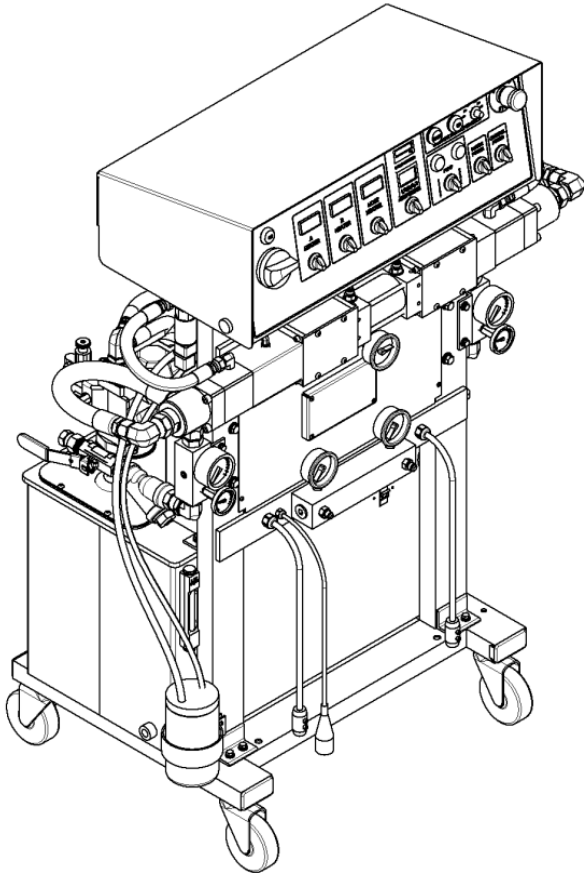




**POLYURETHANE  
MACHINERY  
CORPORATION**

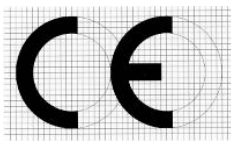


# PH/PHX-2 Proportioner

For Professional Use Only  
Not approved for use in European explosive  
atmosphere locations

## Service Manual

Ref. # MN-04014  
Revision 4.0  
May 2, 2016



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**Before installing the PH Series Proportioner and start-up, carefully read all the technical and safety documentation included in this manual. Pay special attention to the information in order to know and understand the operation and the conditions of use of the PH Series Proportioner. All of the information is aimed at improving user safety and avoiding possible breakdowns from the incorrect use of the PH Series Proportioner.**

## **TABLE OF CONTENTS**

<b>WARRANTY .....</b>	<b>1</b>
<b>SAFETY AND HANDLING .....</b>	<b>3</b>
<b>CHARACTERISTICS .....</b>	<b>5</b>
Principal Heating System .....	5
Hose Heating System .....	5
Double Acting Opposed Piston Metering Pumps.....	5
Pressure Balance Control System .....	6
<b>TECHNICAL SPECIFICATIONS .....</b>	<b>7</b>
Electrical .....	7
Mechanical .....	8
<b>DESCRIPTION .....</b>	<b>9</b>
<b>INSTALLATION .....</b>	<b>14</b>
Heated Hose Installation .....	16
Hose Heat Transformer .....	18
<b>PROPORTIONER PURGING .....</b>	<b>20</b>
<b>PRESSURE BALANCE CONTROL .....</b>	<b>22</b>
Operation.....	22
<b>DIGITAL TEMPERATURE CONTROLLER.....</b>	<b>23</b>
<b>START-UP .....</b>	<b>24</b>
<b>SHUT-DOWN .....</b>	<b>26</b>
Short-Term .....	26
Long-Term .....	26
<b>TROUBLESHOOTING .....</b>	<b>27</b>
Heaters.....	28
Hydraulic Drive System.....	32
Metering Pump Line.....	34
Hose Heating.....	38
Pressure Balance Control .....	42
<b>MAINTENANCE .....</b>	<b>43</b>
Inlet Material Screens .....	44
ISO LUBRICATION SYSTEM.....	45
Hydraulic Drive System.....	46
Metering Pump Line.....	47

Pump Seal Replacement .....	47
Material Heater .....	48
Thermocouple Replacement.....	48
<b>HYDRAULIC OIL SPECIFICATIONS.....</b>	<b>50</b>
Manufacturers:.....	50
<b>REPLACEMENT KITS .....</b>	<b>51</b>
<b>PARTS IDENTIFICATION.....</b>	<b>52</b>
FRAME ASSEMBLY .....	52
HYDRAULIC MANIFOLD ASSEMBLY .....	54
EXIT MANIFOLD ASSEMBLY .....	55
HYDRAULIC SEAL ASSEMBLY .....	56
HYDRAULIC PISTON ASSEMBLY .....	57
HYDRAULIC CYLINDER ASSEMBLY .....	58
A & R SINGLE PUMP ASSEMBLY (16:1).....	60
A & R SINGLE PUMP ASSEMBLY (30:1).....	61
PUMPLINE ASSEMBLY .....	62
PUMPLINE ASSEMBLY .....	64
“A” INLET MANIFOLD ASSEMBLY .....	66
“R” INLET MANIFOLD ASSEMBLY .....	67
PREHEATER ASSEMBLY (PH-2) .....	68
PREHEATER ASSEMBLY (PHX-2) .....	70
MOTOR LINE ASSEMBLY (1 PHASE) .....	72
MOTOR LINE ASSEMBLY (3 PHASE) .....	73
FINAL ASSEMBLY .....	74
PH-2 HOSES.....	79
PHX-2 HOSES.....	80
LUBE BOTTLE COMPONENTS .....	81
PH-2 .....	81
EXIT MANIFOLD ACCESSORY .....	82
In-Plant Option .....	82

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## **WARRANTY**

Polyurethane Machinery Corporation (hereinafter “PMC”) provides this **LIMITED WARRANTY** (hereinafter “Warranty”) to the original purchaser (hereinafter “Customer”) covering this equipment and the original PMC manufactured accessories delivered with the equipment (hereinafter “Product”) against defects in material or workmanship of the Product (hereinafter “Defect” or “Defective”) for a period of one (1) year from the date of first purchase as shown on the original PMC invoice (hereinafter “Warranty Period”).

If during the Warranty Period under normal use, the Product is suspected by Customer to be Defective in material or workmanship, it is Customer’s responsibility to contact PMC and return the Product to PMC as directed by PMC, freight prepaid. If PMC determines that the Product is Defective and that such Defect is covered by this Warranty, PMC will credit Customer for the reasonable freight charges incurred by Customer in returning the Defective Product to PMC, and PMC (or its authorized agent) will, at PMC’s option, repair or replace the Product, subject to the following:

Original Invoice: The original invoice must be kept as proof of the date of first sale and the Product serial number. The Warranty does not cover any Product if the Original Invoice appears to have been modified or altered, or when the serial number on the Product appears to have been altered or defaced.

Product Maintenance: It is the Customer’s responsibility to maintain the Product properly. See your maintenance schedule and owner’s manual for details. The Warranty does not cover an improperly maintained Product.

Non-PMC Components and Accessories: Non-PMC manufactured components and accessories that are used in the operation of the Product are not covered by this Warranty. Such components and accessories shall be subject to the warranty offered to the Customer, if any, by the original manufacturer of such component or accessory.

Other Warranty Exclusions: The Warranty does not cover any Product that PMC determines has been damaged or fails to operate properly due to misuse, negligence, abuse, carelessness, neglect, or accident. By way of example only, this includes:

- Normal wear and tear.
- Improper or unauthorized installation, repair, alteration, adjustment or modification of the product.
- Use of heating devices, pumping equipment, dispensers, or other parts or accessories with the product that have not been approved or manufactured by PMC.
- Failure to follow the operating instructions and recommendations provided by PMC.
- Cosmetic damage.
- Fire, flood, “acts of God,” or other contingencies beyond the control of PMC.

**THE WARRANTY DESCRIBED HEREIN IS THE EXCLUSIVE REMEDY FOR THE CUSTOMER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS, IMPLIED, STATUTORY OR OTHERWISE, AND THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE AND ALL OTHER WARRANTIES ARE HEREBY DISCLAIMED. TO THE FULLEST EXTENT PERMITTED BY LAW, PMC SHALL NOT BE RESPONSIBLE, WHETHER BASED IN CONTRACT, TORT (INCLUDING, WITHOUT LIMITATION, NEGLIGENCE), WARRANTY OR ANY OTHER LEGAL OR EQUITABLE GROUNDS, FOR ANY CONSEQUENTIAL, INDIRECT, INCIDENTAL, LOST PROFITS, SPECIAL, PUNITIVE OR EXEMPLARY DAMAGES, WHETHER TO PERSON OR PROPERTY, ARISING FROM OR RELATING TO THE PRODUCT, EVEN IF PMC HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH LOSSES OR DAMAGES.**

Non-Warranty Service by PMC: If PMC determines that the suspected Defect of the Product is not covered by this Warranty, disposition of the Product will be made pursuant to the terms and conditions of PMC's written estimate on a time and materials basis.

Continuing Warranty for Products Repaired or Replaced under Warranty: Following the repair or replacement of a Product covered by this Warranty, such Product will continue to be subject to the original Warranty for the remainder of original Warranty Period or for three (3) months from the repair or replacement date, whichever is longer.

No Rights Implied: Nothing in the sale, lease or rental of any Product by PMC shall be construed to grant any right, interest or license in or under any patent, trademark, copyright, trade secret or other proprietary right or material owned by anyone; nor does PMC encourage the infringement of same.

Exclusive Warranty: This writing is the final, complete, and exclusive expression of the Warranty covering the Product. Any statements made by PMC, its employees or agents that differ from the terms of this Warranty shall have no effect. It is expressly understood that Customer's acceptance of this Warranty, by performance or otherwise, is upon and subject solely to the terms and conditions hereof, and any additional or different terms and conditions proposed or expressed by Customer or anyone, whether in writing or otherwise, are null and void unless specifically agreed to in writing by an Officer of PMC.

## **SAFETY AND HANDLING**

This chapter contains important information on the safety, handling, and use of your PH Series Proportioner.



**Before installing the PH Series Proportioner and start-up, carefully read all the technical and safety documentation included in this manual. Pay special attention to the information in order to know and understand the operation and the conditions of use of the PH Series Proportioner. All of the information is aimed at improving user safety and avoiding possible breakdowns from the incorrect use of the PH Series Proportioner.**

***WARNING!*** Symbol is presented in front of information to alert of a situation that might cause serious injuries if the instructions are not followed.

***CAUTION!*** Symbol is presented in front of information that indicates how to avoid damage to the Proportioner or how to avoid a situation that could cause minor injuries.

***NOTE!*** Symbol is presented in front of relevant information of a procedure being carried out.

Careful study of this manual will enable the operator to know the characteristics of the PH Series Proportioner and the operating procedures. By following the instructions and recommendations contained herein, you will reduce the potential risk of accidents in the installation, use, and maintenance of the PH Series Proportioner. You will provide a better opportunity for greater output, incident-free operation for a longer time, and the possibility of detecting and resolving problems quickly and simply.

Keep this Operations Manual for future consultation of useful information at all times. If you lose this manual, ask for a new copy from your PMC Service Center or go on line at our web site ([www.polymac-usa.com](http://www.polymac-usa.com)).

The PH Series Proportioner has been designed and built for the application of polyurea chemical systems, polyurethane foam chemical systems, and some two-component epoxy systems.

***WARNING! The design and configuration of the PH Series Proportioner does not allow its use in potentially explosive atmospheres or the pressure and temperature limits described in the technical specifications of this manual to be exceeded.***

Always use liquids and solvents that are compatible with the unit. If in doubt, consult your authorized PMC distributor.

When working with the PH Series Proportioner, it is recommended that the operator wear suitable clothing and elements of personal protection, including, without limitation, gloves, protective goggles, safety footwear and face masks. Use breathing equipment when working with the PH Series Proportioner in enclosed spaces or in areas with insufficient ventilation. The introduction and follow-up of safety measures must not be limited to those described in this manual. Before starting up the PH Series Proportioner, a comprehensive analysis must be made of the risks derived from the products to be dispensed, the type of application, and the working environment.



***To prevent possible injury caused by incorrect handling of the raw materials and solvents used in the process, carefully read the Material Safety Data Sheet (MSDS) provided by your supplier.***

***Deal with the waste caused according to current regulations.***



***To avoid damage caused by the impact of pressurized fluids, do not open any connection or perform maintenance work on components subject to pressure until the pressure has been completely eliminated.***



***Use suitable protection when operating, maintaining or being present in the area where the equipment is functioning. This includes, but is not limited to, the use of protective goggles, gloves, shoes and safety clothing and breathing equipment.***



***The equipment includes components that reach high temperatures and can cause burns. Hot parts of the equipment must not be handled or touched until they have cooled completely.***



***To prevent serious injury through crushing or amputation, do not work with the equipment without the safety guards installed on the moving parts. Make sure that all the safety guards are correctly reinstalled at the end of the repair or maintenance work of the equipment.***

## **CHARACTERISTICS**

The PH Series Proportioner has been designed and built for the application of polyurea chemical systems, polyurethane foam chemical systems, and some specific two-component epoxy systems.

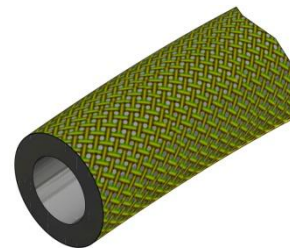
### **Principal Heating System**

The Proportioner consists of one (1) Material Heater without internal seals. The Low Pressure Heater has three (3) Heating Elements per fluid side rated at 1,250, 1,500, or 1750 watts, each giving the Proportioner a total heat output of 7,500, 9,000, or 10,500 watts. The High Pressure Heater has four (4) Heating Elements per fluid side rated at 1750 watts, each giving the Proportioner a total heat output of 14,000 watts. Every heating system provides the necessary control and safety components for their precise operation. The Material Heater design allows for a controlled and precise temperature differential ( $\Delta T$ ) and material application temperatures of up to 190° F under ambient temperatures.

### **Hose Heating System**

The system is designed with a 3 KVA Isolation Transformer that enables effective heating of up to a total hose length of 310 feet (also available with a 2KVA transformer and a 5 KVA transformer for maximum hose lengths of 210 and 410, respectively). The system includes an innovative hose heating concept in which the continuous braid tinned-copper jacket is distributed evenly around the circumference of the hose providing a uniform heating watt density and precise control of the material application temperature. This hose heating element design is extremely resistant to fatigue failure.

100% circumferential coverage produces the most uniform distribution of heat available.



### **Double Acting Opposed Piston Metering Pumps**

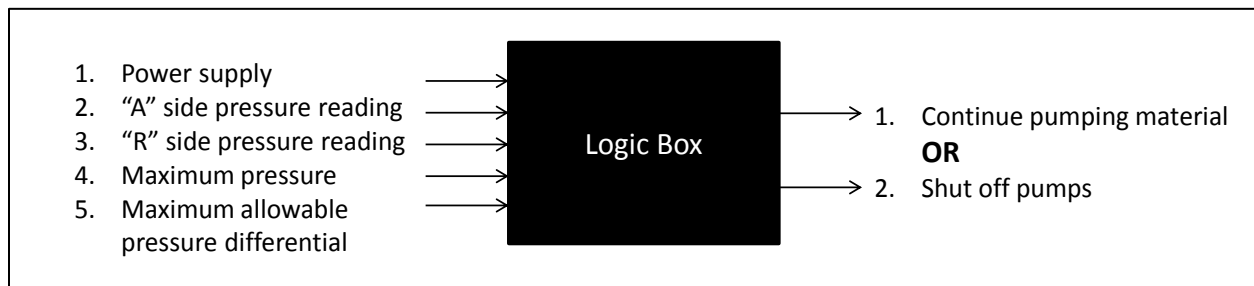
The opposed double acting Pump Line is driven by a double ended Hydraulic Cylinder. The in-line pump system with opposed piston pumps provides a constant volume and guarantees uniform pressures in both directions of pump movement.



## **Pressure Balance Control System**

The Pressure Balance Control (PBC) system performs an automatic shutdown when a chemical imbalance occurs. When the system is turned off, the Proportioner will perform as if there is no PBC system and will continue pumping material. When the system is turned on, it will continually monitor the pressure between the two chemicals (known as the **pressure differential**). If the pressure differential becomes equal to or greater than the **maximum allowable pressure differential**, the pumps will be shut off.

The Pressure Balance Control system can be simplified into a logic box diagram with inputs and outputs. There are five inputs: the power supply from the main console, the pressure readings from each chemical, the maximum pressure, and the maximum allowable pressure differential. Inside the logic box, the actual pressure differential of the chemicals is compared to the maximum allowable pressure differential. Depending on the circumstances of all five inputs, there are only two possible outputs: either the pumps will continue to pressurize and move material, or the pumps will shut off and flow will be lost.



***Logic Box Representation***

## TECHNICAL SPECIFICATIONS

### Electrical

**Main Voltage:** \_\_\_\_\_ **Three Phase** \_\_\_\_\_ **3 x 208-230V, 50/60Hz**

Electrical Consumption: PH-2, 2000 PSI, 7.5 kW (3.75 kW/side) Heaters ..... 40 A  
 Electrical Consumption: PH-2, 2000 PSI, 9.0 kW (4.50 kW/side) Heaters ..... 46 A  
 Electrical Consumption: PH-2, 2000 PSI, 10.5 kW (5.25 kW/side) Heaters ..... 51 A  
 Electrical Consumption: PHX-2, 3000 PSI, 14 kW (7.00 kW/side) Heaters ..... 69 A

**Main Voltage:** \_\_\_\_\_ **Single Phase** \_\_\_\_\_ **1 x 208-230V, 60Hz**

Electrical Consumption: PH-2, 2000 PSI, 7.5 kW (3.75 kW/side) Heaters ..... 61 A  
 Electrical Consumption: PH-2, 2000 PSI, 9.0 kW (4.50 kW/side) Heaters ..... 67 A  
 Electrical Consumption: PH-2, 2000 PSI, 10.5 kW (5.25 kW/side) Heaters ..... 72 A  
 Electrical Consumption: PHX-2, 3000 PSI, 14 kW (7.00 kW/side) Heaters ..... 109 A

**Main Voltage:** \_\_\_\_\_ **Five Wire** \_\_\_\_\_ **3 x 400V, 50/60Hz**

Electrical Consumption: PH-2, 2000 PSI, 7.5 kW (3.75 kW/side) Heaters ..... 40 A  
 Electrical Consumption: PH-2, 2000 PSI, 9.0 kW (4.50 kW/side) Heaters ..... 46 A  
 Electrical Consumption: PH-2, 2000 PSI, 10.5 kW (5.25 kW/side) Heaters ..... 51 A  
 Electrical Consumption: PHX-2, 3000 PSI, 14 kW (7.00 kW/side) Heaters ..... 55 A

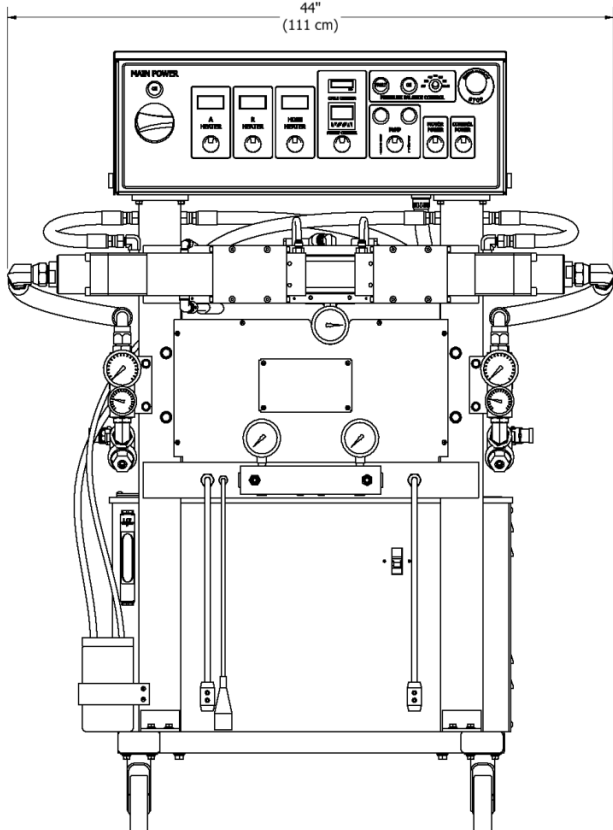
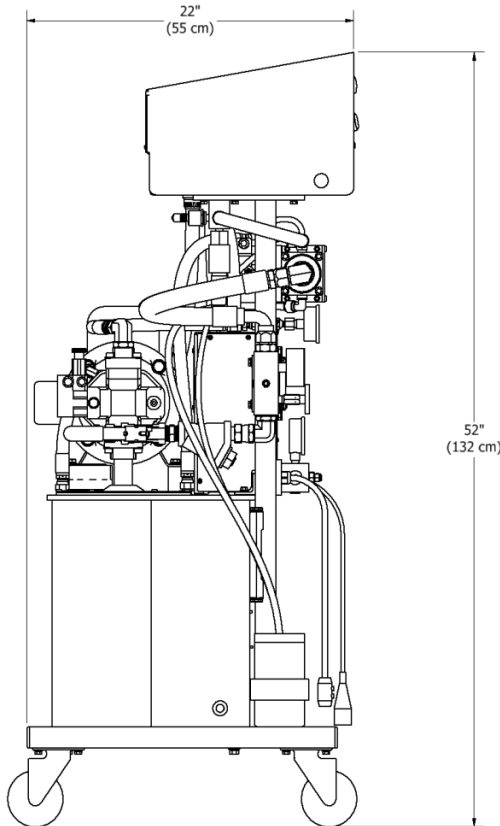
Material Heater Power: PH-2, 3.75 kW/side (3 x 1250 W/side) ..... 7.5 kW Total  
 Material Heater Power: PH-2, 4.50 kW/side (3 x 1500 W/side) ..... 9.0 kW Total  
 Material Heater Power: PH-2, 5.25 kW/side (3 x 1750 W/side) ..... 10.5 kW Total  
 Material Heater Power: PHX-2, 7.00 kW/side (4 x 1750 W/side) ..... 10.5 kW Total  
 Hose Transformer Power: 70 V ..... 2 KVA  
 Hose Transformer Power: 90 V ..... 3 KVA  
 Hose Transformer Power: 120 V ..... 5 KVA  
 Electrical Motor Power: PH-2 ..... 3 hp  
 Electrical Motor Power: PHX-2 ..... 5 hp



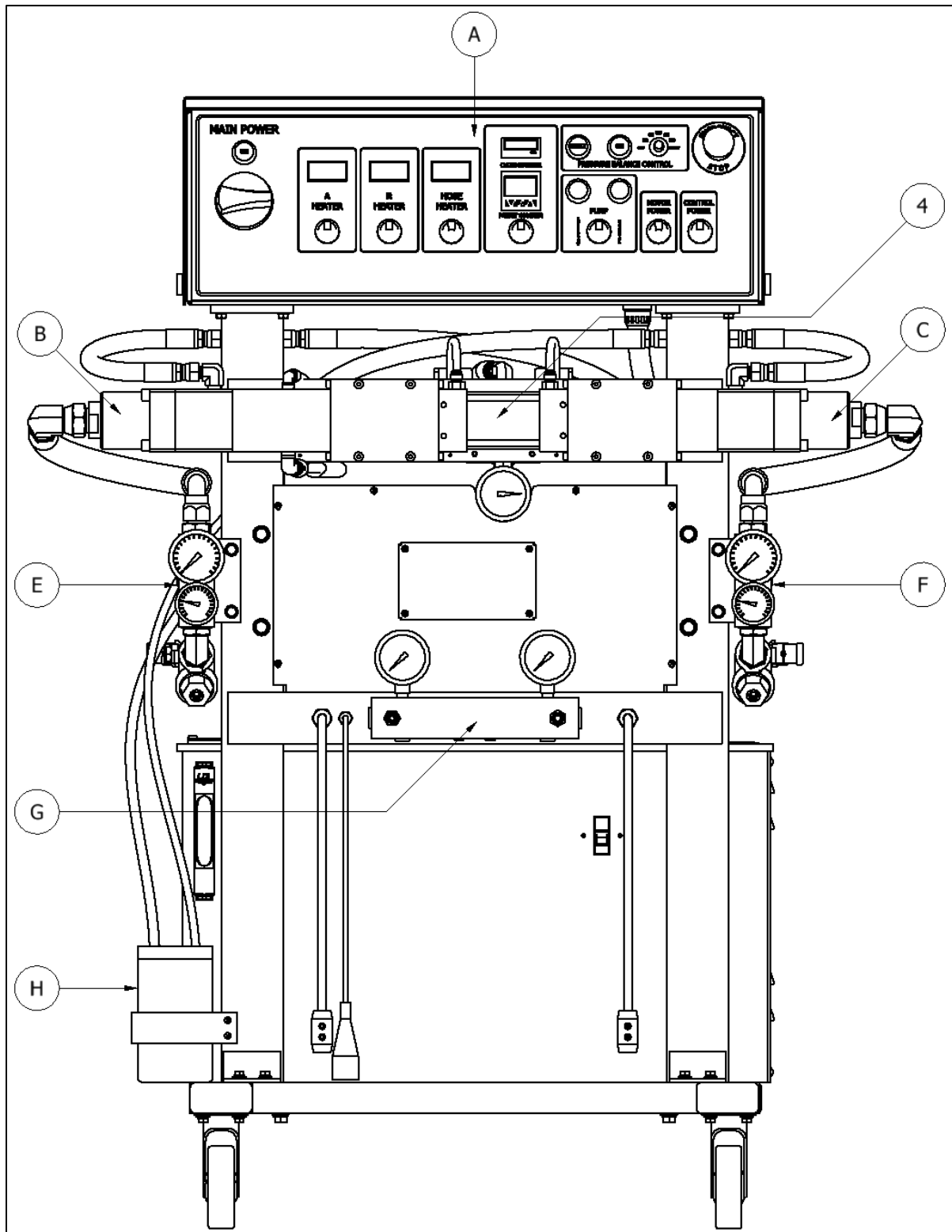
***CAUTION!*** Inside the console is a Terminal Strip for connecting the main power (wire not supplied) to the PH Series Proportioner. This electrical connection must be made only by a qualified electrician.

