	1	NN
	286	Ring, Spacer, 316 SS	21474	1	C5, SN, S7
	287	Intermediate Ring - A -XW	21472	2	C5, SN, S7
	288	Intermediate Ring - B -XW	21473	2	C5, SN, S7
	290	Diaphragm, Teflon, 3.390" Dia.	2980015075	1	NN
	291	Diaphragm, Gylon, 0.03 THK	41051	2	C5, SN, S7
	295	O-Ring, 2-044 Viton, 70 Duro	4080109415	1	C5, SN, S7
	330	Diaphragm, Head, 316 SS	21484	1	C5, SN, S7
	334	Tube, Conn, 1/8" NPT, 316 SS	40061	1	C5, SN, S7
	350	SHCS, 1/2" -13 X 2.25" Long	40337	8	NN, C5, SN, S7
	380	Switch Bracket	2040206006	1	C5, SN, S7
	390	Screw, HEX HD, 5/16-18 X 1/2 STL	4050017071	2	C5, SN, S7
	400	Washer, Spring Lock, 5/16 316 SS	40409	2	C5, SN, S7
	457	Mineral Oil	4070317020	1oz	C5, SN, S7
	1150	Tube, Check Valve, 1/8", 1/3 PSI, 316 SS	40065	1	C5, SN, S7
	1160	Gage, Pressure, 0-5000 PSI	40405	1	C5, SN, S7
	1170	Adapter, Reducer, 1/4F X 1/8M NPT 316 SS	40067	1	C5, SN, S7
	1190	Tee, 1/8" NPT Female, 316 SS	40062	1	SN, S7
	1191	Tee, 1/8" NPT Female, 316 SS	40062	1	C5, SN, S7
	1200	Connector, Tube, 1/8" Tubex, 1/8" NPT 316 SS	40061	2	C5, SN, S7
	1201	Connector, Tube, 1/8" Tubex, 1/8" NPT 316 SS	40061	2	SN, S7
	1210	Valve, Bleed, 1/8" NPT, 316 SS	40063	1	C5, SN, S7

- Parts Not Illustrated

FIGURE NUMBER	ITEM NUMBER	DESCRIPTION	PART NUMBER	QTY	REFERENCE CODE
16	1220	Screw, Pan Head, #4-40X1/2"	4050263050	3	C5, SN, S7
	1230	Washer, Spring Lock, #4 18-8 SS	4040095023	3	C5, SN, S7
	1240	Nut, Hex, #4-40NC, 18-8 SS	4050182012	3	C5, SN, S7
	1250	Switch, NEMA 4 Pressure, 5-30 PSI	4060388001	1	SN
	1250	Switch, NEMA 7 Pressure, 5-30 PSI	4060389001	1	S7
	1260	Nipple, Reducing Hex, 12"X1/8" NPT 316 SS	40064	1	SN, S7
	1270	Screw, HEX HD, 1/4"-20 X 3/4 18-8 SS	4050016095	2	SN, S7
	1280	Washer, Spring Lock, 1/4" 18-8 SS	4040039022	2	SN, S7
	1290	Nut, Hex, #1/4-20NC, 18-8 SS	4050064012	2	SN, S7
	1320	Tube, 1/8" ODX 0.028Wall, 316 SS	50108	12"	SN
	1320	Tube, 1/8" ODX 0.035 Wall, 316 SS	4020502993	20"	SN, S7
	1320	Tube, Gauge to Switch, NEMA 7	2490138016	1	S7

- Parts Not Illustrated

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