**Mechanical**

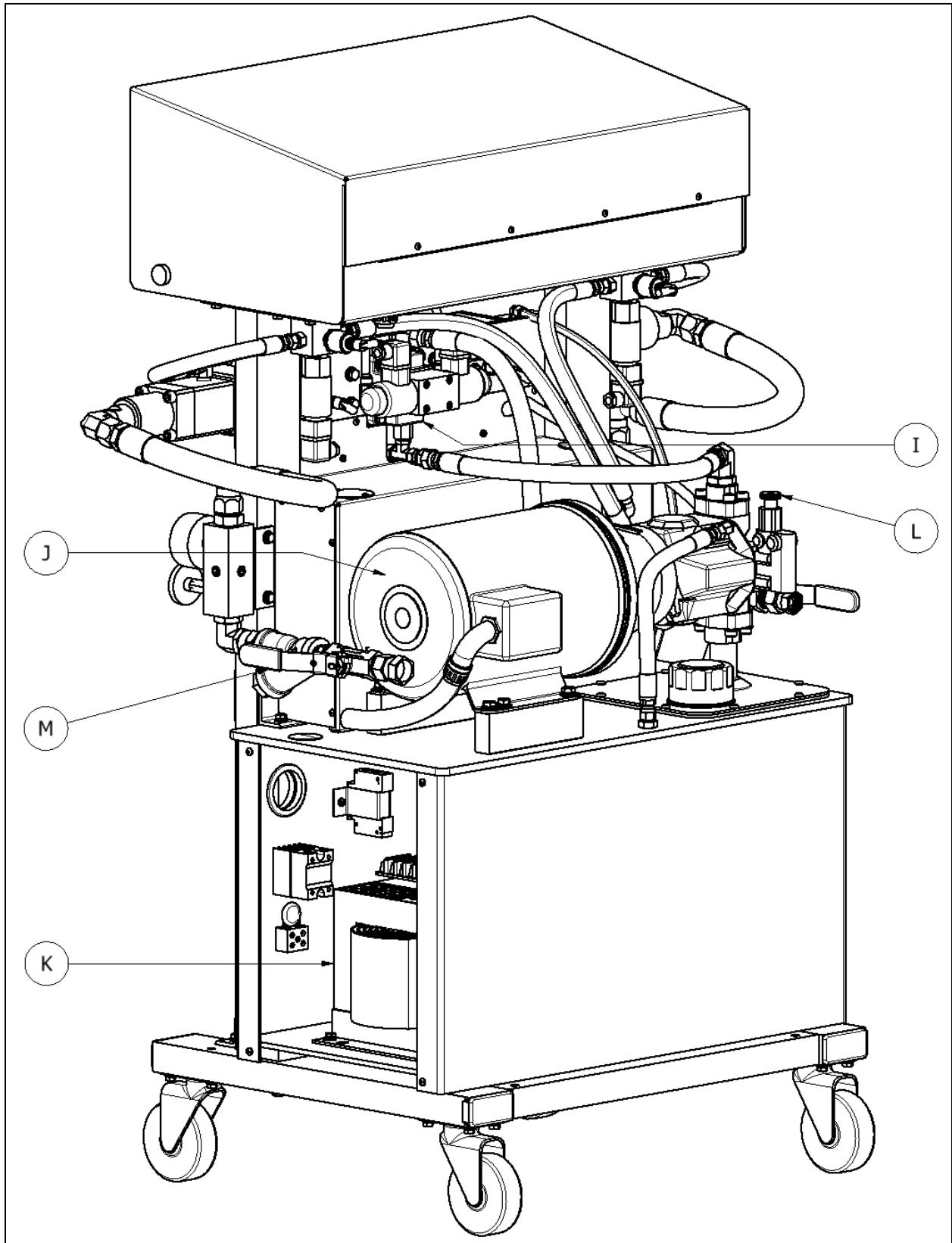
Maximum working pressure: PH-2 (123 pumps).....	2,000 psi (14 MPa, 138 bar)
Maximum working pressure: PHX-2 (61 pumps) .....	3,000 psi (21 MPa, 207 bar)
Maximum production ratio: 1:1 PH-2 (123 pumps) .....	31 lb/min (14 kg/min)
Maximum production ratio: 1:1 PHX-2 (61 pumps).....	2.3 gpm (10.5 Lpm)
Minimum production.....	2 lb/min (1 kg/min)
Gallons per stroke: PH-2 (123 pumps) .....	0.01859 gal/stroke (.07037 L)
Gallons per stroke: PHX-2 (61 pumps).....	0.00911 gal/stroke (.03449 L)
Strokes per 55 gal (200 L) drum: PH-2 (123 pumps) .....	2958 strokes
Strokes per 55 gal (200 L) drum: PHX-2 (61 pumps).....	6037 strokes
Maximum hose length: 2 KVA Transformer .....	210 ft (64 m)
Maximum hose length: 3 KVA Transformer .....	310 ft (95 m)
Maximum hose length: 5 KVA Transformer .....	410 ft (125 m)
Approximate weight (Hydraulic Tank empty) .....	415 lbs (166 kg)
Approximate weight (Hydraulic Tank full @ 12 gal) .....	450 lbs (197 kg)
Dimensions .....	44in W x 22in D x 52in H
.....	.....(111cm W x 55cm D x 132cm H)



## DESCRIPTION

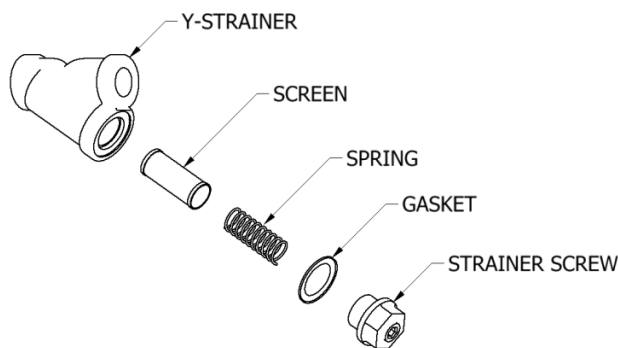


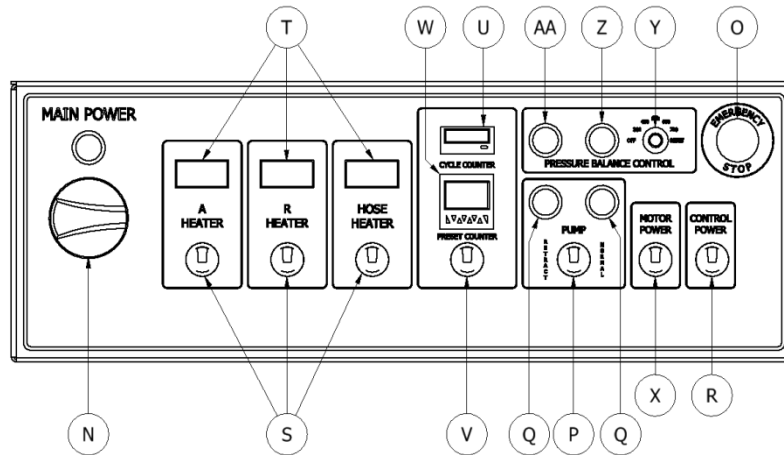
**PH-2 PROPORTIONER**



**PHX-2 PROPORTIONER**

- A. Control Panel**  
Controls and regulates the operation of the PH Series Proportioner.
- B. Isocyanate (Iso, A) Metering Pump**  
Meters the Isocyanate material.
- C. Polyol (Poly, R) Metering Pump**  
Meters the Polyol material.
- D. Hydraulic Cylinder Assembly**  
Transfers power from hydraulic pump to material pumps.
- E. Isocyanate (Iso, A) Inlet Manifold Assembly**  
Provides Isocyanate temperature and pressure readings prior to heating and pressurizing
- F. Polyol (Poly, R) Inlet Manifold Assembly**  
Provides Polyol temperature and pressure readings prior to heating and pressurizing
- G. Exit Manifold Assembly**  
Provides pressure reading of material after heating and pressurizing
- H. Isocyanate (Iso, A) Lube Reservoir**  
Provides lube to the Isocyanate pump shaft
- I. Hydraulic Manifold Assembly**  
Provides pressure reading of hydraulic fluid and controls direction of flow
- J. Motor**  
Provides power for hydraulic pump.
- K. Hose Heating Transformer – Right side, inside of hydraulic tank**  
Supplies the required voltage for material Heated Hoses
- L. Hydraulic Pressure Control**  
Allows the pressure of the hydraulic system to be increased or decreased. Turn clockwise to increase the pressure and counterclockwise to decrease. To regulate the pressure of the hydraulic system, the NORMAL or RETRACT Pump Switch position must be selected.
- M. Inlet Material Strainer**  
Screens (60 mesh) material from bulk supply.





- N. Main Power** - Turns ON and OFF main power to the control panel. It must be turned ON for any operation to be performed with the unit. When turned ON, the red pilot will light.
- O. Emergency Stop** - Interrupts the PH- Series control power circuit to stop all motion and heating.
- P. Pump Switch**  
**Off** - Removes power from the pump circuit. The directional indicator lights will not be lit.  
**Normal** - Activates the normal operation of the machine. When the switch is ON, the directional light corresponding to the stroke direction will light.  
**Retract** - Sets the Piston Rod of the Iso (A) metering pump into the pump to prevent crystallization of Iso (A) on the Piston Rod. Press the RETRACT key every time the unit is stopped by the operator (see Shut-Down, page 26).
- Q. Direction Indicator Lights** - Indicates the movement direction of the Metering Pumps. If excessive pressure is caused in the system, the pump circuit will be disabled and the directional lights will be OFF.
- R. Control Power** - Turns ON and OFF the control power to the complete electrical circuit including Heaters and Hose Heater.
- S. Heater Temperature Switch – A (Iso), R (Poly), HOSE** – Turns ON and OFF power to the specific Heaters and Hose.
- T. Temperature Controllers** – Displays the temperature of the chemicals. See page 23 for detailed Temperature Controller instructions.
- U. Totalizer** – Indicates the number of pump cycles to calculate material usage.

MODEL	PUMP SIZE	CYCLES PER GAL (3.79 L)
PH-2, 2000 PSI	123	27
PHX-2, 3000 PSI	61	55

- V. Auto Shut Down Switch** - Turns ON and OFF power to the Auto Shut Down unit.
- W. Auto Shut Down Counter** – Used to set the amount of cycles required to prevent the chemical drums from running dry, the machine will shut down when the preset cycles

expire. There is an on/off switch to activate this feature or deactivate and not use it, see page 25.

- X. **Motor Switch** - Turns ON and OFF the Electric/Hydraulic Motor. When turned ON, the pilot will light. In the event of an overload of the Motor, pilot light will turn OFF and Motor will stop.
- Y. **Pressure Balance Control Knob** – Used to set the maximum allowable pressure differential (in PSI) between the A (Iso) and R (Poly) pumps. See page 22 for more information.
- Z. **Pressure Balance Control “ON” Light** – Indicates that the Pressure Balance Control system is on and functioning.
- AA. **Pressure Balance Control “FAULT” Light** – Indicates that the pressure differential is equal to or greater than the maximum allowable pressure differential.

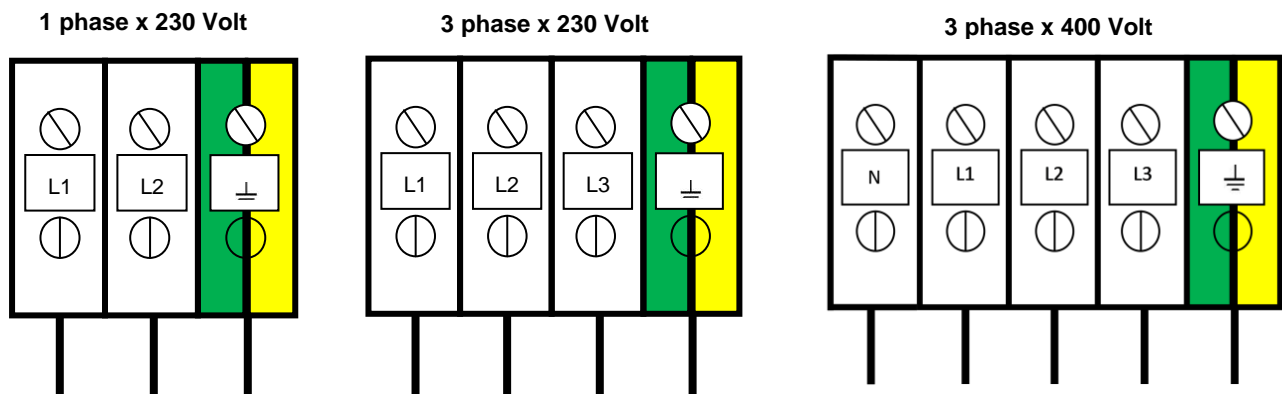


## INSTALLATION

***WARNING!*** Use suitable protection and follow the recommendations in the Safety Information enclosed and provided by material suppliers when installing or working with the Proportioner.

***NOTE!*** To ensure the PH Series Proportioner works correctly, the electrical supply must meet the specifications indicated on the Serial Number Placard affixed to the Electrical Console.

***CAUTION!*** Make sure the power cable is disconnected from the main power source before connecting to the Terminal Strip in the Console.

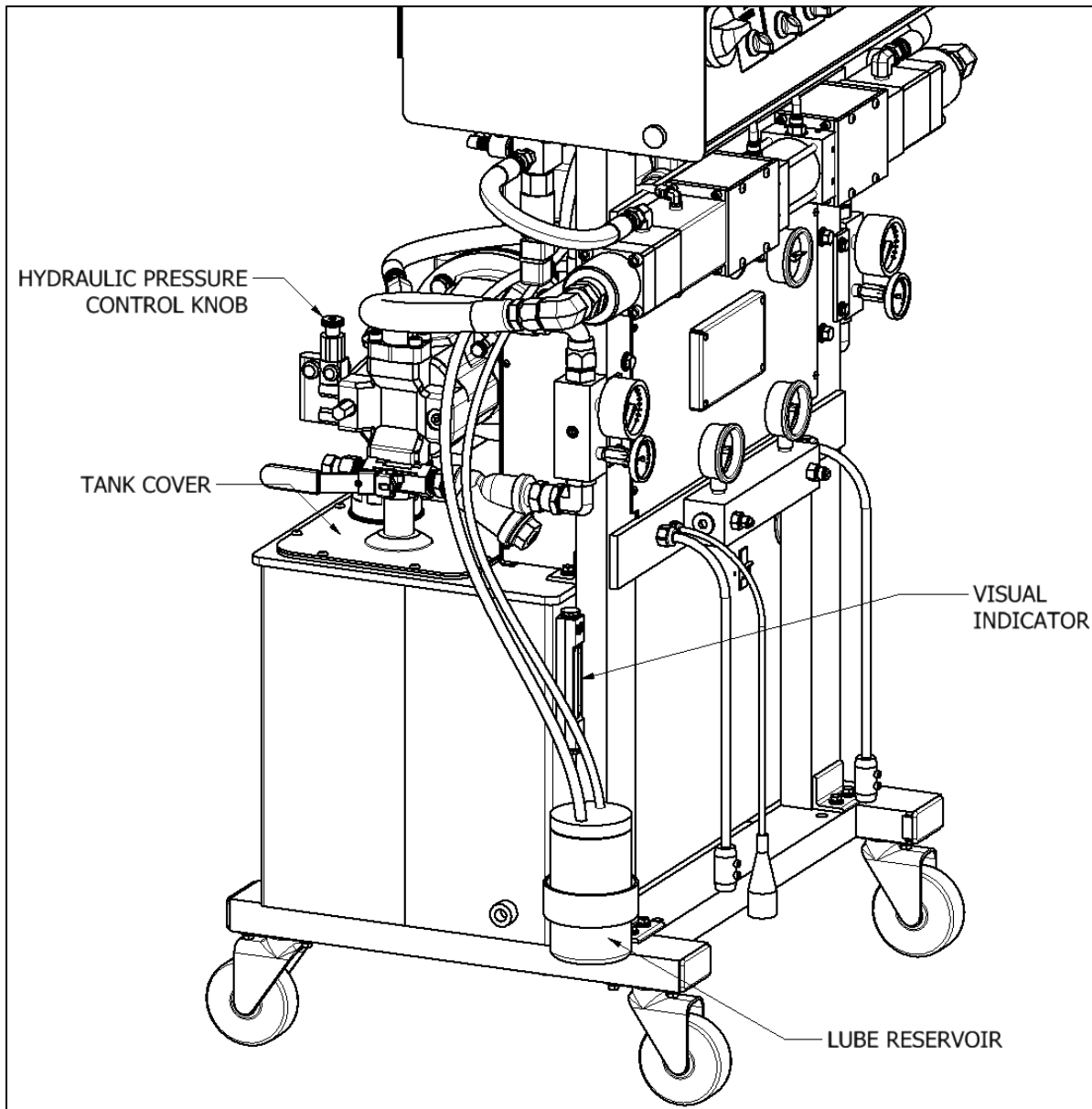


Follow the recommended procedure in the indicated order to install the Proportioner:

1. Insert the main power cable by passing it through the wire stop at the bottom of the electrical console and connect as shown in the diagram above.
2. Fill the Hydraulic Reservoir with 10 gallons (37 Liters) of approved hydraulic fluid. See page 50 for oil specifications.

***NOTE!*** Do not fill the tank to maximum capacity; use the Visual Level Indicator on the tank to make sure the amount of hydraulic fluid is not more than 10 gal (37 L) or 80% of the tank maximum capacity.

3. To check the level of the hydraulic fluid in the Hydraulic Pump Case, disconnect the Hydraulic Hose from the 90° fitting and remove Fitting from Hydraulic Case. Add fluid as required. Reattach Fitting and Hydraulic Hose. Turn the hydraulic pressure control knob counter clockwise until it stops, that is the lowest hydraulic pressure setting.



**CAUTION!** *Ensure that the emergency stop is not engaged.*

4. **Three-phase Proportioner Only:** Check the Electric Motor to ensure rotation is **clockwise** when viewing the end of the Electric Motor. A counter clockwise rotation indicates two of the incoming power leads need to be reversed.

**CAUTION!** *Ensure Main Power Switch is OFF and incoming power is locked OFF before reversing power leads.*

Recheck rotation before proceeding with Installation.

3. Fill the Lube Reservoir with PMC Pump Lube or suitable diluents. It is not necessary to prime the system.

## Heated Hose Installation

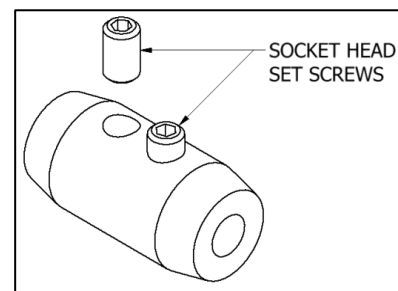
**CAUTION!** *The material delivery Heated Hoses are color coded Red and Blue, allowing the user to recognize them. The Red corresponds to the Isocyanate (Iso, A) and the Blue to the Polyol (Poly, R). To avoid connection errors, the Coupling Connections of the Iso (A) and Poly (R) Heated Hoses are different sizes to ensure correct orientation.*

**NOTE!** *The material delivery Heated Hoses are capped at the ends to prevent absorbing moisture. Do not remove caps until the Heated Hoses are going to be installed on the Proportioner.*

1. Lay out all the Heated Hose assemblies end to end aligning the Iso “A” (red) and Poly “R” (blue) and connect the respective Coupling Connections using the appropriate sized open-end wrench after ensuring Heated Hose assemblies lay flat.

**CAUTION!** *Take care to not cross-thread or over-tighten the Coupling Connections. Thread seal tape or compound is not recommended for this tapered seat Coupling Connections.*

2. Connect the material Heated Hoses to the outlets of the respective Heaters i.e. Iso (A) Heated Hose to the Iso (A) Heater and the Poly (R) Heated Hose to the Poly (R) Heater ensuring Heated Hose assemblies lay flat.
3. Connect Air Hose Coupling Connections.
4. Connect the Heated Hose power wires to the “Fast-Lock” Connector (Part # KT-00029A) coming from the Hose Heat Transformer as follows:
  - a. Loosen the Socket Head Set Screw to allow insertion of the Heated Hose electrical wire Terminal.
  - b. Insert the Terminal into the “Fast-Lock” Connector Body.
  - c. Securely tighten the Socket Head Set Screw.
  - d. Install electrical tape around Connector Body.



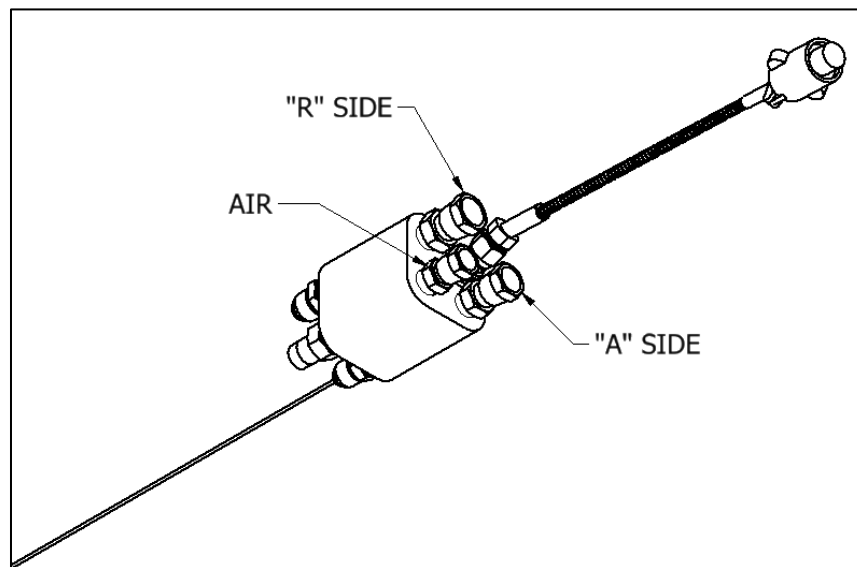
**NOTE!** *A good practice is to add some dielectric grease (Permatex 67VR or equivalent) to the outside of the Terminal, where the electrical connection is made, prior to insertion.*

5. Repeat the above steps to connect the “Fast-Lock” Connectors that you will find on all Heated Hose power wire.

**CAUTION!** Ensure the proper mechanical and electrical connections of the Heated Hoses are made to avoid possible material leakage and Hose heat problems.

6. It is recommended the TSU be installed between the last section of Heated Hose and the Gun Whip. Carefully straighten the sensing wire, inserting it in the Iso (A) Heated Hose and tighten fluid fittings with appropriate sized open-end wrenches.

**CAUTION!** To protect the TSU sensor, you must pay special attention not to kink or excessively bend the Heated Hoses. Do not coil the Heated Hoses with a diameter of less than 4 feet (1.22 Meters).



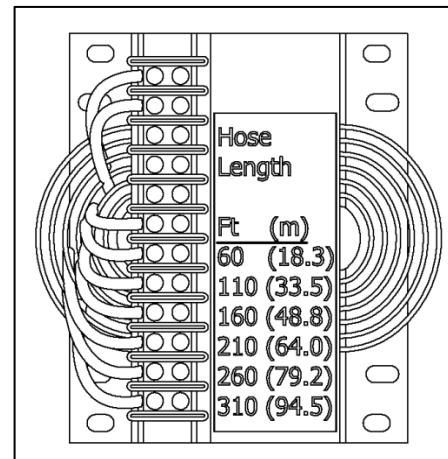
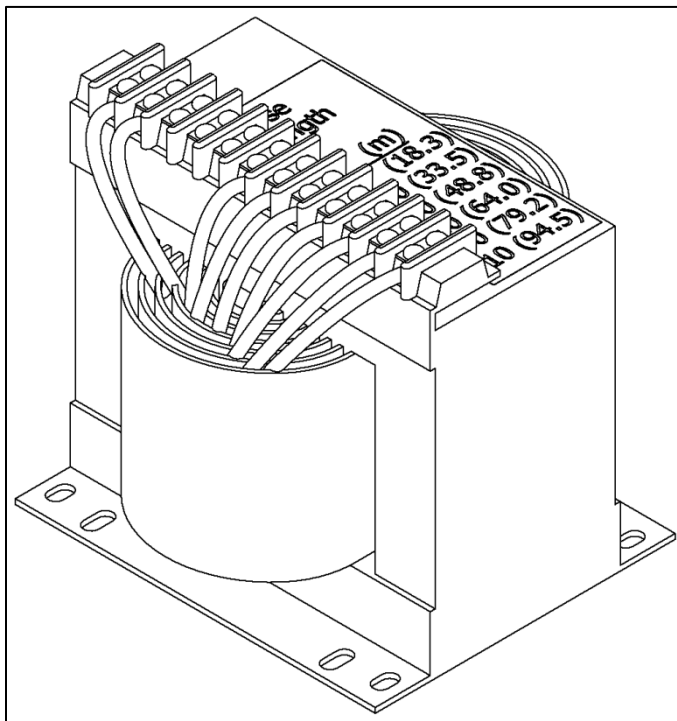
*Temperature Sensing Unit  
(TSU) Part # EL-51A-4  
Replacement Sensor Part # EL-51A-2*

**CAUTION!** Connecting the TSU between the first and second section of Heated Hose results in the TSU sensing the material temperature exiting the Heater and not the inside of the Heated Hose near the Spray Gun.

## Hose Heat Transformer

The Hose Heat Transformer offers the ability of connecting to different output voltages depending on the total length of the Heated Hose in use, maximizing the heating ability of the Heated Hose. The factory setting is 18 volts for use with 60 feet of Heated Hose. Before starting the Proportioner, ensure the setting matches the Heated Hose length installed. If Heated Hose sections are added or removed, the Tap setting should be changed to a setting which will limit the maximum amperage in the Heated Hose to 52 amps. The suggested settings are tabled below<sup>2</sup>:

<b>RECOMMENDED TAP SETTINGS<sup>1</sup></b>		
<b>Tap</b>	<b>Feet</b>	<b>Meters</b>
120V	410	125.0
105V	360	109.7
90V	310	94.5
75V	260	79.5
60V	210	64.0
45V	160	48.8
30V	110	33.5
18V	60	18.3



<sup>1</sup> 90V transformers (shown above) allow for a maximum hose length of 310 ft (94.5 m). 120V transformers allow for a maximum hose length of 410 ft (125 m).

<sup>2</sup> 90V Transformers (shown above) are standard on all PH(X)-25 Proportioners. 120V Transformers are standard for all PH(X)-40 Proportioners, and are also optional for PH(X)-25 Proportioners

7. Ensure the Manual Valves are CLOSED and connect the Coupling Block to the Heated Gun Whip.

**CAUTION!** Excessive force closing or opening the Manual Valves may result in damage to the Manual Valves and/or Coupling Block.

8. Connect the Transfer Pump/ Heated Hose Assemblies/ Air Supply and Air Dryer systems as required. Review the Installation Instructions for each to ensure proper set-up and operation.
9. Install the Material Transfer Pumps as follows:

**WARNING!** If Transfer Pumps have been previously used, pay special attention to connect each Pump to “its” specific material. Inadvertently changing the Transfer Pumps will cause a chemical reaction rendering them useless.

**NOTE!** Placing a tape of the same color as of the Material Delivery Hoses (red for the Iso (A), blue for the Poly (R)) on each Transfer Pump would be a good method for minimizing errors in connection.

- a. Make sure that the Inlet Valves on the Proportioner are closed.
- b. Connect one end of the Polyol (R) Material Delivery Hose ( $\frac{3}{4}$ ” thread) to the Proportioner Polyol (R) Inlet Valve and the other end to the Polyol (R) Transfer Pump.
- c. Connect one end of the Iso (A) Material Delivery Hose ( $\frac{1}{2}$ ” thread) to the Proportioner Iso (A) Inlet Valve and the other end to the Iso Transfer Pump.
- d. Connect the air hose to the Transfer Pumps after ensuring each Transfer Pump Shut-Off Valve is CLOSED.

**NOTE!** To avoid errors in connection, the Coupling connections of the Iso (A) and Poly (R) Material Delivery Hoses are different sizes, making it difficult to swap connections.

10. Ground the Transfer Pump as recommend by the material supplier. The movement of product inside the Hoses can cause static electricity and produce electrical discharges.
11. Connect air to the air line coming off the first section of hose (90-110 psi, 6-8 bar)



---

## **PROPORTIONER PURGING**

***WARNING!*** Use suitable *Personal Protection Equipment (PPE)* and follow the recommendations in the *Safety Information* provided by product suppliers when installing or working with the unit.

***WARNING!*** Do not turn the *Temperature Controllers ON* until the *Proportioner purging procedure* is complete and the *Primary Heaters and Heated Hoses* are filled with material.

***NOTE!*** Before using the *Proportioner* it is necessary to purge the entire system, including *Heated Hoses* of mineral oil left over from *Quality Control testing* and air. The following procedure is also followed to purge air entrapped by running out of material in the supply *Drum/Reservoirs* resulting in a significant indicated material pressure imbalance as indicated by the *Pressure Gauges* and sprayed material.

1. Ensure the following before proceeding:
  - a. Air supply to Transfer Pumps is 90 - 110 psi (6 - 8 bar)
  - b. Proportioner Inlet ball Valves are CLOSED.
  - c. All connections are tight.
  - d. Material should be stored to the material suppliers' recommended temperatures.
  - e. Spray gun coupling block is installed and manual valves are closed.
2. Slowly OPEN the Poly (R) Transfer Pump Air Shut-Off Valve allowing Pump to cycle slowly as it fills the Material Delivery Hose to the Proportioner. Check for leaks.
3. OPEN Poly (R) Coupling Block Manual Valve over a waste container.
4. Slowly OPEN Proportioner Poly (R) Inlet Valve allowing Transfer Pump to move material through the system. When all spitting of air stops and all traces of mineral oil have disappeared, CLOSE Poly (R) Coupling Block Manual Valve. Clean Coupling Block.
5. Repeat steps 2 to 4 for Iso (A) side.

***CAUTION!*** Properly dispose of all waste chemicals in accordance with all applicable local, state and federal codes. DO NOT turn on the Auto Countdown Switch or the Pressure Balance Control Switch.

1. Turn Hydraulic Pressure Control (L, page 11) full COUNTERCLOCKWISE.
2. Turn ON Main Power (N, page 12). Green pilot will light.
3. Turn ON Control Power (R12, page 12). Switch will light.
4. Turn ON Motor Power (X, page 13). Switch will light.
5. Set Pump Switch (P, page 12) to NORMAL. Turn Hydraulic Pressure Control CLOCKWISE increasing **material pressure** to 400 psi (28 bar). Both Material Pressure Gauges (E, F, page 11) should approximately read the same. Check all Heated Hose Coupling connections for leakage.
6. Check all TSU and “Fast-Lock” connections for leaks.
7. Bundle all Heated Hose Connections ensuring that there are NO kinks in the TSU Cable or Air Hose. Wrap with Electrical Tape to securely hold all components in place and minimize places for bundle to snag onto job site protrusions.

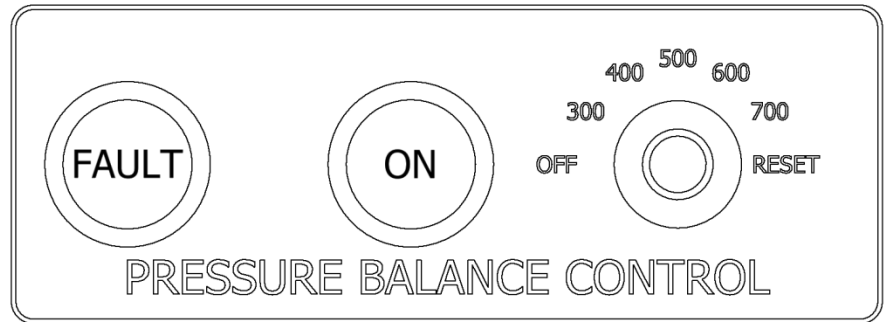


## PRESSURE BALANCE CONTROL

The PH Series Proportioner has been designed with a pressure balance control system. This system will give the operator of this machine the ability to control a pressure imbalance within certain predetermined parameters.

The system consists of:

Selector Switch  
Fault Light  
On Light  
Control Unit  
Pressure Transducers  
Relay



### Operation

Position the selector switch on one of the three options:

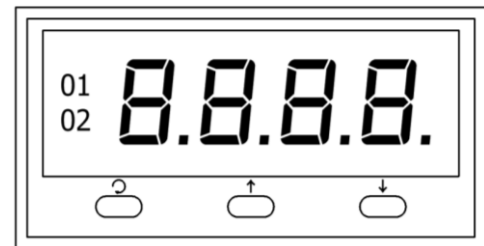
- **Pressure differential number** – these consist of 300, 400, 500, 600, and 700 PSI. Selecting any of these numbers with the switch will activate the green ON light. While the pressure differential numbers are selected, the control box will continually monitor pressure on both sides of the Proportioner. In the event that the pressure differential between both sides of the Proportioner is equal to or larger than the selected number, a fault is given (the red fault light is turned on and the active green light is turned off) and shuts down.
- **Off** – if the selector switch is placed in this position, the Proportioner will operate as though there is NO PRESSURE BALANCE CONTROL SYSTEM (neither the red fault light nor the active green light will be lit). The over pressure system will remain active for the machine and personnel protection.
- **Reset** – in the event of a pressure imbalance, resolve the Proportioner imbalance, position the selector switch on reset to clear the fault light and restore power to the Proportioner. After the fault has been cleared, position the switch in either a Pressure Differential number or in the Off Position to continue operations.

## **DIGITAL TEMPERATURE CONTROLLER**

The PH Series has three Digital Temperature Controllers to manage the temperatures for the Primary Heaters (Iso (A), Poly (R)) and the Heated Hose. The Hose Heater Controller is programmed different from the Iso (A) and Poly (R) Controllers and therefore not interchangeable with them.

***WARNING! Do not turn the Temperature Controllers ON until the Proportioner Purging procedure is complete and the Primary Heaters and Heated Hoses are filled with material.***

1. Ensure Main Power (Q, page 12) is ON, Control Power (S, page 12) is ON and **01** Display light is lit.



2. Press and release **↻** button. The display will read **SP1**.
3. Press and release **↑** or **↓** button to display the **current material temperature set-point**.
4. Press and hold the **↑** or **↓** to **increase** or **decrease** the material temperature set-point to the desired value as determined by the material supplier or application conditions.
5. Press and release **↑** and **↓** together to return to the **actual material temperature** in the Primary Heater/Hose Heater.

***WARNING! The Controllers are factory programmed and are not field re-programmable. If a problem is encountered, contact your PMC Distributor. Do not attempt to change any of the programmed parameters. Do not substitute a Controller from an alternate supplier as its use may result in equipment damage and/or bodily injury.***

***NOTE!*** The Temperature Controller normally displays the actual material temperature. When lit, the “01” display in the upper left indicates power is sent to the designated heating system. The “01” display goes out when the material temperature has reached its set-point. The “01” display will continue to cycle on and off indicating the Controller is maintaining the material temperature set-point.

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## **START-UP**

**NOTE!** Follow the recommended procedure in the order shown.

**CAUTION!** The Start-up procedures assume that all steps in Proportioner purging have been performed and no problems were found.

1. Check the hydraulic fluid level and service as required.
2. Make sure the materials have been stored at the manufacturer's recommended temperature. Ask your material supplier for information (Material Safety Data Sheet) on the minimum storage temperature.
3. Y-Strainer screens should be checked routinely.
4. Connect air supply to the two Transfer Pumps and ensure Air Valves are in the full OPEN position. OPEN both Proportioner Material Inlet Ball Valves.

**CAUTION!** Remove all Heated Hose sections from coiled storage and lay flat to eliminate heat build-up and possible Heated Hose failure.

5. Turn ON Main Power (N, page 12).
6. Turn ON Control Power (R, page 12).
7. Turn ON Hose Heater (S, page 12) and confirm material set-point temperature as recommended by the material supplier or application conditions.

**CAUTION!** To avoid excessive pressure in the Proportioner, wait for the Hose Heater to reach its set-point temperature before continuing.

8. Turn ON each Primary Heater and confirm material set-point temperature as required by the material supplier or application conditions has been reached.
9. Turn ON Motor Power (X, page 13).
10. Set Pump Switch (P, page 12) to NORMAL. One of the Directional Indicator Lights (Q, page 12) will illuminate, indicating the Metering Pump direction, and the Metering Pump Shafts will begin to move.

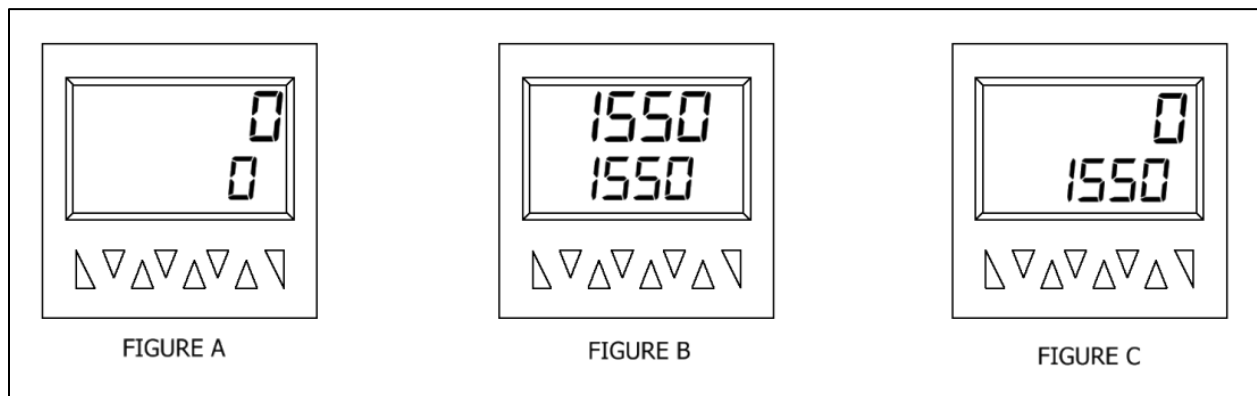
**NOTE!** The Material Pressure Gauges should be approximately equal and remain constant throughout the Metering Pump cycle. If not, refer to Trouble Shooting section.

**NOTE!** Directional Indicator Lights must indicate Metering Pump direction when Pump Switch is in the NORMAL position. If not, refer to Trouble Shooting section.

11. Using the Hydraulic Pressure Control, adjust to the required stall pressure<sup>1</sup> and check each Material Pressure Gauge.
12. Auto Shut Down Counter - **If this function is not needed, leave it in the off position.**  
To set the Auto Shut Down Counter:
  - a. Turn the switch to the on position, the green light will illuminate.
  - b. Insert the number of cycles desired to disable the PH machine by pushing in on the white triangles to set the cycle count. Push in on the red button until the data is replicated on the top row, the top row will count down. Figure B

MODEL	PUMP SIZE	CYCLES PER GALLON
PH-2 (2000 PSI)	123	23 cycles = 1 gal (3.79 L)
PHX-2 (3000 PSI)	61	47 cycles = 1 gal (3.79 L)

- c. When the counter counts down to zero the machine will stop and the pump directional light will be off, push in on the red button to reset.



13. Proceed with Installation and Start-up of the Spray Gun as per the Gun manual.

<sup>1</sup> Stall pressure: When materials are at recommended application temperature and Metering Pumps are pressurized but not moving. This pressure is normally 100 – 200 psi (7-14 Bar) greater than the developed spray pressure as recommended by the material supplier.

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## **SHUT-DOWN**

### **Short-Term**

Follow the procedure below for temporary shut-downs, such as **lunch breaks**:

1. Set Pump Switch (P, page 12) to OFF position.
2. Turn both “A” and “R” Heaters OFF. Hose Heater should remain ON. Never leave Proportioner ON if unattended.
3. CLOSE Spray Gun Manual Valves.

***CAUTION! Excessive force opening or closing the Manual Valves may result in damage to the Manual Valves and/or Coupling Block.***

### **Long-Term**

Follow the procedure below for shut-downs when work is **stopped for the day**:

1. Set the Pump Switch (P, page 12) to RETRACT.
2. Spray off the application surface until Material Pressure Gauges (E, F, page 11) readings begin to fall.

***CAUTION! To avoid possible Proportioning Pump Seal weepage, and moisture vapor drive into the Heated Hoses, the system pressure should not be reduced to zero. It is recommended to lower the system pressure to a minimum of 400 psi (28 bar).***

3. CLOSE the Spray Gun Coupling Block Manual Valves.

***CAUTION! Excessive force opening or closing the Manual Valves may result in damage to the Manual Valves and/or Coupling Block.***

4. Turn OFF Motor Power (X, page 13).
5. Turn OFF the A and R Heaters and Hose Heater (S, page 12).
6. Turn OFF the Control Power (R, page 12).
7. Turn OFF the Auto Shut Down Switch (V, page 12).
8. Turn OFF the Main Power (N, page 12).
9. Disconnect the air supply to the two Transfer Pumps and CLOSE the Proportioner Material Inlet Valves.

## **TROUBLESHOOTING**

This PH Series Proportioner has been designed and built to withstand severe working conditions with a high degree of reliability, provided that it is used in a suitable application by a properly trained operator. This chapter contains information on possible faults that may interrupt the operation of the PH Series Proportioner. The information provided will serve as a guideline to detect and resolve problems. In any case, feel free to contact your authorized PMC distributor, where a qualified technician will advise you.

***WARNING: Only qualified personnel should perform troubleshooting; unqualified personnel may cause damage to the unit and put the operator at risk.***



***To prevent possible injury caused by incorrect handling of the raw materials and solvents used in the process, carefully read the Material Safety Data Sheet (MSDS) provided by your supplier.***

***Deal with the waste caused according to current regulations.***



***To avoid damage caused by the impact of pressurized fluids, do not open any connection or perform maintenance work on components subject to pressure until the pressure has been completely eliminated.***



***Use suitable protection when operating, maintaining or being present in the area where the equipment is functioning. This includes, but is not limited to, the use of protective goggles, gloves, shoes and safety clothing and breathing equipment.***



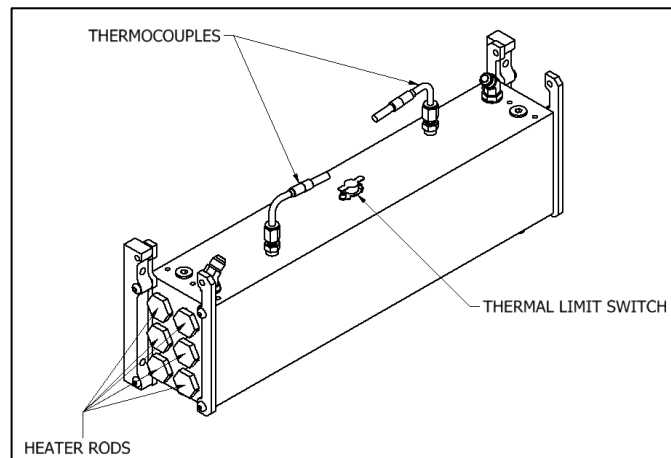
***The equipment includes components that reach high temperatures and can cause burns. Hot parts of the equipment must not be handled or touched until they have cooled completely.***



***To prevent serious injury through crushing or amputation, do not work with the equipment without the safety guards installed on the moving parts. Make sure that all the safety guards are correctly reinstalled at the end of the repair or maintenance work of the equipment.***

## Heaters

***WARNING!*** Only qualified personnel should perform troubleshooting; unqualified personnel may cause damage to the unit, personnel, or property and put the operator at risk. The Heaters are components that reach high temperatures; you must wait until they cool before handling.



***NOTE!*** The Thermal Limit Switch is a safety switch in contact with the Heater Body. If the surface temperature exceeds 220° F (109° C) the Limit Switch will shut off the Heater power. The Limit Switch will not re-set until the temperature in the Heater is below 190°F (88°C). The system is designed that in case of an over temperature, a contactor located in the console will open and disable power to both Heaters and the Hose.

Follow the recommended procedure in the indicated order to solve the problem and avoid unnecessary repairs. Make sure all Switches are in the correct position and Indicator Lights ON before determining the existence of a fault.

## **PROBLEM**

Primary heater does not heat and the display on the controller shows ambient temperature.

## **SOLUTIONS**

1. Check that the light on the on/off switch is lit when the heater is turned on, if not replace the switch.

**If the light is on, move to the next step.**

2. Check the heater breaker in the main console and reset the breaker. If it continues to trip, wrap an Amp Clamp around one of the wires coming off the breaker. If the Amperage reading does not exceed the rating of the breaker, the breaker needs to be replaced. If the breaker draws more than its rating the most likely cause is that one or more of the fire rods located in the heater are shorted.

**If the breaker is not tripped, move on to the next step.**

3. Open the console top and locate the solid state relays for the heaters, looking over the console top from the front of the machine. There are two relays to the left bottom of the console, the one to the far left is for the "A" heater and the one to the right is for the "R" heater. With the heater on, look to see if an LED light is lit on the relay.

**If there is no LED light on the solid state relay, move to the next step.**

4. With a DC volt meter read across position A1 and A2 on the solid state relay (smaller wires) if you have a reading of 4-6 volts DC and the AC reading across L1 and L2 (Heavy wires) reads 208-230 volts AC replace the solid state relay. With 4-6 volts DC at A1 and A2 the proper reading should be 1 volt AC across L1 and L2. A defective over temperature switch will open a contactor disabling both Heaters and the Hose.

**If there is no DC voltage to the relay, move to the next step.**

5. Check the M1 contactor to ensure it is activated. If not, inspect the contactor for failure.

**If the M1 contactor is activated, move to the next step.**

6. Using a DC volt meter measure across position 9 and 10 on the back of the heater controller. This is the output of the controller and sends power to the solid state relay; your reading will be 4-6 volts DC. If there is no reading check to make sure that the set temperature of the controller is above the actual temperature reading on the controller. Before replacing the controller read across position 1 and 2 to make sure that the controller is powered up, your reading will be 208 to 230 volts AC. If there is no voltage detected; check for loose wires or a malfunction of the heater circuit breaker.



### **PROBLEM**

Primary heater does not heat and the display on the controller shows an error message (*SbEr*, *EEPE*, *CjEr*, *AdEr*).

### **SOLUTIONS**

1. Check position 6 and 7 on the heater controller for loose wires.

**If the wires are tight, move to the next step.**

2. Remove the heater cover and check that the thermocouple wires are secure to the harness going up to the controller.

**If there are no loose connections replace the heater thermocouple.**

### **PROBLEM**

Primary heater controller shows excessive temperature and the circuit has turned off.

***CAUTION!* The heater must be allowed to cool down before continuing.**

### **SOLUTIONS**

1. Set the controller set point at least 20 degrees lower than the temperature shown on the controller. Briefly turn on the heater and look for the LED light on the solid state relay to be on.

**If the light is on, replace the controller.**

**If the light is off, replace the solid state relay.**

### **PROBLEM**

Primary heater Temperature drops excessively while spraying.

### **SOLUTIONS**

1. Temperature of the chemical in the containers is too cold.
2. Exceeding the flow rate specification of the machine. Use a smaller mixing chamber to reduce flow.
3. Disconnect power to the machine. One or more of the fire rods in the heater have malfunctioned. Remove the heater cover and disconnect the wires to measure the resistance across each rod. Installing a smaller mixing chamber in the gun may allow you to spray until a new rod(s) is installed.

**CAUTION!** *If the rod that is used in conjunction with the thermocouple is defective, do not operate the heater until the rod is replaced.*

<b>INDIVIDUAL OHMS MEASUREMENT</b>	
<b>1250 WATT</b>	<b>37 OHMS</b>
<b>1500 WATT</b>	<b>31 OHMS</b>
<b>1750 WATT</b>	<b>27 OHMS</b>

## Hydraulic Drive System

Follow the recommended procedure in the indicated order to solve the problem and avoid unnecessary repairs. Make sure all Switches are in the correct position and Indicator Lights ON before determining the existence of a fault.

**WARNING!** Before correcting any kind of defect, make sure the Main Power Switch is OFF and incoming power is locked OFF. NEVER access the inside of the Control Panel with the Proportioner power supply ON. The Hydraulic Unit is a component that works under pressure. Do not open any connection or carry out maintenance on components subject to pressure until all pressure has been bled to zero.

**CAUTION!** Do not attempt to reset the Motor Contactor more than twice. Failure of the Motor Contactor safety mechanism will occur and the Contactor will become inoperable and/or the Motor will be damaged. The cause of the problem must be determined and corrected.

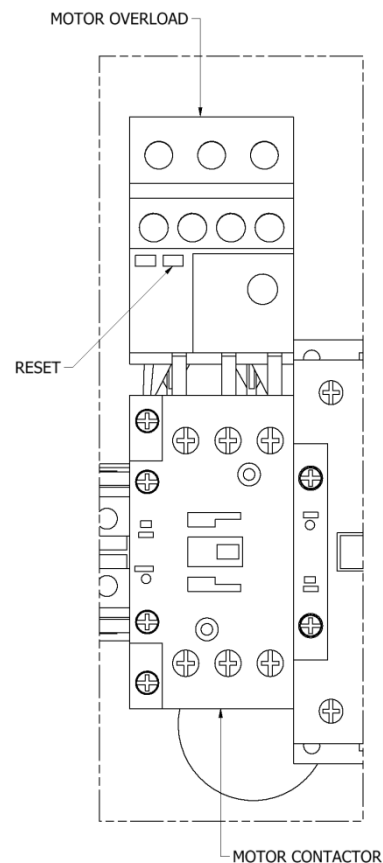
### PROBLEM

Hydraulic Pump does not develop pressure and the electric motor is not running.

### SOLUTIONS

1. Motor Contactor Safety or Motor Breaker

The Electric Motor is protected from excessive current by an Overload Safety Switch. After allowing the Motor to cool, open the Control Panel and reset Motor Contactor Safety.



## **PROBLEM**

Hydraulic Pump does not develop pressure.

## **SOLUTIONS**

### 1. Hydraulic Power Package

**NOTE!** Hydraulic pressure is not generated if the Motor Power Switch (X, page 12) is OFF or the Pump Switch (Y, page 12) is in the OFF position.

With the Pump Switch in the NORMAL position, the failure of the Hydraulic Pump to develop pressure is loss of pump suction (prime). To ensure positive prime, check the following:

- a) Motor rotation (page 15).
- b) Hydraulic Reservoir is filled to the correct level (page14).
- c) Hydraulic Pump Case is filled with the proper hydraulic fluid (page 50).
- d) Loose Inlet Plumbing: Check that all inlet plumbing to Hydraulic Pump is tight ensuring no air leakage into the hydraulic system.

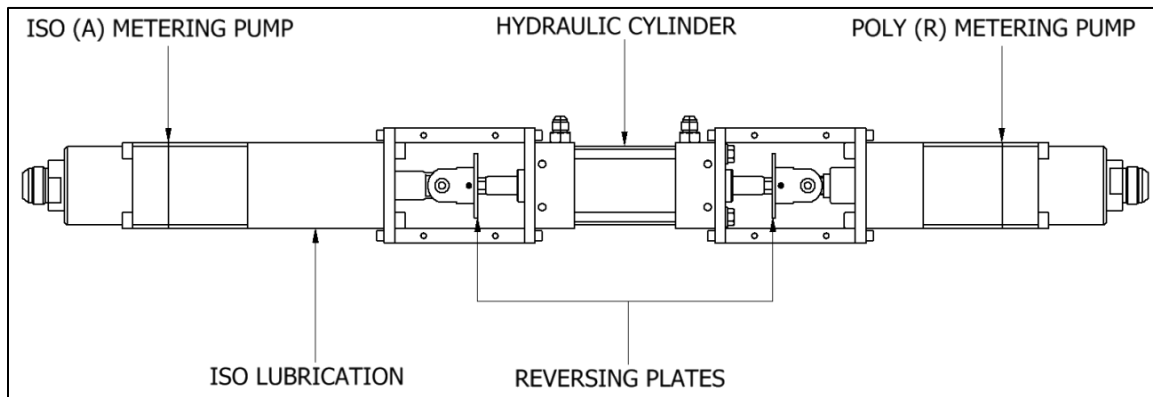
## **PROBLEM**

Low or zero hydraulic pressure with unusual Hydraulic Pump noises.

## **SOLUTIONS**

1. The use of an incorrect hydraulic fluid can result in unusual noises from the pump, excessive wear, and moisture absorption. Ensure the hydraulic oil used is from the list on page 50. In addition, continuous excessive hydraulic oil temperature as well as failure to change the hydraulic oil on a yearly basis will cause the oil to fail and result in excessive Hydraulic Pump wear and unusual noises.
2. Loose Inlet Plumbing: Check that all inlet plumbing to Hydraulic Pump is tight, ensuring no air leakage into the hydraulic system.

## Metering Pump Line



**NOTE:** As seen from front of unit.

**Follow the recommended procedure in the indicated order to solve the problem and avoid unnecessary repairs. Make sure all Switches are in the correct position and Indicator Lights ON before determining the existence of a fault.**

### PROBLEM

Metering pumps do not change direction and the pressures on both of chemical gauges are lower than normal.

### SOLUTIONS

1. The Metering Pump Line has Reversing Plates which actuates two Proximity Switches (EL-153, Page 74), one at each end of the stroke. The Prox Switches in turn actuates the appropriate Directional Valve Solenoid (HI-05003, Page 74). Failure to make contact with either PROX Switch may be caused by:
  - a. Deformation of the Reversing Plate.
  - b. Foreign material preventing the Reversing Plate from contacting the Prox Switches.
2. Passing of the Reversing Plate beyond the Prox Switch may be caused by:
  - a. Failure of the Prox Switch and related components on the side of the over-run.
  - b. Failure of a component of the Directional Valve.
  - c. Mounting Plate (PU-07006, Page 74) and/or Prox Switch is out of adjustment.

***NOTE!*** IF THE DIRECTIONAL INDICATOR LIGHT (P, Q, Page 12) IS ON CHECK THE REVERSING VALVE COIL ON THE SIDE THAT THE LIGHT IS ON. IF YOU HAVE 24 VOLTS DC AT THE PLUG CHECK THE OHM'S RESISTANCE OF THE COIL, IT SHOULD READ APPROXIMATELY 19 OHM's, IF NOT REPLACE THE COIL OR REVERSING VALVE.

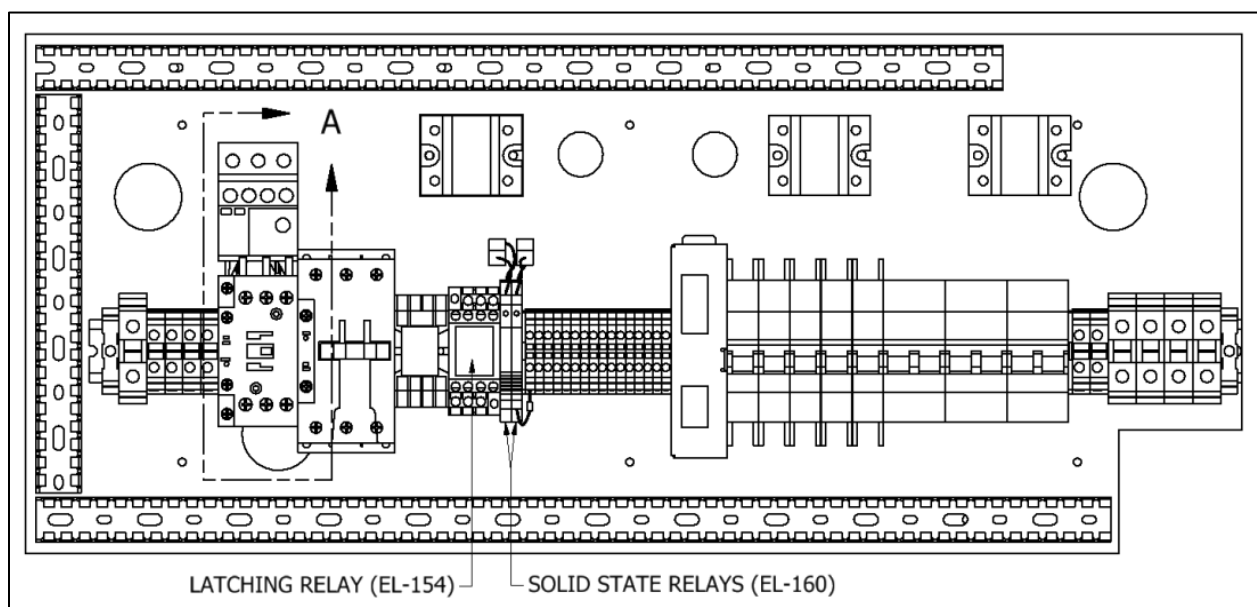
**NOTE!** IF THE DIRECTIONAL LIGHT IS OFF PROCEED BELOW

**NOTE!** BEFORE TROUBLESHOOTING, THE REVERSING PLATE MUST BE MOVED AWAY FROM THE SWITCH.

- d. Bleed down the chemical pressures.
- e. Ensure Pump Switch (X, page 13) is **OFF**.
- f. Turn on the motor (W, page 12).
- g. Go to the Directional Valve and locate the Actuation Coils. Located in the middle of each coil is a small round tab that can be pushed in to manually shift the spool to move the pumps. If the Reversing plate is all the way to the left push in on the right side coil. If it's all the way to the right side, push in on the left side coil.

**WARNING!** THE MOTOR MUST BE OFF AND THE PUMP SWITCH IN THE NORMAL POSITION.

- h. Take a small screw driver or a thin piece of metal and move it across the front of each Prox switch. A red light on the back of the switch should illuminate. If not, replace the switch that does not light.
- i. If the Prox switches light up, turn off all power and check for continuity on both over pressure switches, pin 1 and 2. If the pressure switches are good, go to the two solid state relays inside the console and interchange them, they can be pulled from their housing. Power up the unit with the pump switch in the normal position and the motor **OFF**. If the directional light comes on replace the defective solid state relay. If not replace the Latching relay.



### 3. Safety Pressure Switch

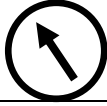




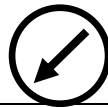




Each Metering Pump has a Safety Pressure Switch set to 2,200 psi. for #123 pumps, 3,200 psi for #61 pumps. When the material system reaches this pressure, the Safety Pressure Switch will remove power from the Directional Valve and Direction Indicator Lights (Q, page 12). Lack of Direction Indicator Lights along with high pressure indicated on one or both of the material Pressure Gauges (E, F, page 11) is an indication of an over-pressure condition. The Safety Pressure Switches are a momentary design; when the pressure bleeds off the Metering Pump Line will resume normal operation. However, the cause of the over-pressure should be determined and corrected. The three most common causes are:

- a) Cavitations of the Metering Pump on the **low** pressure side causing high pressure on the opposite side.
- b) A restriction in the Spray Gun on the **high** pressure side.

### 4. Pressure/Material Imbalance

In summary troubleshooting this problem requires the applicator to:

- a) Know what the NORMAL spray pressures are for the application in progress.
- b) Determine what material is NOT exiting the Mixing Chamber.
- c) Read the Pressure Gauge on the problem side and interpret the reading.

MATERIAL CONDITION	“A” GAUGE	“R” GAUGE
NORMAL		
LACK OF ISO (A)		
LACK OF POLY (R)		
RESTRICTION OF ISO (A)		
RESTRICTION OF POLY (R)		

1. **Cavitations** - Cavitations occur when the Metering Pump (B or C, page 11) requires a larger volume of material than the supply system (Transfer Pump) can furnish. This creates a "void" of material in the Metering Pump. The most common causes of cavitations are:
  - a. Material temperature too low causing increased material viscosity resulting in the inability of the Transfer Pump to maintain sufficient supply to the Metering Pump. This is most common with today's blowing agents. Ensure the material temperature in the drums is no lower than the material suppliers' recommendation.
  - b. Failure to vent the material drum while drawing material out with the Transfer Pump causes a vacuum and cavitations in the Transfer Pump. Ensure the drum is vented to the atmosphere or a Desiccated Air Dyer Kit is installed as recommended by the material supplier.
  - c. Insufficient air volume for Transfer Pump or a partially closed Transfer Pump Air Valve will limit the ability of the Transfer Pump to operate at its maximum capability.
  - d. Inlet Material Screen (M, page 11) obstructed (See MAINTENANCE section, page 44).
  - e. Metering Pump Inlet Ball does not seat properly allowing material to flow back into the Material Delivery Hose when the Metering Pump is on the "Discharge" stroke. This causes the volume of material on that Metering Pump to be less on the discharge stroke resulting in intermittent off-ratio material and Pressure Gauge fluctuation.
  
5. **Pressure Loss: Discharge/Inlet Ball** - Simultaneous observation of the material Pressure Gauge (E, F, page 11) and Direction Indicator Light (Q, page 12) is necessary to determine which direction the Metering Pump fails to maintain pressure. Refer to the chart to determine problem:

	← Directional Indicator Light ON	→ Directional Indicator Light ON
Iso Pressure Gauge FALLS	Iso Inlet Ball does not seat properly	Iso Discharge Ball does not seat properly
Poly Pressure Gauge FALLS	Poly Discharge Ball does not seat properly	Poly Inlet Ball does not seat properly

In most cases the cause of a leaking Inlet/Discharge Ball is foreign material preventing the Ball from seating properly. If the above steps do not resolve the problem, replace the appropriate Ball, Ball Seat.

**For service see [MAINTENANCE/Metering Pump Line](#), page 47.**



## Hose Heating

***WARNING!*** Before correcting any kind of defect, make sure the Main Power Switch is OFF and incoming power is locked OFF. NEVER access the inside of the Control Panel with the Proportioner power supply ON. The Heated Hose are components which reach high temperatures; you must wait until they have cooled before handling.

***CAUTION!*** All electrical testing must be done by a qualified electrician.

Follow the recommended procedure in the indicated order to solve the problem and avoid unnecessary repairs. Make sure all Switches are in the correct position and Indicator Lights ON before determining the existence of a fault.

### PROBLEM

Heated Hose does not heat and the display on the controller shows ambient temperature.

### SOLUTIONS

1. Check that the light on the on/off switch is lit when the heater is turned on, if not replace the switch.

**If the light is on, move on to the next step.**

2. Check the Hose Heat breaker in the main console and reset the breaker. If it continues to trip, wrap an Amp Clamp around one of the wires coming off the breaker. If it does not draw more than the rated value of the breaker, the breaker needs to be replaced.

**If the breaker is not tripped, move on to the next step.**

3. Check the circuit breaker mounted on the transformer and reset the breaker. If it continues to trip, wrap an Amp Clamp around one of the wires from the transformer going to the heated hose. If it does not draw more than the rated value of the breaker, the breaker needs to be replaced.

**If the Amp Draw is less than the rated value, move on to the next step.**

4. Check that the tap setting on the transformer is set for the proper hose length.

**If it is set correctly, move to the next step.**

5. To check the secondary side of the transformer, you must take an AC volt reading across the two leads coming out of the transformer that are connected to the "A" and

“R” hose leads. If you are reading voltage (your volt reading will vary depending on what tap setting is used), most likely the problem is in the heated hose. Either a connector has come loose or there is a broken wire.

6. Because the gun whip takes the most abuse, it is most likely the whip that has failed. Disconnect the crossover wires on the machine end of the whip hose and connect the two wires together coming off the 50' section. Turn on the hose heat and see if the hose heat circuit is operating; if so replace the whip. To take a continuity reading through the heated hose, one of the leads from the transformer to the “A” or “R” heated hose must be disconnected.

**If no voltage is coming out of the transformer to the heated hose, move on to the next step.**

7. Open the right side of the tank (where the transformer is located) and locate the solid state relay for the hose circuit (EL-35, Page 74). With the hose turned on and the LED light illuminated on the relay, take a volt meter (set on DC) and measure across position A1 and A2; your reading should be 24 volts. Then take an AC volts measurement across position L1 and L2 (heavy wires). With the relay functioning properly you should have a 1 volt Reading. If the Reading is 18 to 90 volts AC, the relay has malfunctioned and needs to be replaced. If the AC Reading across L1 and L2 is .025 volts check the over temperature switches in the heaters. A defective over temperature switch will open a contactor disabling both Heaters and the Hose.

**If there is no light on the solid state relay, move to the next step.**

8. Using a DC volt meter, measure across position 5 and 6 on the back of the hose controller. This is the output of the controller and sends power to the solid state relay. Your reading will be **4-6 volts DC**. If there is no voltage, check to make sure that the set temperature of the controller is above ambient temperature. Before replacing the controller, read across position 1 and 2 to make sure that the controller is powered up; your reading will be 208 to 230 volts AC.

**If there is no DC voltage to the relay, move to the next step.**

### **PROBLEM**

Hose does not heat and the display on the controller shows an error message (EEEE).

### **SOLUTIONS**

1. Check position 6 and 7 on the heater controller for loose wires.

**If the wires are tight, move to the next step.**

2. Remove the transformer cover and check that the thermocouple wires are secure to the harness going up to the controller. If there are no loose connections, disconnect the wire from the TSU and connect it directly to the thermocouple harness coming out of the hose transformer.

If the controller still shows the error code, replace the hose thermocouple. If the error code goes away and temperature is now shown on the display of the controller, then all the TSU harnesses from the TSU to the transformer need to be checked for loose connectors or one or more of the harnesses are defective.

#### **PROBLEM**

---

Heated hose controller shows excessive temperature

#### **SOLUTIONS**

1. Set the controller set point at least 20 degrees lower than the temperature shown on the controller. Briefly turn on the hose and look for the led light on the solid state relay to be on.

**If the light is on, replace the controller.**

**If the light is off, replace the solid state relay.**

#### **PROBLEM**

---

Hose will heat but does not come up to set temperature.

#### **SOLUTIONS**

1. Check the tap setting on the transformer to ensure that the correct position has been selected for the length of hose being used. Depending on the machines incoming voltage, you may have to move the tap setting higher (up one).

***CAUTION!*** Do not exceed the trip value of the transformer hose breaker.

***WARNING!*** Before correcting any kind of defect, make sure the Main Power Switch is OFF and incoming power is locked OFF. NEVER access the inside of the Control Panel with the Proportioner power supply ON.

#### **PROBLEM**

---

Hose does not heat and the display on the controller shows an error message.

#### **SOLUTIONS**

1. Check position 9 and 10 on the heater controller for loose wires.

**If the wires are tight, move to the next step.**

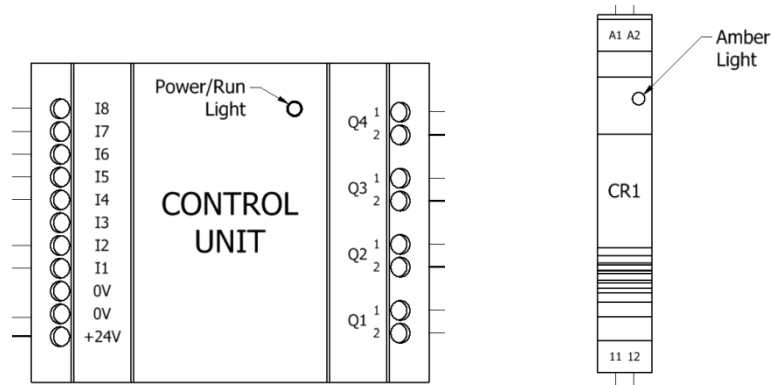
2. Remove the transformer cover and check that the thermocouple wires are secure to the harness going up to the controller. If there are no loose connections disconnect the wire from the TSU and connect it directly to the thermocouple harness coming out of the hose transformer.

**If the controller still shows the error code, replace the hose thermocouple.**

**If the error code goes away and temperature is now shown on the display of the controller, then all the TSU harnesses from the TSU to the transformer need to be checked for loose connectors or one or more of the harnesses are defective.**

## Pressure Balance Control

If the Pressure Balance Control box is not working properly, follow these steps to resolve the potential issue:



1. With the Main Power **ON**, check the Power/Run light on the Control Unit:
  - a. If **OFF**, the Control Unit is not getting power. Check for loose or poor wire connections. If the Power/Run light still does not turn on, contact your authorized PMC distributor.
  - b. If **SOLID**, the Control Unit has power but no program. Contact your authorized PMC distributor.
  - c. If **BLINKING**, the Control Unit has power and is programmed properly. Proceed to the next step.
2. With Main Power **ON**, turn the Rotary Switch to a Pressure Differential Number and check the Amber light on CR1:
  - a. If **OFF**, CR1 is not activating properly. Check for loose or poor wire connections between the Control Unit and CR1.
  - b. If **ON**, CR1 is activating, but the mechanical switch inside the relay may not be functioning properly. If the system has faulted (i.e. a pressure imbalance exists, the ON light turns off, and the FAULT light turns on), but the pumps do not shut off, check for continuity between contacts 11 and 12 on CR1. If there is continuity, contact your authorized PMC distributor. If there is discontinuity, proceed to the next step.
3. With Main Power **OFF**:
  - a. Check all remaining wires to ensure secure and proper connections.
  - b. Check for continuity across the ON light terminals and the FAULT light terminals. These light units are LEDs (light emitting diodes) which means that only one direction has continuity (similar to a check valve). When checking for continuity, make sure to use the correct terminals on the multimeter.
4. Contact your authorized PMC distributor for further assistance.

## **MAINTENANCE**

To achieve maximum output from the PH Series Proportioner, a daily or regular maintenance schedule is required.



*To prevent possible injury caused by incorrect handling of the raw materials and solvents used in the process, carefully read the Material Safety Data Sheet (MSDS) provided by your supplier.*

*Deal with the waste caused according to current regulations.*



*Disconnect the unit from the power supply before carrying out any operation inside the electrical console.*

*The electrical maintenance of the machine must only be performed by a qualified electrician.*



*To avoid damage caused by the impact of pressurized fluids, do not open any connection or perform maintenance work on components subject to pressure until the pressure has been completely eliminated.*



*Use suitable protection when operating, maintaining or being present in the area where the equipment is functioning. This includes, but is not limited to, the use of protective goggles, gloves, shoes and safety clothing and breathing equipment.*



*The equipment includes components that reach high temperatures and can cause burns. Hot parts of the equipment must not be handled or touched until they have cooled completely.*



*To prevent serious injury through crushing or amputation, do not work with the equipment without the safety guards installed on the moving parts. Make sure that all the safety guards are correctly reinstalled at the end of the repair or maintenance work of the equipment.*

**CAUTION!** *All repairs performed by unqualified personnel or the use of parts other than supplied by PMC may cause damage to the unit and put the operator at risk.*

## **Inlet Material Screens**

Inspection of the Inlet Material Screens on a daily basis is no longer necessary as long as the following conditions are met.

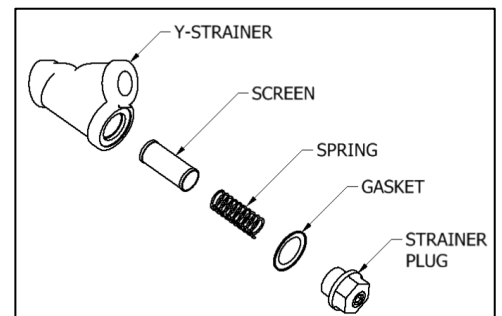
1. Material drums are stored within the recommended material storage temperature range and drums are not opened prior to installing the Proportioner Material Transfer Pumps.
2. Desiccant air dryers are used to dry replacement air as material is removed from the drums to the Proportioner.
3. Consolidation of old material into a common drum for use is minimized, especially the Iso (A).

If the above conditions are met, inspection of the Inlet Material Screens may be done on a **bi-weekly** basis.

**NOTE!** *Inspect and clean Inlet Material Screens before Proportioner start-up. They should not be cleaned after the days' operation as the Proportioner should be purged (see page 20) immediately after inspection and cleaning. This is to reduce the risk of moisture contamination, contamination through the reaction with the solvent used in the cleaning operation, and cross-over at the Spray Gun due to air entrapment.*

**CAUTION!** *Make sure the Main Power Switch is OFF and incoming power is locked OFF.*

1. CLOSE the Poly (R) Proportioner Inlet Valve.
2. Place a suitable container under the Material Inlet Strainer to collect the residual material. Carefully loosen the Strainer Plug to drain material into the container.
3. Completely unscrew the Strainer Plug.
4. Remove the Seal, Spring and Screen and clean them with a suitable solvent. Dry the parts and ensure the Screen is not obstructed. Replace the Screen if more than 20% of the Screen surface is obstructed by residue.
5. Reinstall the Screen, Spring and Seal. Screw on the Strainer Screw and screw in Plug.
6. OPEN the Poly (R) Proportioner Inlet Valve, pressurize the Material Transfer Pump, check for leaks and wipe Y-strainer clean.
7. Repeat above for the Iso (A) side.
8. Proceed with Proportioner Purging operation (page 20).

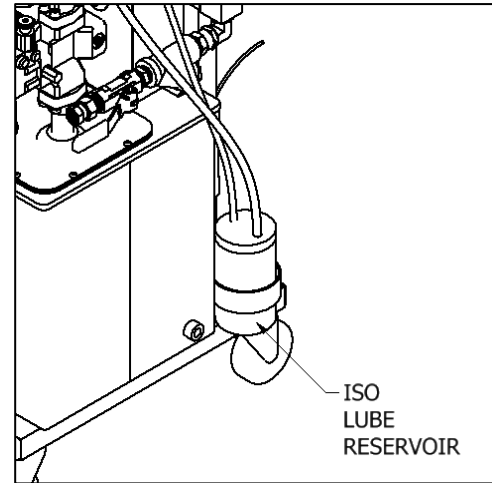


## **ISO LUBRICATION SYSTEM**

**Daily:** Check the condition of the PMC Lube Oil in the Iso Lube Reservoir. Replace the PMC Lube Oil if you see significant changes in the color or signs of solidification. Ensure inside of Reservoir is wiped clean.

To replace the Lube Oil, proceed as follows:

1. Remove the Lube Reservoir from its support, unscrew the Lid and remove the Check Valve from the Suction Hose.
2. Empty the contaminated Lube Oil in a waste container and refit the Check Valve in the Suction Hose.



***NOTE!*** Valve is directional.

3. Clean the Reservoir, refill with Lube Oil, and screw on the Lid and place the Reservoir in its support.

**The system is auto-suction and does not need priming.**



## Hydraulic Drive System

***WARNING!*** Before performing any maintenance, make sure the Main Power Switch is OFF and incoming power is locked OFF. The Hydraulic Unit is a component that works under pressure. Do not open any connection or carry out maintenance on components subject to pressure until all pressure has been bled to zero.

The hydraulic unit should be serviced **yearly**:

1. Completely drain the Tank of hydraulic fluid.
2. Clean the Tank Top to prevent foreign material from falling into the Tank when the Cover is removed.
3. Unscrew the Suction Pipe from its connection with the Hydraulic Pump.
4. Remove the Cover and Suction Pipe from the Hydraulic Tank. Take care not to damage Tank Cover Gasket.
5. Inspect the bottom of the Tank for sediment and clean as required. Clean the Suction Pipe and its connections
6. Fill the Tank with 10 gal (37 L) of approved hydraulic fluid. See page 50 for recommendations.
7. Insert the Suction Pipe into the Tank Cover and install the Cover. Again, take care not to damage Tank Cover Gasket. Connect the Suction Pipe securely to the Hydraulic Pump.
8. Ensure the Hydraulic Pump Case is full of fluid and proceed with the normal operation.

### Metering Pump Line

***WARNING!*** Before performing any maintenance, make sure the Main Power Switch is OFF and incoming power is locked OFF. Allow material temperature to cool below 80°F and bleed all material pressure to zero.



**Weekly:** When the Proportioning Pumps are functioning properly it is not unusual for a small amount of Poly (R) material to appear on the Pump Shaft. This material should be wiped away so dirt does not accumulate on the Pump Shaft and the Pump Shaft Packings are not damaged.



**Yearly or as required:** It is not unusual for those who use the PH Series Proportioner on a regular basis to rebuild the Proportioning Pumps on a yearly basis and service the Hydraulic Drive System (page 44) at the same time, while the Proportioner is out of service.

### Pump Seal Replacement

Refer to Parts Identification (Pages 60-82) reference.

#### ***NOTE:***

- *When Iso (A) Proportioning Pump Cylinder is disassembled for service, all parts included in the Seal Kit (KT-PAX or KT-PA) should be replaced.*
- *When the Poly (R) Proportioning Pump Cylinder is disassembled for service, all parts included in the Seal Kit (KT-PAX or KT-PA) should be replaced.*
- *When assembling Proportioning Pump, lubricate all Seals, Piston Rod, and Pump Cylinder with #1 Lithium Grease to assist in assembly and minimize Seal damage during re-assembly.*

***CAUTION!*** Use wooden or plastic tools or a brass brush for cleaning. Do not use metal or abrasive tools that can scratch the contact surfaces.

## Material Heater

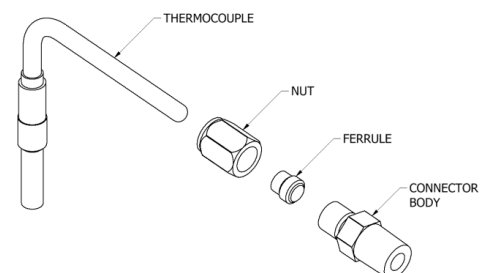
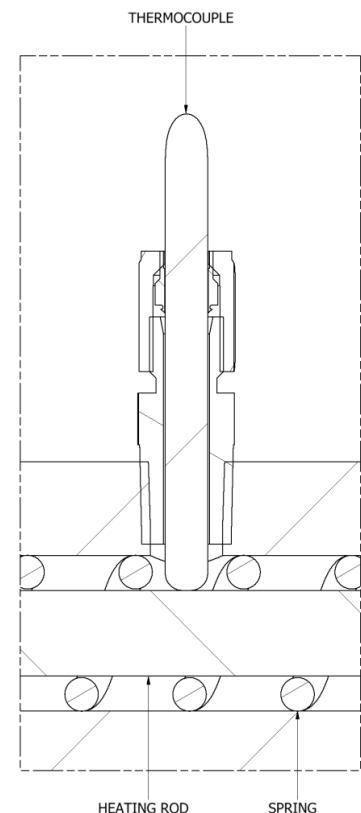
***WARNING!*** Before performing any maintenance, make sure the Main Power Switch is OFF and incoming power is locked OFF. NEVER access the inside of the Control Panel with the Proportioner power supply ON. The Heaters are components that reach high temperatures; you must wait until they have cooled before handling and bleed all material pressure to zero.



### Thermocouple Replacement

***NOTE!*** The Thermocouple is assembled into the Connector Body with a Ferrule and Nut. Once inserted into the Body and the Nut is tightened, the Ferrule locks to the Thermocouple and does not allow it to be relocated or moved. The location of the Thermocouple is very important and must be done correctly before tightening the Nut.

1. Unscrew the Nut that holds the defective Thermocouple and remove from the Body. Disconnect Thermocouple wiring located under the Top Cover of the Heater. Remove Body and discard.
2. Install Heating Element and Spring if also removed.
3. Install Connector Body into Heater using an open-end wrench and tighten to prevent leakage. Teflon Tape or appropriate Thread Sealant should be used.
4. Slide the Nut and the Ferrule over the Thermocouple and insert this assembly into the Connector Body until it comes into **positive physical contact** with the Heating Rod. Make sure the Spring does not prevent the Thermocouple from making contact with the Heating Rod.
5. Slowly tighten the Nut using an open-end wrench, ensuring the Thermocouple maintains positive physical contact with the Heating Rod.
6. Reinstall the Thermocouple wires.



***WARNING!*** Before performing any maintenance, make sure the Main Power Switch is OFF and incoming power is locked OFF. NEVER access the inside of the Control Panel with the Proportioner power supply ON. The Heaters are components that reach high temperatures; you must wait until they have cooled before handling and bleed all material pressure to zero.

To replace a defect Heating Rod, proceed as follows:

1. Ensure Main Power Switch is OFF and incoming power is locked OFF. Depressurize proportioner and remove the Cover on Heater.

***WARNING!*** If the Heating Rod to be replaced is the one in contact with the Thermocouple, it is necessary to remove the Thermocouple first (see page 48). Do not loosen or tighten Thermocouple Body.

2. Disconnect the suspect Heating Rod from the wire connections and test the Heating Rod again for proper electrical resistance.

HEATING ROD	INDIVIDUAL OHMS MEASUREMENT	TOTAL OHMS MEASUREMENT PER FLUID SIDE
1250 WATT	39.0 Ω	13.0 Ω
1500 WATT	32.4 Ω	10.8 Ω
1750 WATT	27.5 Ω	9.2 Ω

3. Unscrew the Heating Rod and remove from the Heater Block along with its Spring and inspect; it must be smooth and shiny in appearance. If it is blackened or has material adhered to it replace the Heating Rod, even if ohm reading is acceptable.
4. Apply Teflon Tape or appropriate Thread Sealant to the Heating Rod thread and assemble Heating Rod and Spring into the Heater Block. Tighten securely to 110 ft/lbs (150 Nm)
5. If necessary carefully re-install Thermocouple ensuring **positive physical contact** with the Heating Rod. Make sure the Spring does not prevent the Thermocouple from making contact with the Heating Rod. Tighten Nut with open-end wrench.
6. Reconnect wire connections and replace Cover.
7. Ensure Heater is full of material prior to electrical testing.

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## **HYDRAULIC OIL SPECIFICATIONS**

Recommended Hydraulic Oil Specification:

ISO/ASTM Viscosity Grade 32

Viscosity: 28.8 – 35.2 SSU@ 104° F

Rust and Oxidation Inhibited

### **Manufacturers:**

- Mobil DTE24 (Recommended)
- Cook's Albavis 8
- Ashland-Valvoline AW15
- Shell – Tellus 32(25)
- Sun Oil- Sunvis 706
- Chevron ISO32
- American Oil & Supply – PQ Iso 32
- Gulf Oil – Harmony 32AW (43AW)
- Atlantic Richfield – Duro AWS-150
- BP Oil – Energol HLP-C32
- Exxon – Nuto H-32(44)
- Margolis – T.I.P.100-15-7
- Fiske Bros. – Lubriplate Hyd. #0
- SW – Alemite Hydraulic HD#0
- Texaco – Rando HD32 (HD A0)
- White & Bagley – EP Hyd. 150

## REPLACEMENT KITS

### **HYDRAULIC CYLINDER REBUILD KIT (KT-05200)**

<b>Part Number</b>	<b>Description</b>	<b>QTY</b>
HI-05025-1	U-Cup	2
HI-05025-2	Back-up Ring, Piston	2
HI-05025-3	Wear Ring	1
HI-05025-4	Rod Wiper	2
HI-05025-5	Shaft Seal	2
HI-05025-6	Back-up Ring, Bushing	2
OR-00039A	O-ring	2
OR-00040A	O-ring	2

### **HEATER THERMOCOUPLE KIT (KT-05021)**

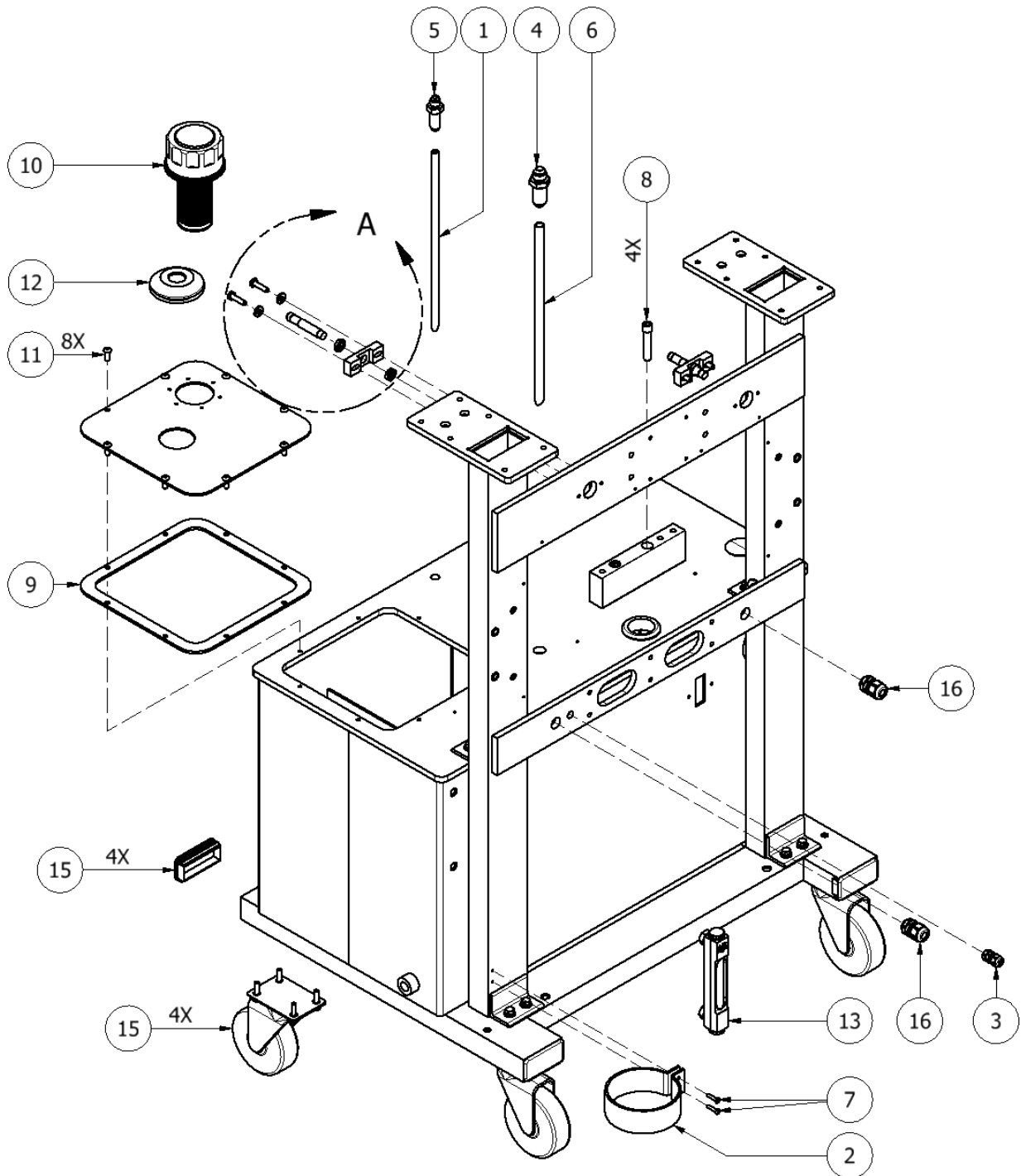
<b>Part Number</b>	<b>Description</b>	<b>QTY</b>
HI-05020	Body, Nut, Ferrule	1
HI-05021	Thermocouple	1

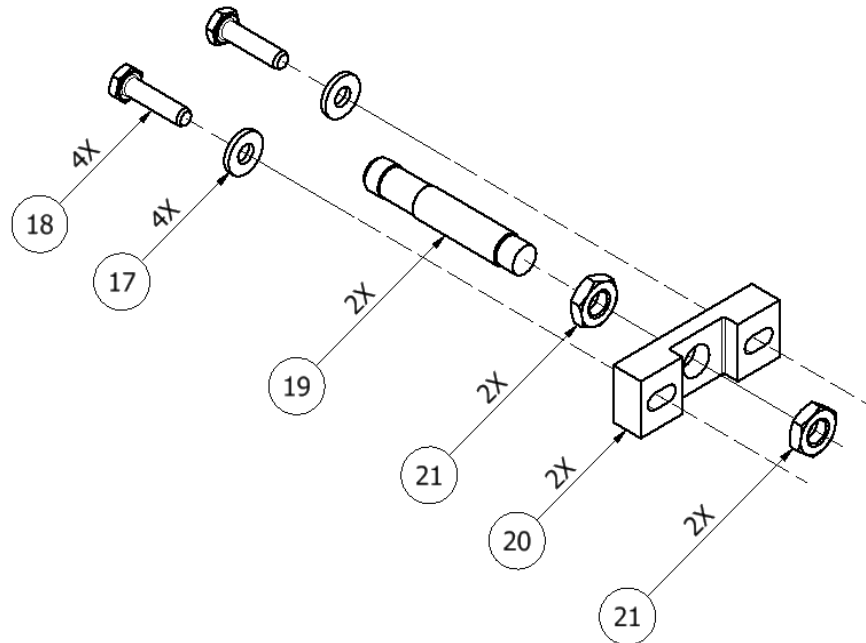
### **PUMP REBUILD KITS**

<b>Part Number</b>	<b>Description</b>	<b>QTY</b>
KT-PAX	PHX pump rebuild kit (3000 psi) See page 61	1
KT-PA	PH pump rebuild kit (2000 psi) See page 60	1

# PARTS IDENTIFICATION

## FRAME ASSEMBLY

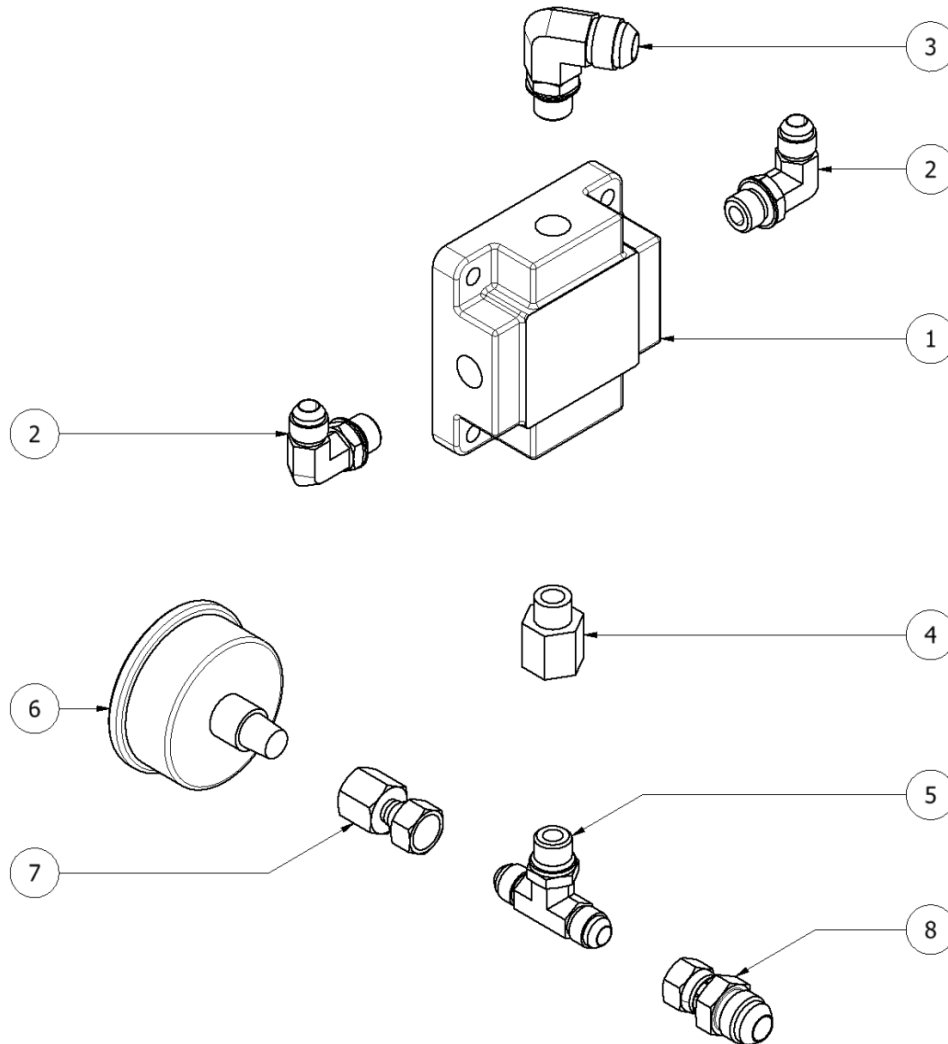




<b>FRAME ASSEMBLY</b>			
<b>FR-10</b>			
<b>ITEM</b>	<b>QTY</b>	<b>PART NUMBER</b>	<b>DESCRIPTION</b>
1	1	HI-05306	TANK PUMP DRAIN TUBE
2	1	MQ-01008A	LUBE BOTTLE BRACKET
3	1	EL-000P7	HAYCO SR
4	1	HI-05319	1/2 JIC BULKHEAD UNION
5	1	HI-05317	3/8 JIC BULKHEAD UNION
6	1	HI-05308	TANK DISCHARGE TUBE
7	2	FLOOR STOCK	#8-32 X 3/4 HEX SOCKET BUTTON HEAD CAP SCREW
8	4	FLOOR STOCK	3/8-16 X 2 HEX SHCS
9	1	HI-00014-03A	TANK TOP GASKET
10	1	HI-00047A	HYDRAULIC FILL STRAINER
11	8	FLOOR STOCK	1/4-20 X 3/4 HEX SOCKET BUTTON HEAD CAP SCREW
12	1	HI-00002-A-1	GROMMET MODIFIED 1"
13	1	HI-00001A	SIGHT GUAGE
14	1	FR-9	FRAME ASSY, PH(X)-2
15	4	HI-001	PLASTIC TUBE CAPS
16	2	EL-000P12	HAYCO #6
17	4	FLOOR STOCK	1/4 WASHER
18	4	FLOOR STOCK	1/4-20 X 1 HEX CAP SCREW
19	2	EL-153	12MM PROX SWITCH
20	2	PU-07006	PROXIMITY MOUNT
21	4	FLOOR STOCK	M10 X 1.5 HEX JAM NUT

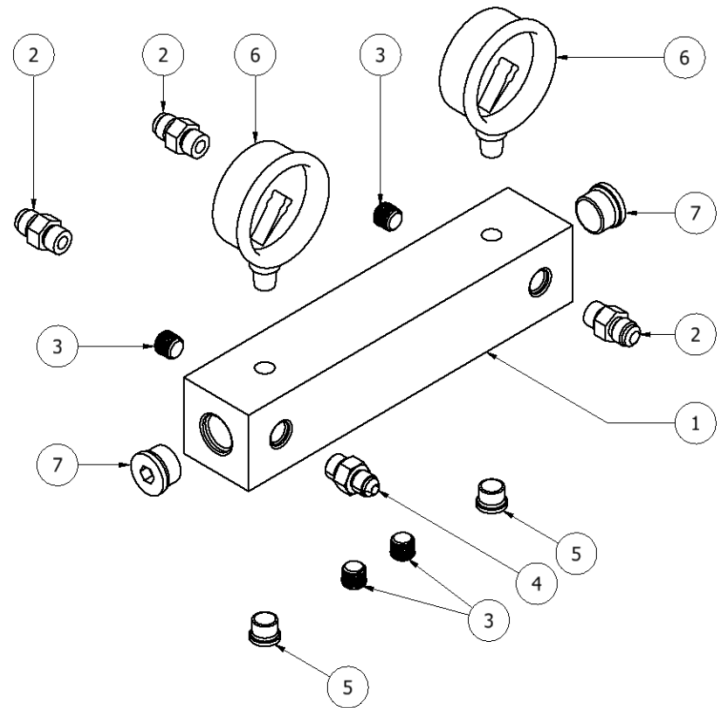
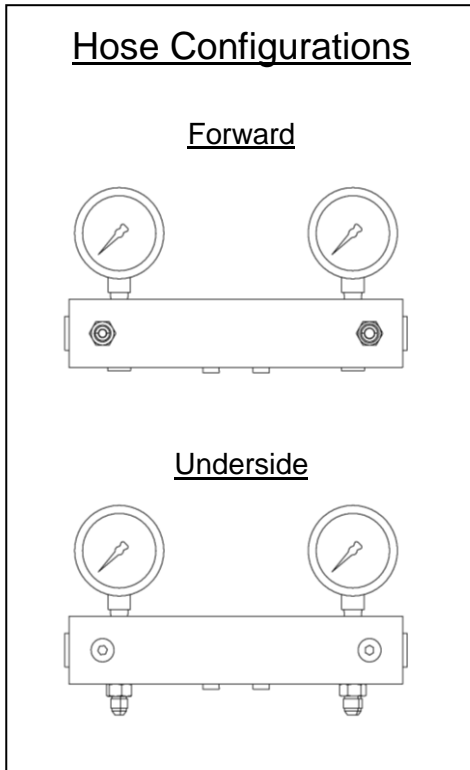


## HYDRAULIC MANIFOLD ASSEMBLY



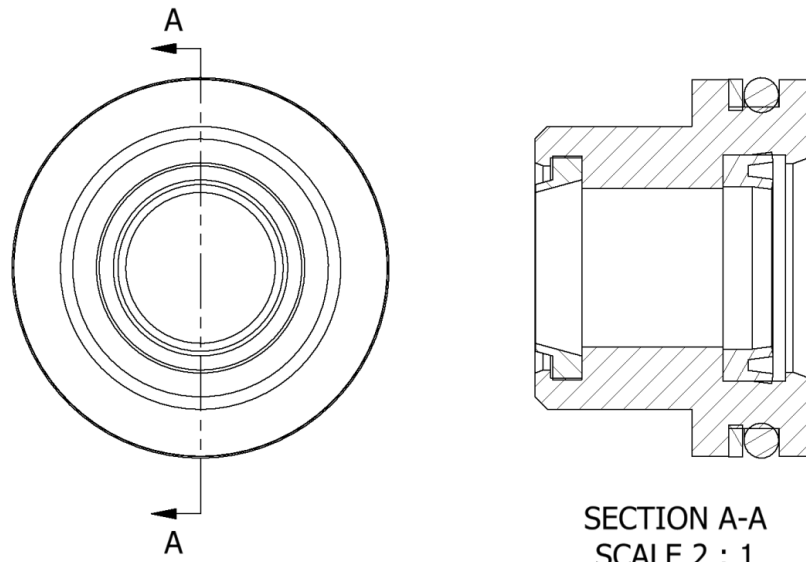
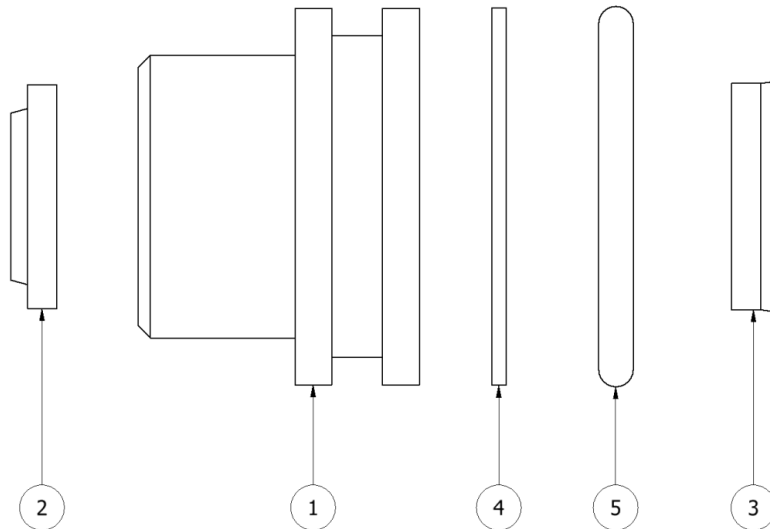
<b>HYDRAULIC MANIFOLD ASSEMBLY</b>			
<b>HI-05335</b>			
<b>ITEM</b>	<b>QTY</b>	<b>PART NUMBER</b>	<b>DESCRIPTION</b>
1	1	HI-05070-3	HYDRAULIC MANIFOLD
2	2	HI-05007	6 ORB X 6 JIC
3	1	HI-05324	6 ORB X 1/2 JIC; 90 DEG
4	1	HI-05348	6 ORB EXTENTION
5	1	HI-05350	6 JIC 6 ORB "T"
6	1	HI-05040	PRESSURE GAUGE 0-2000 PSI
7	1	HI-05006-6	1/4 NPT X 6 JIC GAUGE FITTING
8	1	HI-05349	6 JIC X 8 JIC

**EXIT MANIFOLD ASSEMBLY**



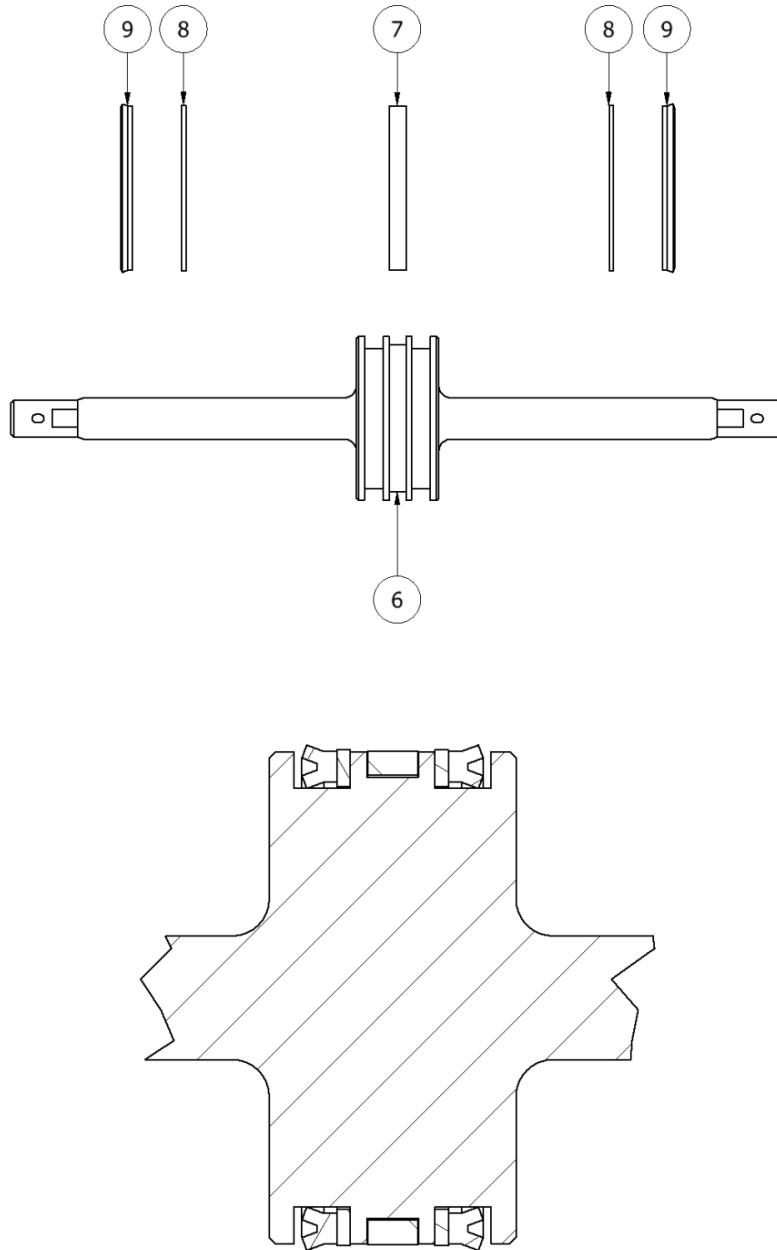
<b>EXIT MANIFOLD ASSEMBLY</b>			
<b>HI-05331 – LOW PRESSURE</b>			
<b>HI-05343 – HIGH PRESSURE</b>			
<b>ITEM</b>	<b>QTY</b>	<b>PART NUMBER</b>	<b>DESCRIPTION</b>
1	1	HI-05307	OUTLET MANIFOLD
2	3	HI-05011	6 ORB X 6 JIC N
3	4	HI-05036	1/4 NPT FLUSH SEAL PIPE PLUG
4	1	HI-05329	6 ORB X 5 JIC
5	2	HI-05070-4	HEX SOCKET O-RING BOSS
6	2	HI-05028	PRESSURE GAUGE 0-3000 PSI (HI-05331)
	2	HI-00035	PRESSURE GAUGE 0-5000 PSI (HI-05343)
7	2	HI-05323	10 ORB PLUG

**HYDRAULIC SEAL ASSEMBLY**



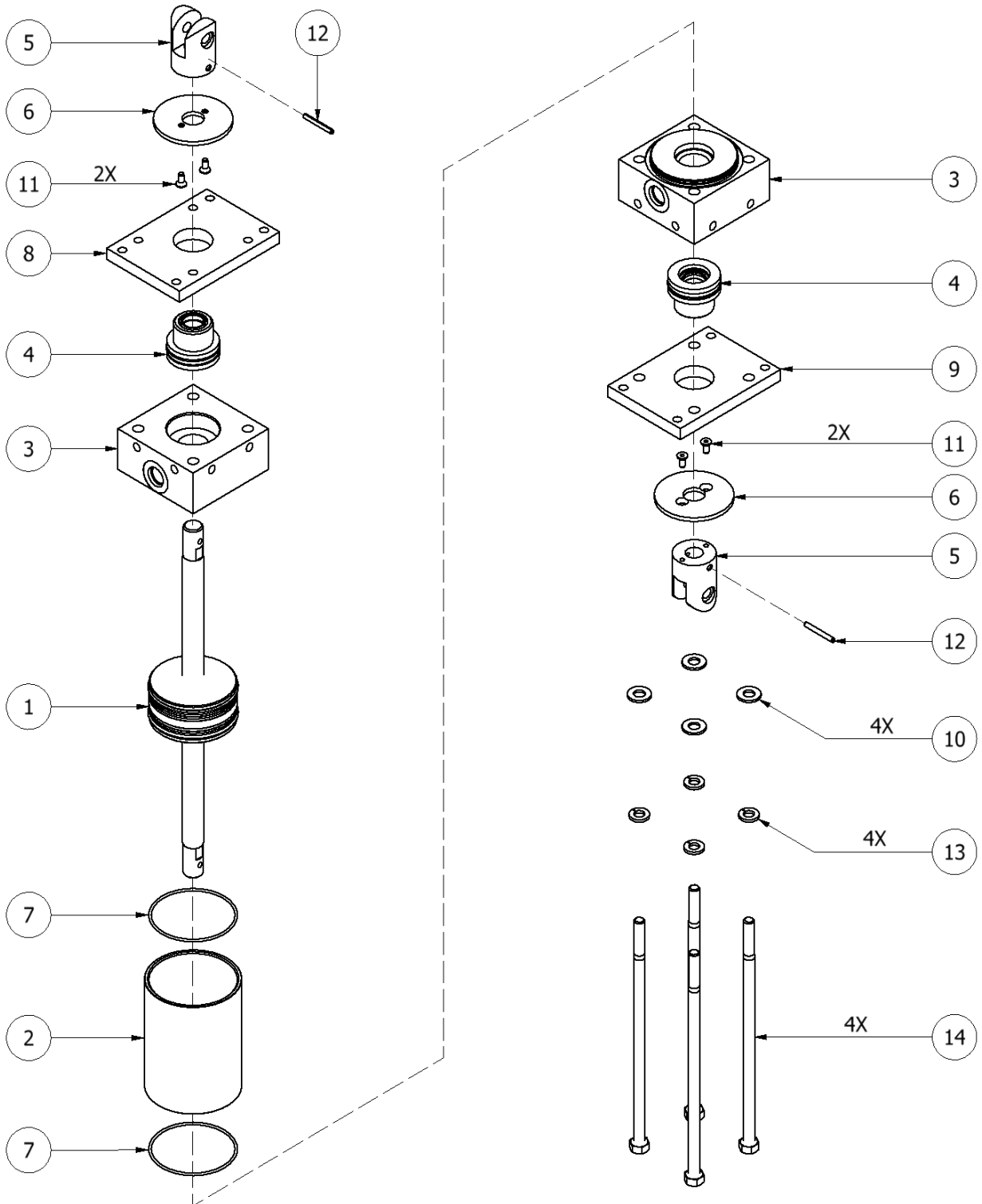
<b>HYDRAULIC SEAL ASSEMBLY</b>			
<b>ITEM</b>	<b>QTY</b>	<b>PART NUMBER</b>	<b>DESCRIPTION</b>
1	1	HI-05025-13	BUSHING; ROD
2	1	HI-05025-4	ROD WIPER
3	1	HI-05025-5	SHAFT SEAL
4	1	HI-05025-6	BACK-UP RING; BUSHING
5	1	OR-00039A	O-RING #218 HYD CYLINDER ROD

**HYDRAULIC PISTON ASSEMBLY**



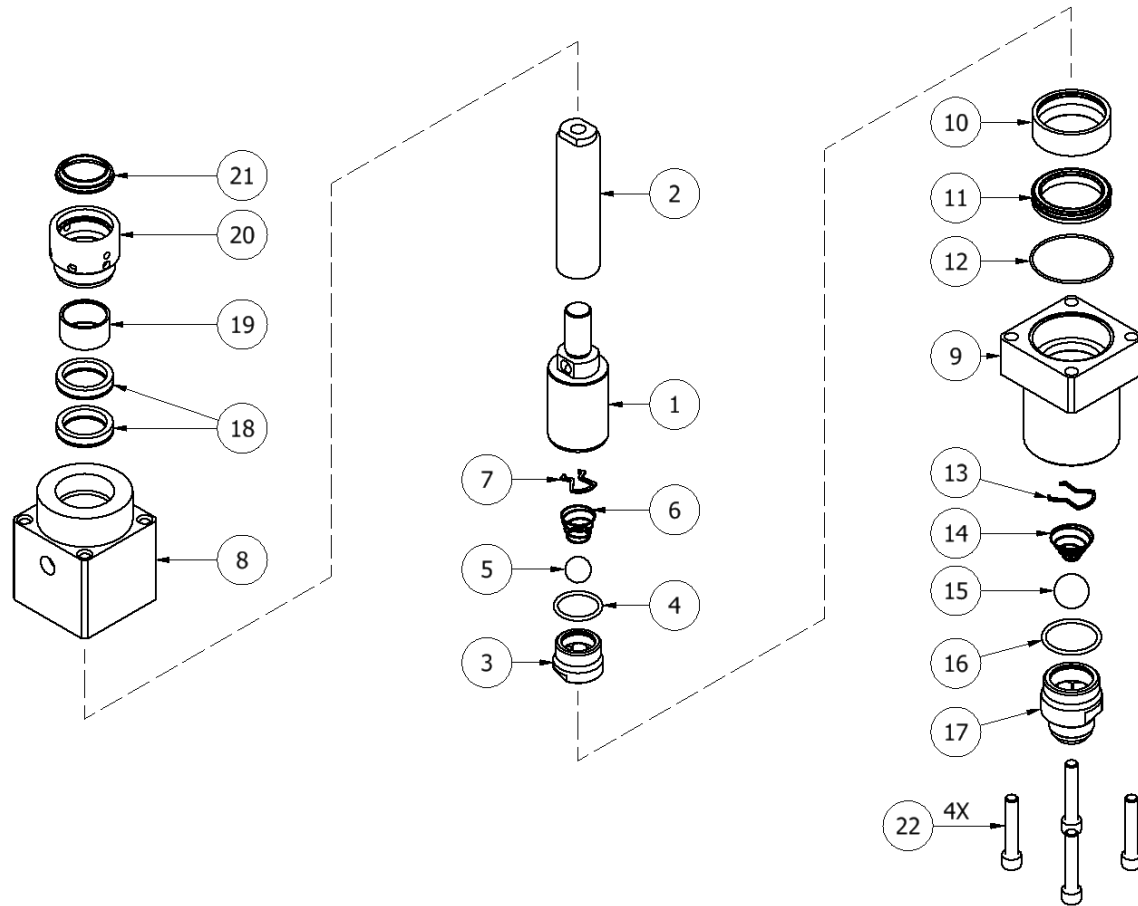
<b>HYDRAULIC PISTON ASSEMBLY</b>			
<b>ITEM</b>	<b>QTY</b>	<b>PART NUMBER</b>	<b>DESCRIPTION</b>
6	1	HI-05300	HYDRAULIC PISTON
7	1	HI-05025-3	WEAR RING
8	2	HI-05025-2	BACK UP RING; PISTON
9	2	HI-05025-1	U CUP

**HYDRAULIC CYLINDER ASSEMBLY**



<b>HYDRAULIC CYLINDER ASSEMBLY</b>			
<b>HI-05336</b>			
<b>ITEM</b>	<b>QTY</b>	<b>PART NUMBER</b>	<b>DESCRIPTION</b>
1	1	-	HYDRAULIC PISTON ASSEMBLY (SEE PAGE 57)
2	1	HI-05301	HYDRAULIC CYLINDER
3	2	HI-05200-3	PORT BLOCK; HYDRAULIC
4	2	-	HYDRAULIC SEAL ASSEMBLY (SEE PAGE 56)
5	2	HI-05302	FEMALE CLEVIS
6	2	HI-05303	SWITCH PLATE
7	2	OR-00040A	O-RING #036 HYD CYLINDER
8	1	HI-05332	FLANGE RTAINER, "A" SIDE
9	1	HI-05333	FLANGE RETAINER, "R" SIDE
10	4	FLOOR STOCK	5/16 WASHER
11	4	FLOOR STOCK	#8-32 X 3/8 FLAT COUNTERSUNK SHCS
12	2	FLOOR STOCK	SPRING PIN; SLOTTED 1/8" DIA
13	4	HI-05337	5/16 LOCK WASHER
14	4	FLOOR STOCK	5/16-18 X 7 HEX BOLT

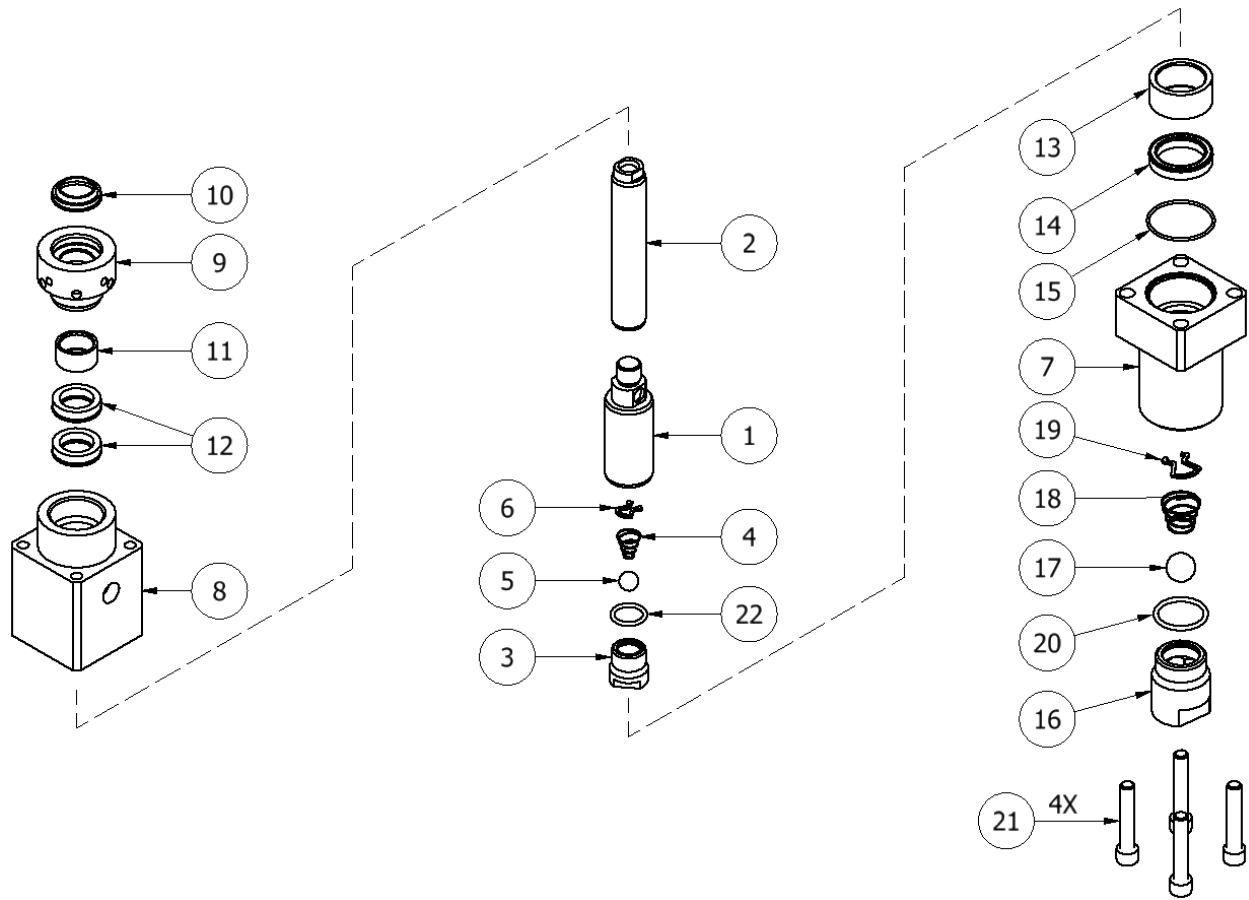
## A & R SINGLE PUMP ASSEMBLY (16:1)



### A & R SINGLE PUMP ASSEMBLY PA-044

ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	PA-047	PISTON	12	1	OR-035	O-RING
2	1	PA-062	FLUID ROD	13	1	PA-060	BALL STOP
3	1	PA-046	PISTON VALVE	14	1	PA-061	FOOT VALVE SPRING
4	1	OR-916	O-RING	15	1	PA-059	1" BALL
5	1	PA-048	3/4" CHROME BALL	16	1	OR-920	O-RING
6	1	PA-049	SPRING	17	1	PA-058	INLET VALVE
7	1	PA-050	SPRING RETAINER	18	2	PA-052	ROD SEAL ASSEMBLY
8	1	PA-045	OUTLET BODY	19	1	PA-051	ROD BUSHING
9	1	PA-053	INLET BODY	20	1	PA-064	PACKING NUT
10	1	PA-055	PISTON BUSHING	21	1	PA-065	SCRAPER SEAL
11	1	PA-054	PISTON SEAL ASSEMBLY	22	4	PA-057	CAP SCREW

## A & R SINGLE PUMP ASSEMBLY (30:1)



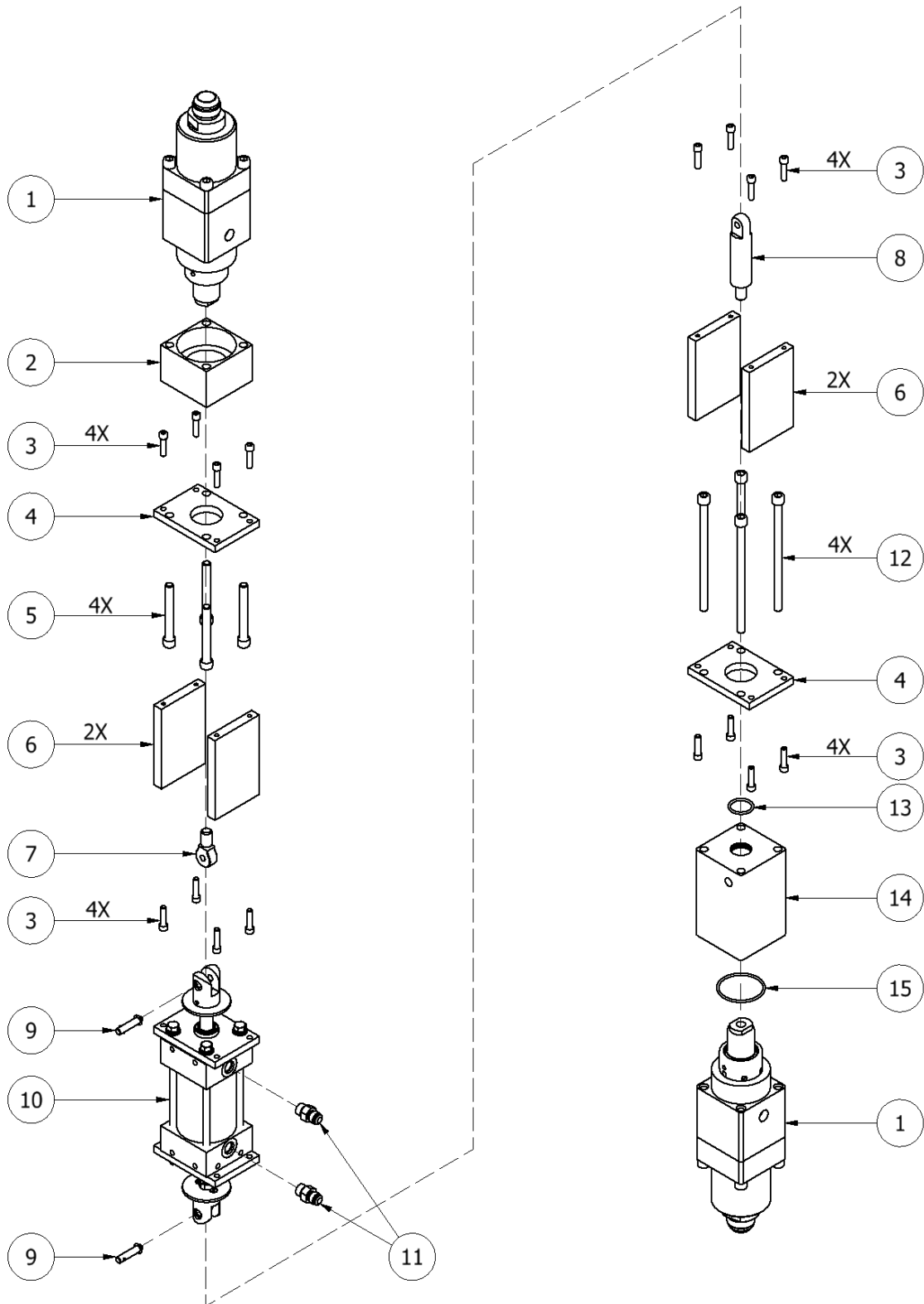
### A & R SINGLE PUMP ASSEMBLY

#### PAX-044

ITEM	QTY	PART NUMBER	DESCRIPTION	ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	PAX-047	PISTON	12	2	PAX-052	ROD SEAL ASSEMBLY
2	1	PAX-062	FLUID ROD	13	1	PAX-055	PISTON BUSHING
3	1	PAX-046	PISTON VALVE	14	1	PA-052	ROD SEAL ASSEMBLY
4	1	PAX-049	SPRING	15	1	OR-030	O-RING
5	1	PAX-059	1/2" CHROM BALL	16	1	PAX-058	INLET VALVE
6	1	PAX-050	SPRING RETAINER	17	1	PA-048	3/4" CHROME BALL
7	1	PAX-053	INLET BODY	18	1	PA-049	SPRING
8	1	PAX-045	OUTLET BODY	19	1	PA-050	SPRING RETAINER
9	1	PAX-064	SOLVENT CUP	20	1	OR-916	O-RING
10	1	PAX-065	SCRAPPER SEAL	21	4	PA-057	CAP SCREW
11	1	PAX-051	ROD BUSHING	22	1	OR-116	O-RING

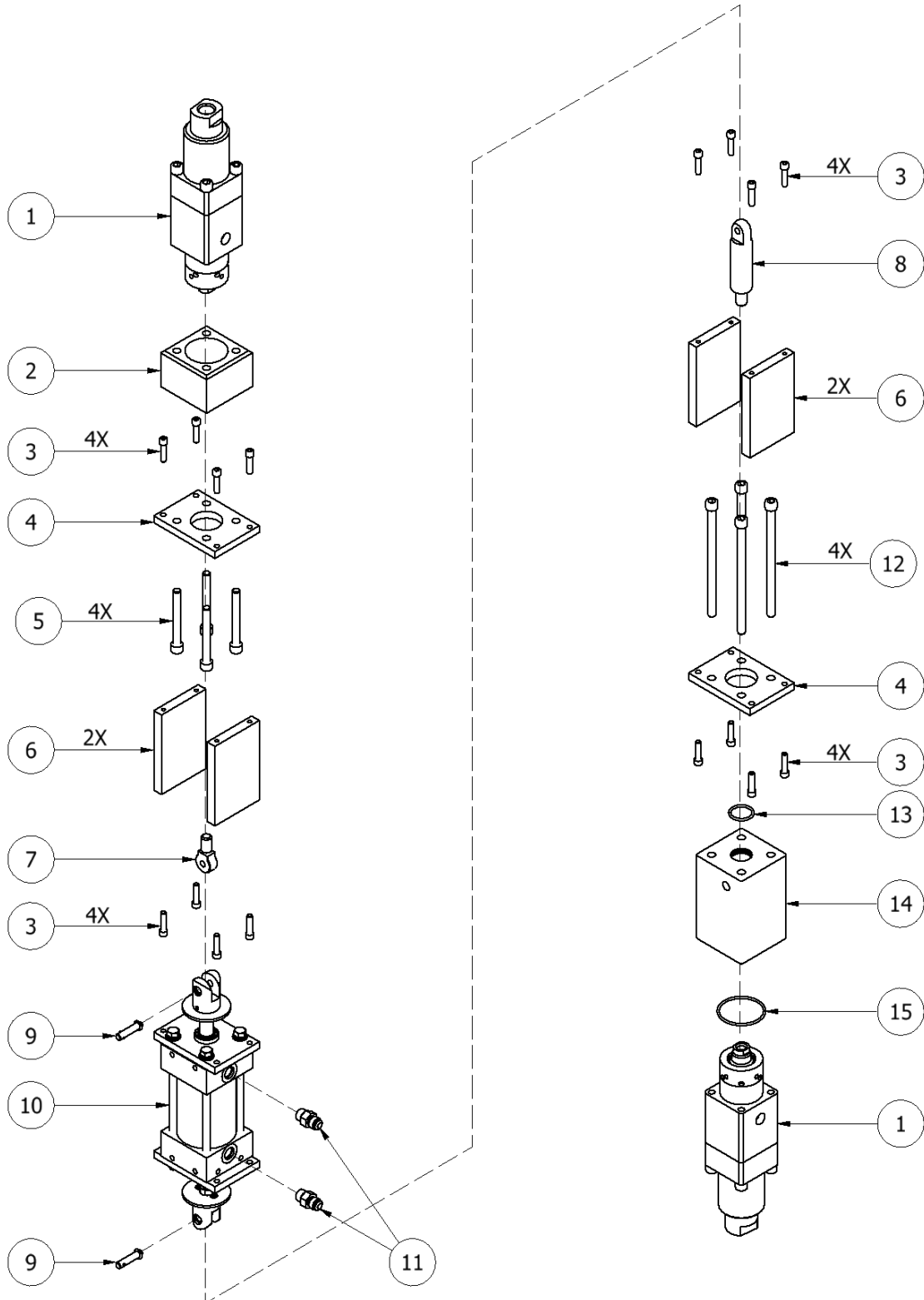


**PUMPLINE ASSEMBLY**



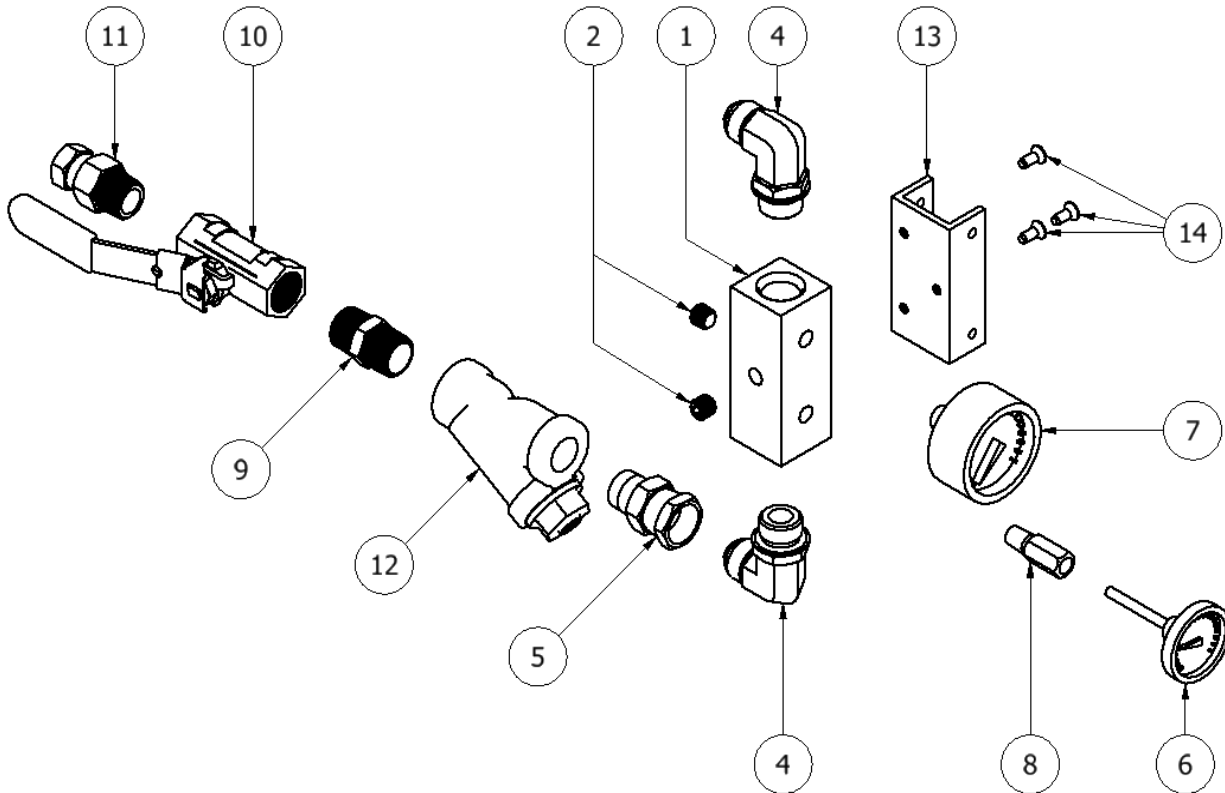
<b>PUMP LINE ASSEMBLY</b>			
<b>PL-9</b>			
<b>ITEM</b>	<b>QTY</b>	<b>PART NUMBER</b>	<b>DESCRIPTION</b>
1	2	PA-044	SINGLE PL-PA PUMP (SEE PAGE 60)
2	1	PU-07007	BRACKET, PA PUMP
3	16	FLOOR STOCK	¼-20 X 1 HEX SHCS
4	2	HI-05334	FLANGE, PA
5	4	FLOOR STOCK	3/8-16 X 3 HEX SHCS
6	4	PU-07009	STAND OFF, PUMPLINE
7	1	PU-07001	MALE CLEVIS
8	1	PU-07003	SHAFT, PA LUBE
9	2	PU-05007	CLEVIS PIN
10	1	HI-05336	HYDRAULIC CYLINDER ASSY, PH(X)-2 (SEE PAGE 58)
11	2	HI-05011	9/16-18 O-RING X 9/16-18 JIC
12	4	FLOOR STOCK	3/8-16 X 6 HEX SHCS
13	1	OR-806	O-RING #120 VITON
14	1	PU-07008	LUBE SECTION
15	1	OR-807	O-RING #137 VITON

**PUMPLINE ASSEMBLY**



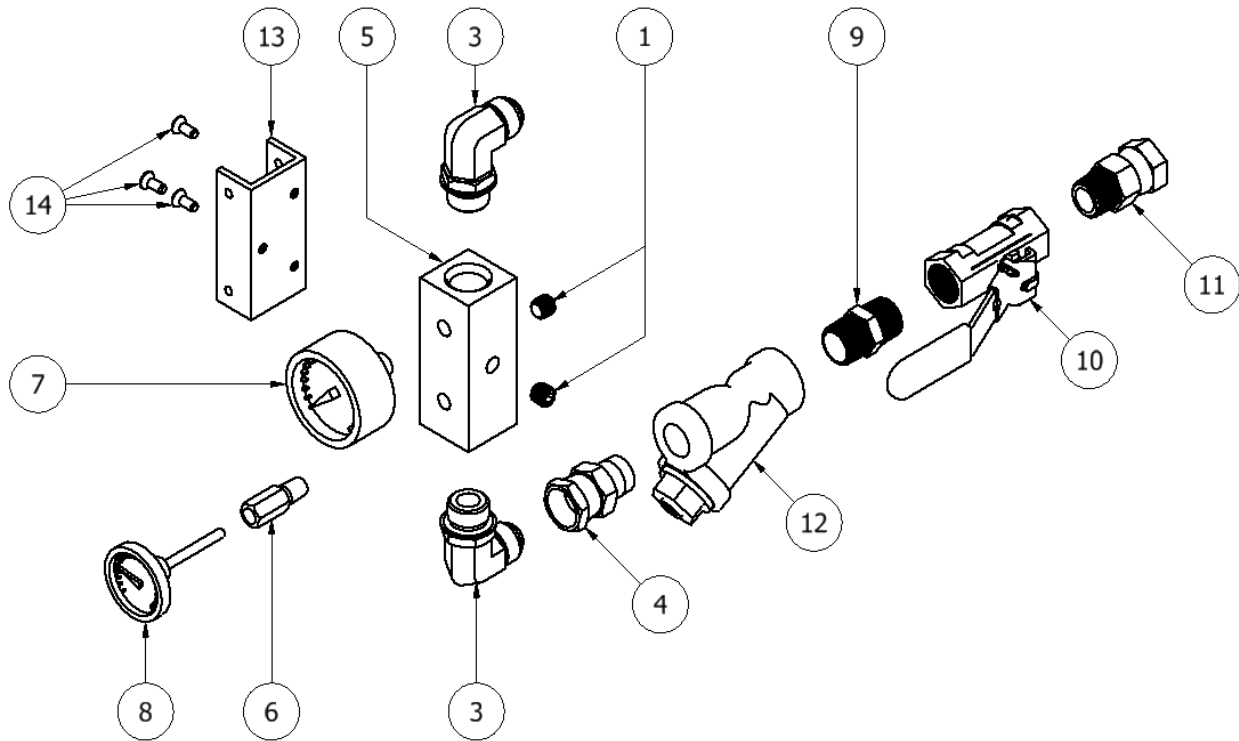
<b>PUMPLINE ASSEMBLY</b>			
<b>PL-10</b>			
<b>ITEM</b>	<b>QTY</b>	<b>PART NUMBER</b>	<b>DESCRIPTION</b>
1	2	PAX-044	SINGLE PL-PAX PUMP (SEE PAGE 61)
2	1	PU-07002	BRACKET, PAX
3	16	FLOOR STOCK	¼-20 X 1 HEX SHCS
4	2	HI-05338	FLANGE, PAX
5	4	FLOOR STOCK	3/8-16 X 3 HEX SHCS
6	4	PU-07009	STAND OFF, PUMPLINE
7	1	PU-07001	MALE CLEVIS
8	1	PU-07003	SHAFT, PA LUBE
9	2	PU-05007	CLEVIS PIN
10	1	HI-05336	HYDRAULIC CYLINDER ASSY, PH(X)-2 (SEE PAGE 58)
11	2	HI-05011	9/16-18 O-RING X 9/16-18 JIC
12	4	FLOOR STOCK	3/8-16 X 6 HEX SHCS
13	1	OR-806	O-RING #120 VITON
14	1	PU-07004	LUBE SECTION, PAX
15	1	OR-807	O-RING #137 VITON

## "A" INLET MANIFOLD ASSEMBLY



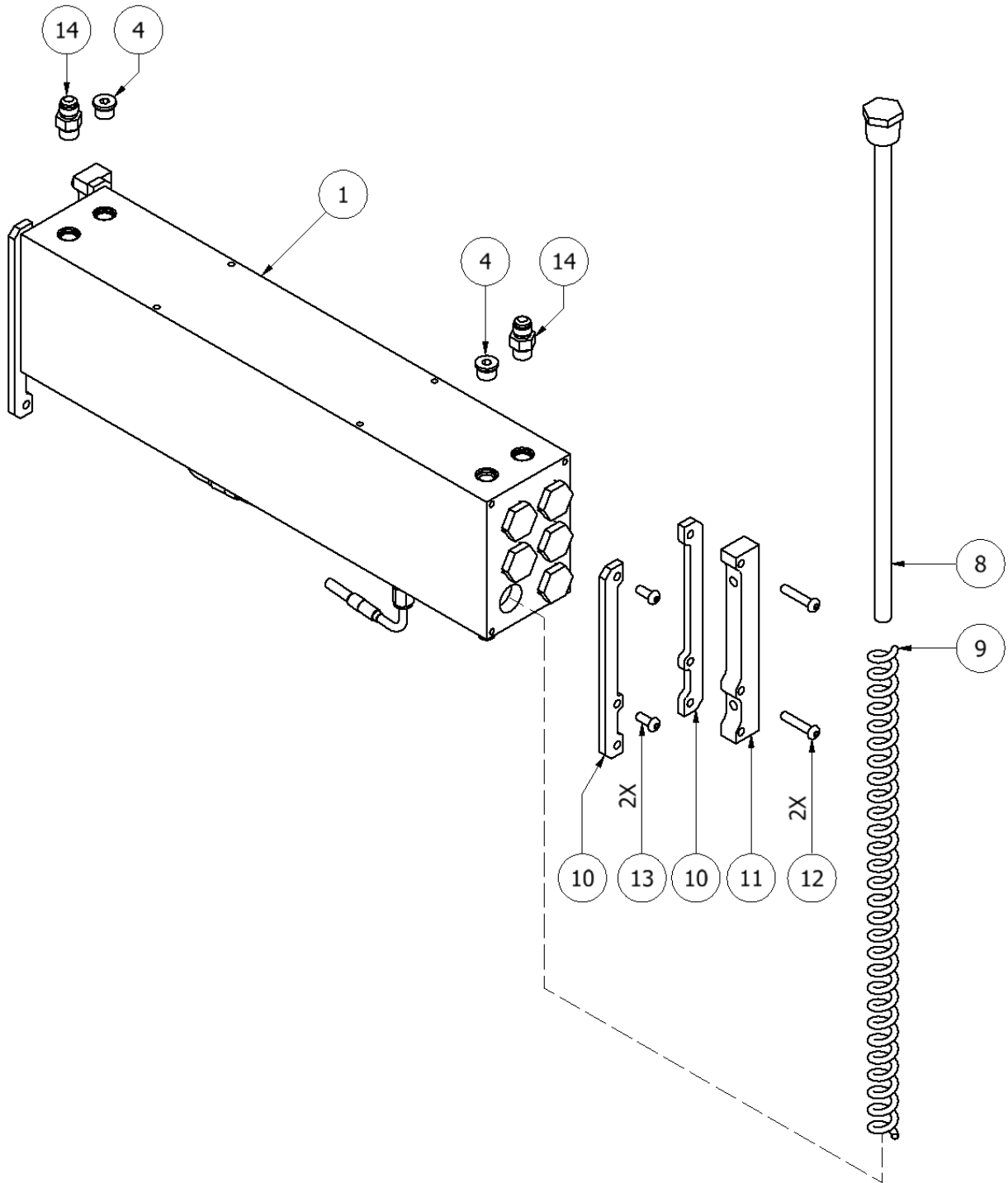
<b>"A" INLET MANIFOLD ASSEMBLY</b>			
<b>YS-6-PHX</b>			
<b>ITEM</b>	<b>QTY</b>	<b>PART NUMBER</b>	<b>DESCRIPTION</b>
1	1	HI-05305	INLET MANIFOLD
2	2	HI-05036	1/4 NPT FLUSH SEAL PIPE PLUG
4	2	HI-05315	12 ORB X 12 JIC 90 DEGREE
5	1	HI-05316	3/4 NPTM X 12 JIC SW
6	1	HI-05055	TEMP GUAGE 0-200 F
7	1	HI-05103	PRESS GUAGE 0-600 PSI
8	1	HI-05311	TEMP GUAGE STAND-OFF
9	1	HI-05017	3/4 NPTM UNION
10	1	RA-00078A	3/4 BALL VALVE SS
11	1	HI-05018	3/4 NPTM X 1/2 NPTM SW
12	1	RA-00074-00A	Y-STRAINER ASSY
13	1	HI-05341	INLET MANIFOLD BRACKET
14	3	FLOOR STOCK	1/4-20 X 5/8 FLAT COUNTERSUNK HCS

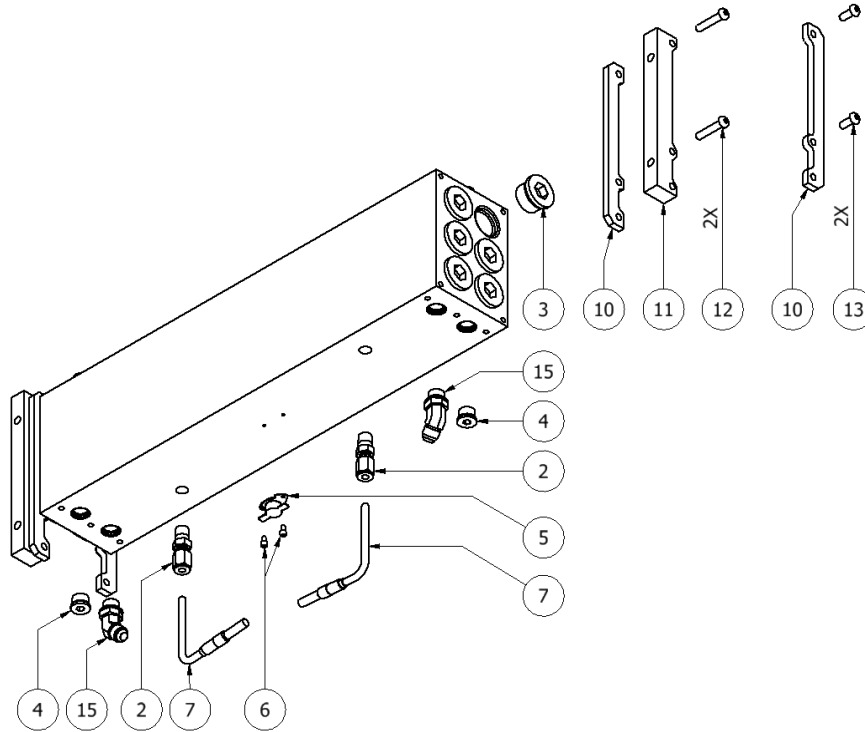
## "R" INLET MANIFOLD ASSEMBLY



<b>"R" INLET MANIFOLD ASSEMBLY</b>			
<b>YS-7-PHX</b>			
<b>ITEM</b>	<b>QTY</b>	<b>PART NUMBER</b>	<b>DESCRIPTION</b>
1	2	HI-05036	1/4 NPT FLUSH SEAL PIPE PLUG
2	1	HI-05325	12 ORB X 12 JIC
4	1	HI-05316	3/4 NPTM X 12 JIC SW
5	1	HI-05305	INLET MANIFOLD
6	1	HI-05311	TEMP GUAGE STAND-OFF
7	1	HI-05103	PRESS GUAGE 0-600 PSI
8	1	HI-05055	TEMP GUAGE 0-200 F
9	1	HI-05017	3/4 NPTM UNION
10	1	RA-00078A	3/4 BALL VALVE SS
11	1	HI-05016	3/4 NPTM X 3/4 NPTF SW
12	1	RA-00074-00A	Y-STRAINER ASSY
13	1	HI-05341	INLET MANIFOLD BRACKET
14	3	FLOOR STOCK	1/4-20 X 5/8 FLAT COUNTERSUNK HCS

**PREHEATER ASSEMBLY (PH-2)**





**PREHEATER ASSEMBLY**

PH-21 (3750 W)

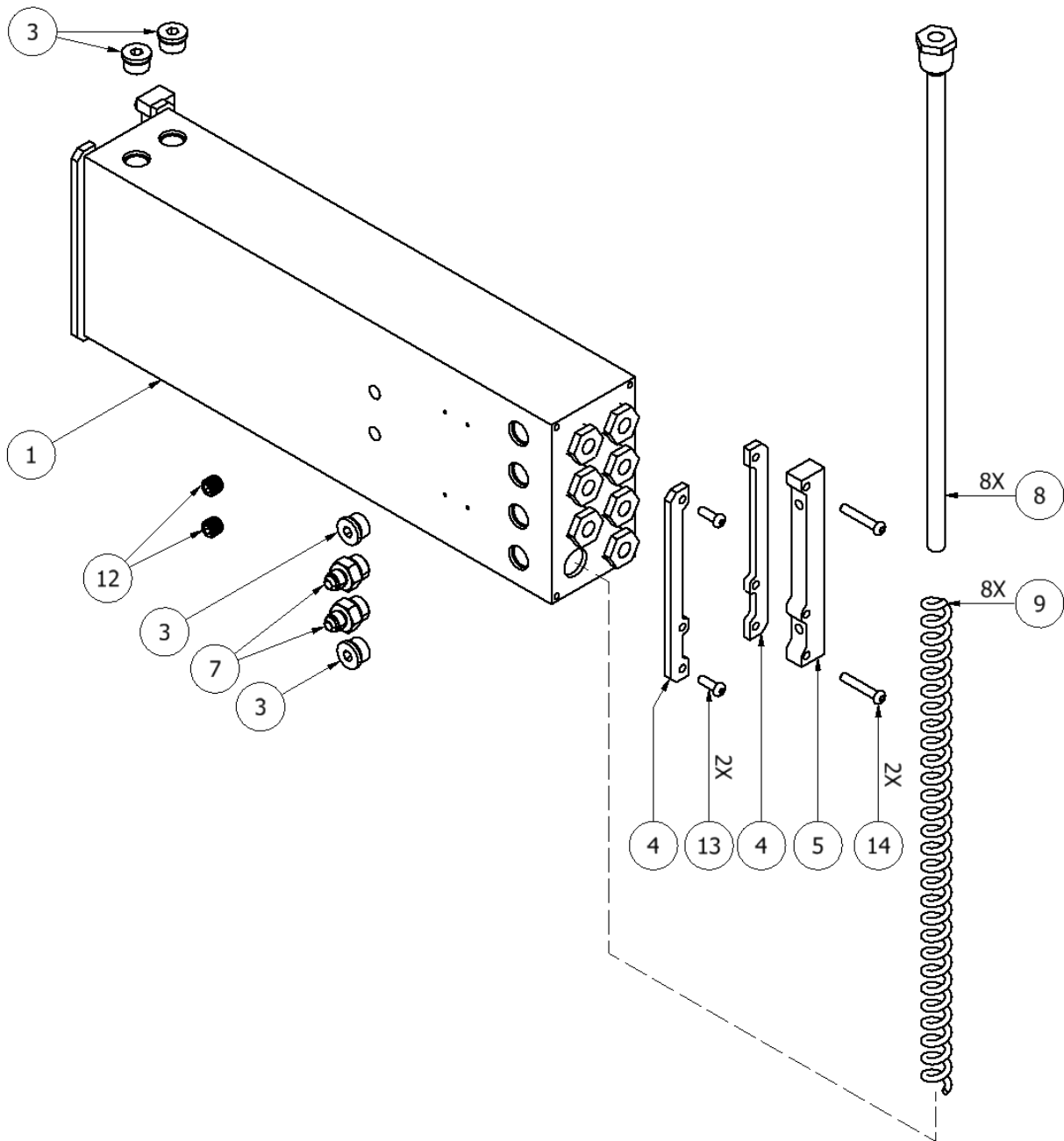
PH-22 (4500 W)

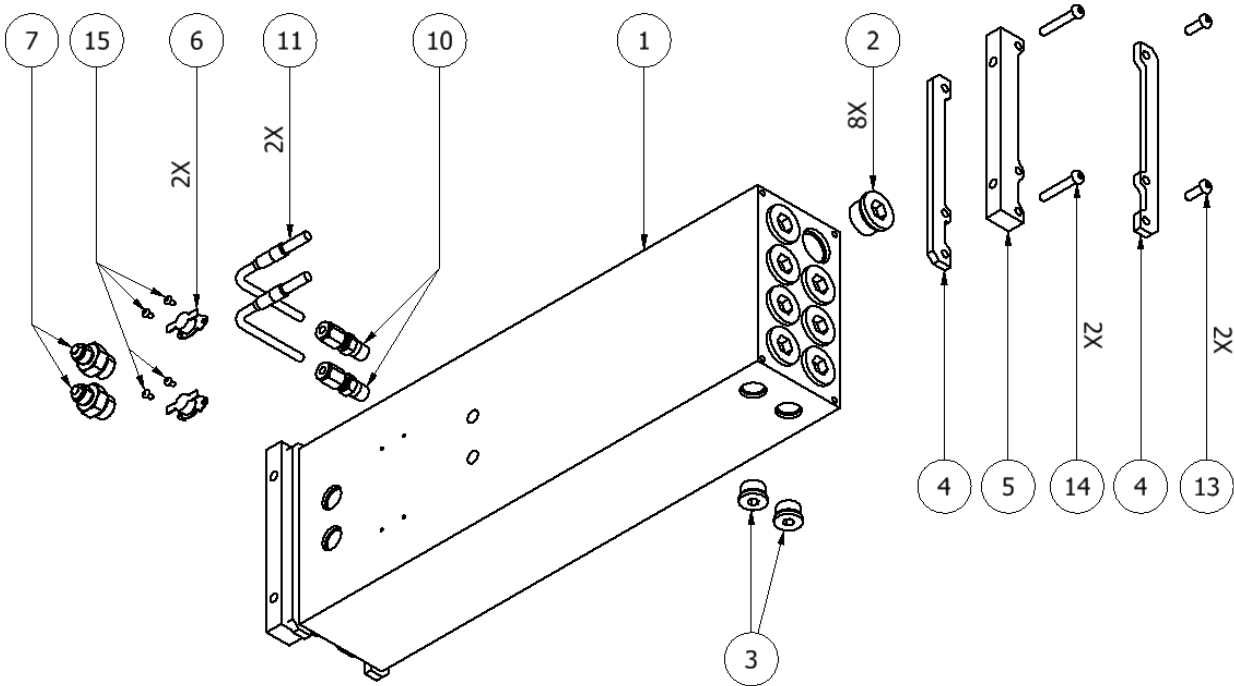
PH-23 (5250 W)

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	GM-07000	HEATER BLOCK
2	2	HI-05020	THERMOCOUPLE NUT
3	6	HI-05034	12 ORB PLUG
4	4	HI-05070-4	6 ORB PLUG
5	1	EL-00006A	OVERTEMP SWITCH
6	2	FLOOR STOCK	#6-32 X 1/4 HEX SHCS
7	2	HI-05021	THERMOCOUPLE, E TYPE
8	6	GM-05423-1250	FIRE ROD; 1250W, 3/4 NPT, 17.5"
	6	GM-05423-1500	FIRE ROD; 1500W, 3/4 NPT, 17.5"
	6	GM-05423-1750	FIRE ROD; 1750W, 3/4 NPT, 17.5"
9	6	GM-05423-7	SPRING 18"
10	4	GM-07004	HEATER SPACER
11	2	GM-07005	HEATER MOUNT
12	4	FLOOR STOCK	1/4-20 X 1-1/4 HEX SOCKET BUTTON HEAD CAP SCREW
13	4	FLOOR STOCK	1/4-20 X 5/8 HEX SOCKET BUTTON HEAD CAP SCREW
14	2	HI-05011	6 ORB X 6 JIC ELBOW
15	2	HI-05318	6 ORB X 6 JIC 45 DEGREE



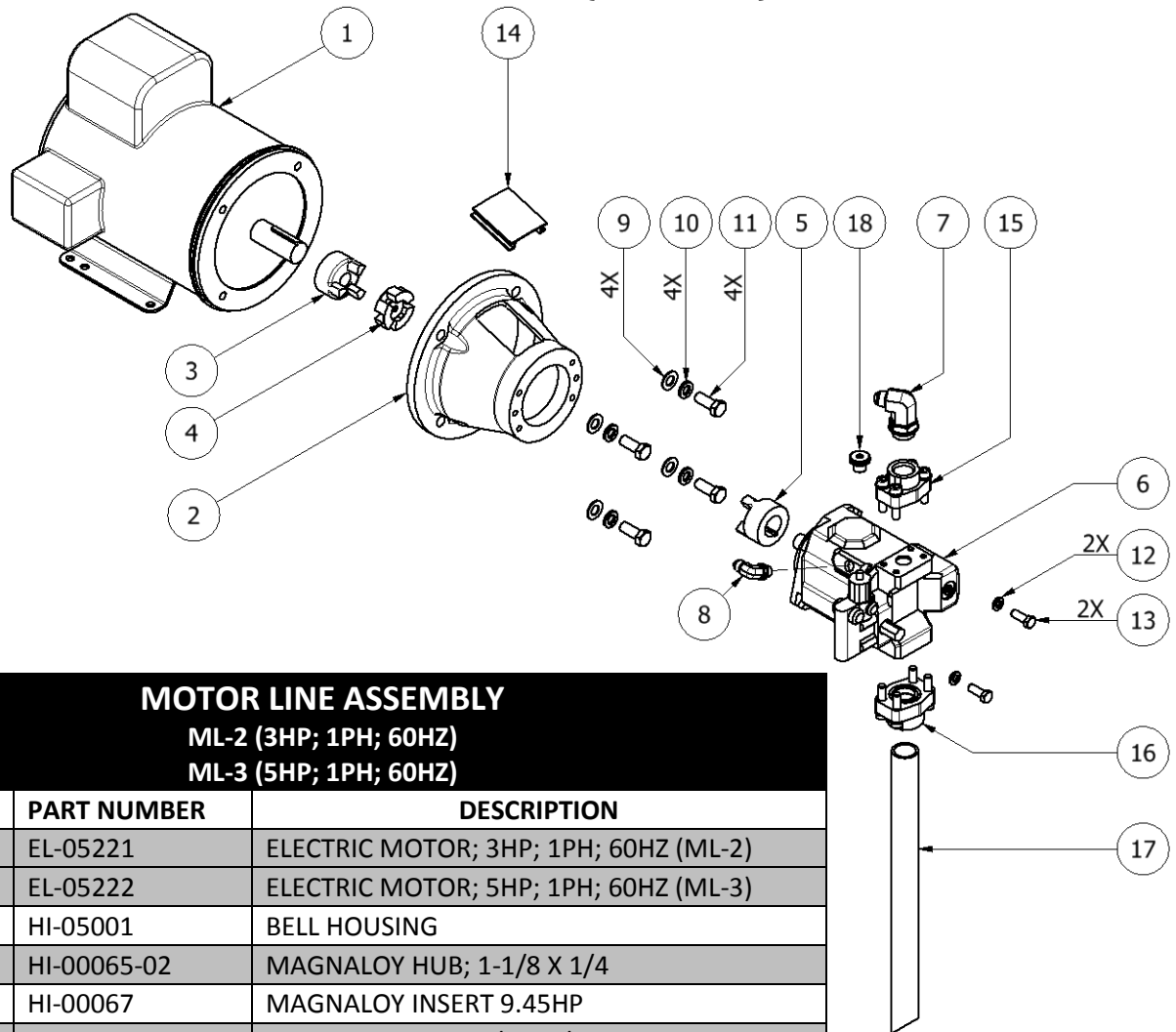
**PREHEATER ASSEMBLY (PHX-2)**





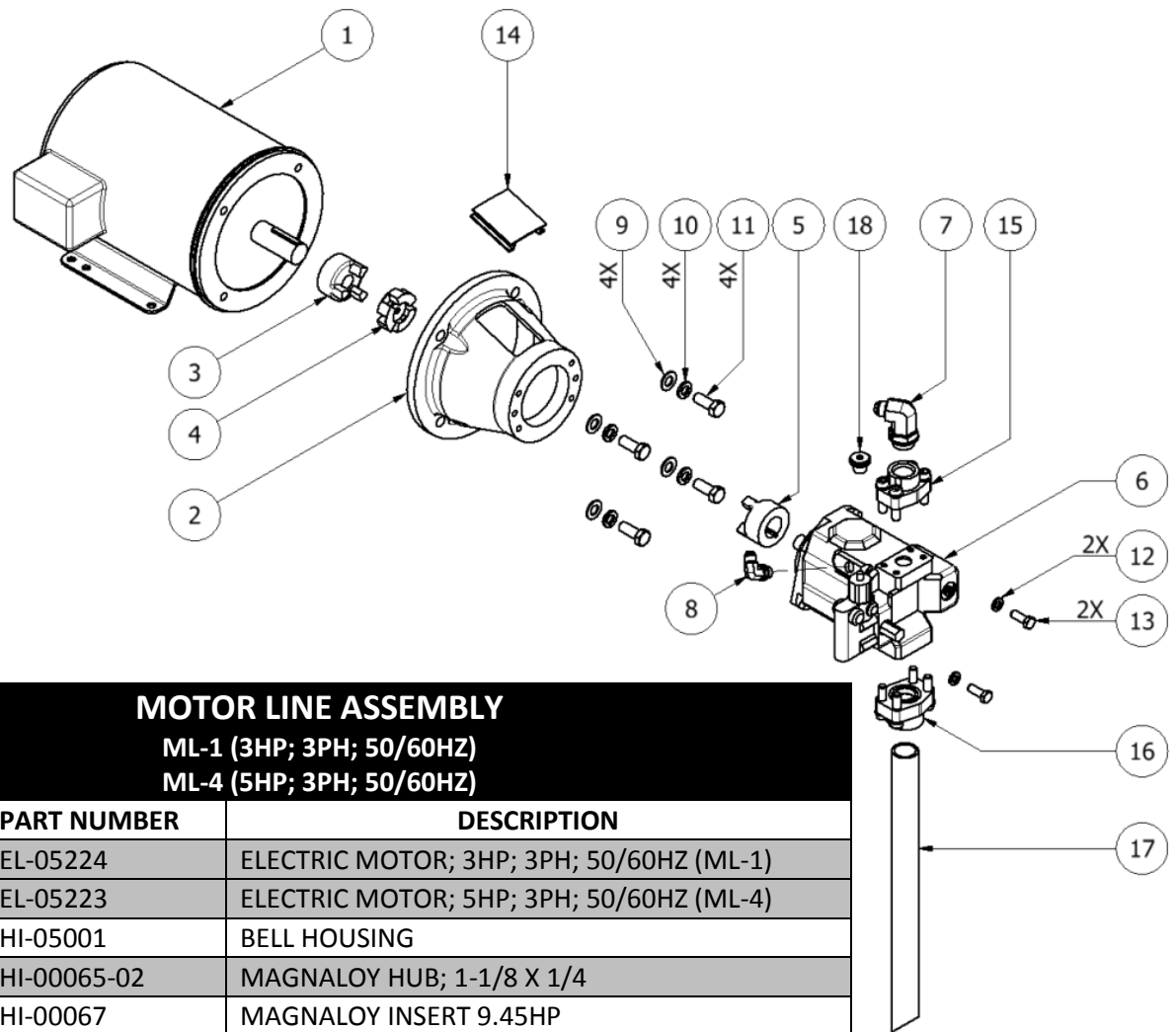
<b>PREHEATER ASSEMBLY PH-33 (7000 W)</b>			
<b>ITEM</b>	<b>QTY</b>	<b>PART NUMBER</b>	<b>DESCRIPTION</b>
1	1	GM-07006	8 ROD HEATER BODY
2	8	HI-05034	12 ORB PLUG
3	6	HI-05033	8 ORB PLUG
4	4	GM-07004	HEATER SPACER
5	2	GM-07005	HEATER MOUNT
6	2	EL-00006A	OVERTEMP SWITCH
7	4	HI-05352	8 ORB X 6 JIC
8	8	GM-05423-1750	FIRE ROD; 1750W, 3/4 NPT, 17.5"
9	8	GM-05423-7	SPRING 18"
10	2	HI-05020	THERMOCOUPLE NUT
11	2	HI-05021	E TYPE THERMOCOUPLE
12	2	HI-05036	1/4 NPT FLUSH SEAL PIPE PLUG
13	4	FLOOR STOCK	1/4-20 X 3/4 HEX SOCKET BUTTON HEAD CAP SCREW
14	4	FLOOR STOCK	1/4-20 X 1-1/2 HEX SOCKET BUTTON HEAD CAP SCREW
15	4	FLOOR STOCK	6-32 X 1/4 HEX SOCKET BUTTON HEAD CAP SCREW

### MOTOR LINE ASSEMBLY (1 PHASE)



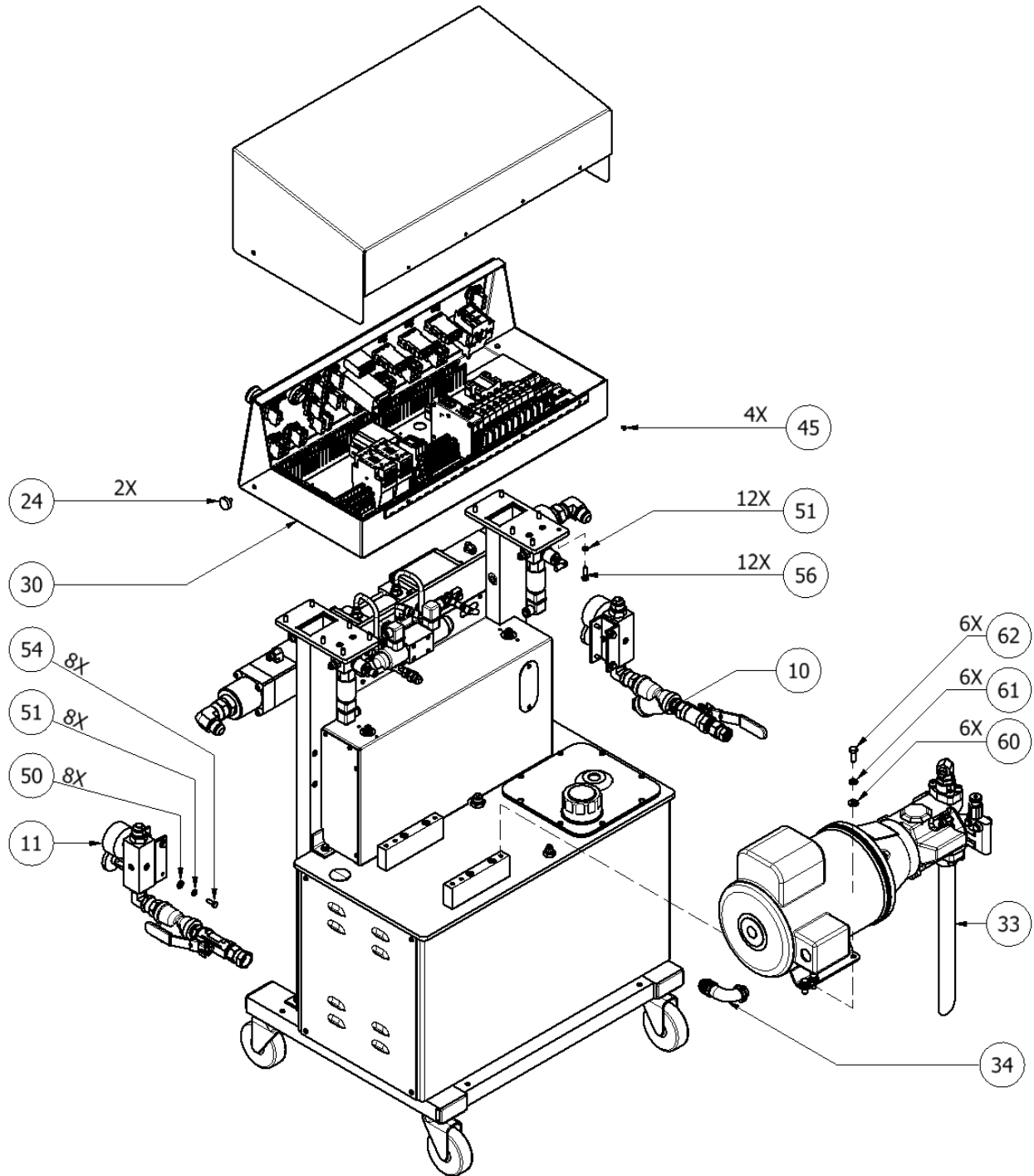
<b>MOTOR LINE ASSEMBLY</b>			
<b>ML-2 (3HP; 1PH; 60HZ)</b>			
<b>ML-3 (5HP; 1PH; 60HZ)</b>			
<b>ITEM</b>	<b>QTY</b>	<b>PART NUMBER</b>	<b>DESCRIPTION</b>
1	1	EL-05221	ELECTRIC MOTOR; 3HP; 1PH; 60HZ (ML-2)
	1	EL-05222	ELECTRIC MOTOR; 5HP; 1PH; 60HZ (ML-3)
2	1	HI-05001	BELL HOUSING
3	1	HI-00065-02	MAGNALOY HUB; 1-1/8 X 1/4
4	1	HI-00067	MAGNALOY INSERT 9.45HP
5	1	HI-00065-03	MAGNALOY HUB; 3/4 X 3/16
6	1	HI-05004	HYDRAULIC PUMP
7	1	HI-05006-3	1-1/16-12 O-RING X 3/4-16 JIC
8	1	HI-05007	3/8 JIC X 6 ORB 90 DEG
9	4	FLOOR STOCK	7/16 PLAIN WASHER
10	4	FLOOR STOCK	7/16 LOCK WASHER
11	4	FLOOR STOCK	1/2-13 X 1 HEX BOLT
12	2	FLOOR STOCK	3/8 LOCK WASHER
13	2	FLOOR STOCK	3/8-16 X 1.5 HEX BOLT
14	1	FLOOR STOCK	ACCESS COVER
15	1	HI-05009	1-1/16-12 OUTLET FLANGE
16	1	HI-05010	1" NPT INLET FLANGE
17	1	HI-00049A	1X16 BLACK PIPE FOR HYDRAULIC
18	1	HI-05004-1	CONTROL KNOB; HYDRAULIC PUMP

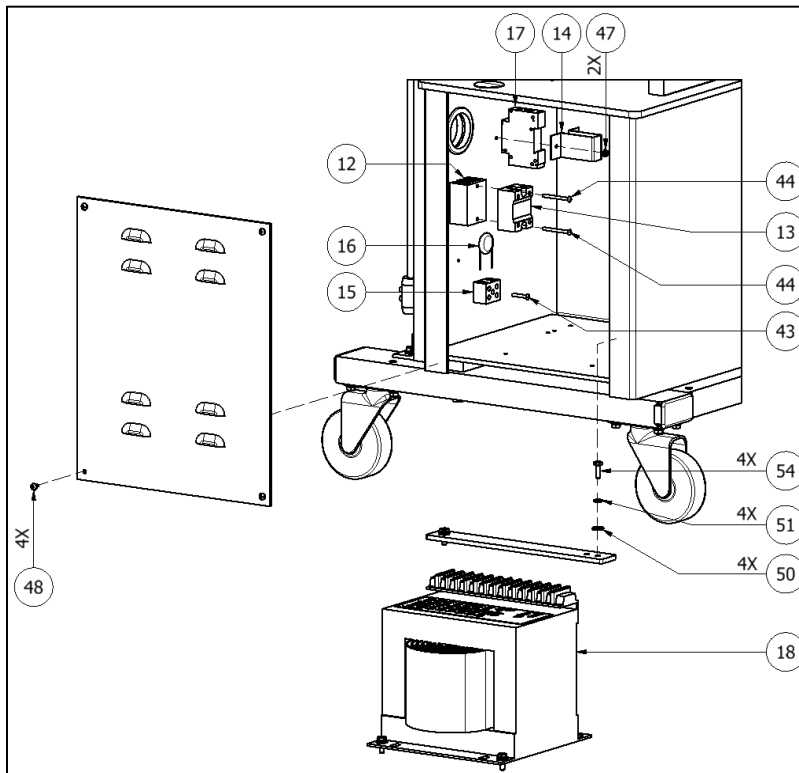
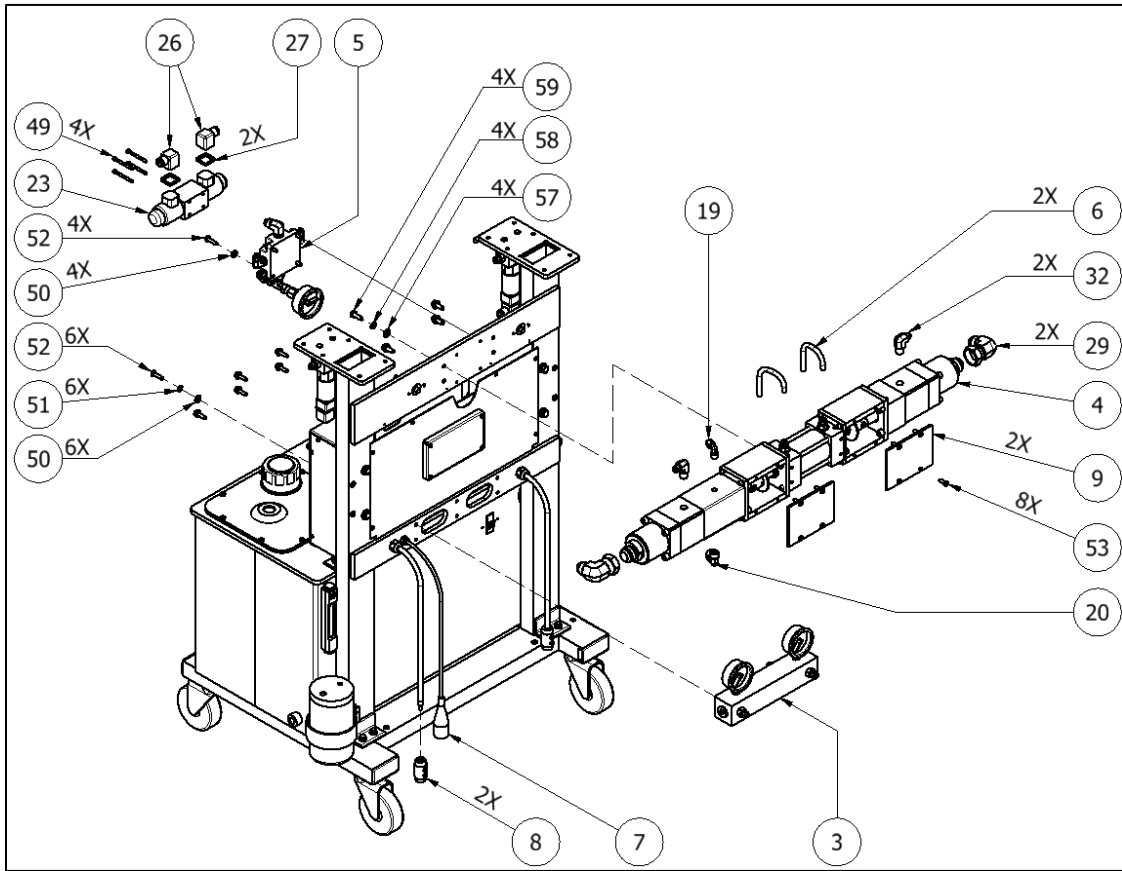
## MOTOR LINE ASSEMBLY (3 PHASE)

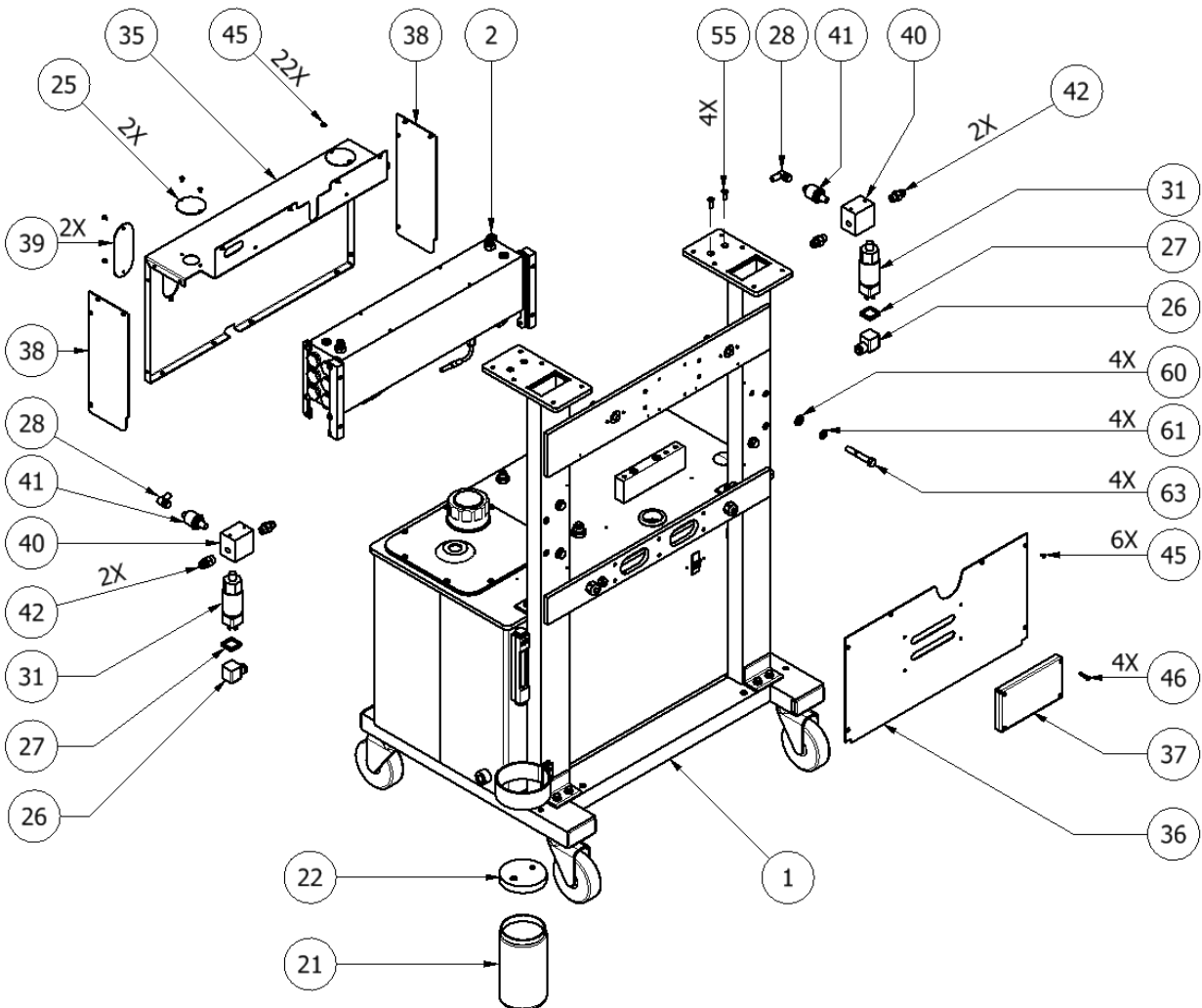


<b>MOTOR LINE ASSEMBLY</b>			
<b>ML-1 (3HP; 3PH; 50/60HZ)</b>			
<b>ML-4 (5HP; 3PH; 50/60HZ)</b>			
<b>ITEM</b>	<b>QTY</b>	<b>PART NUMBER</b>	<b>DESCRIPTION</b>
1	1	EL-05224	ELECTRIC MOTOR; 3HP; 3PH; 50/60HZ (ML-1)
	1	EL-05223	ELECTRIC MOTOR; 5HP; 3PH; 50/60HZ (ML-4)
2	1	HI-05001	BELL HOUSING
3	1	HI-00065-02	MAGNALOY HUB; 1-1/8 X 1/4
4	1	HI-00067	MAGNALOY INSERT 9.45HP
5	1	HI-00065-03	MAGNALOY HUB; 3/4 X 3/16
6	1	HI-05004	HYDRAULIC PUMP
7	1	HI-05006-3	1-1/16-12 O-RING X 3/4-16 JIC
8	1	HI-05007	3/8 JIC X 6 ORB 90 DEG
9	4	FLOOR STOCK	7/16 PLAIN WASHER
10	4	FLOOR STOCK	7/16 LOCK WASHER
11	4	FLOOR STOCK	1/2-13 X 1 HEX BOLT
12	2	FLOOR STOCK	3/8 LOCK WASHER
13	2	FLOOR STOCK	3/8-16 X 1.5 HEX BOLT
14	1	FLOOR STOCK	ACCESS COVER
15	1	HI-05009	1-1/16-12 OUTLET FLANGE
16	1	HI-05010	1" NPT INLET FLANGE
17	1	HI-00049A	1X16 BLACK PIPE FOR HYDRAULIC
18	1	HI-05004-1	CONTROL KNOB; HYDRAULIC PUMP

**FINAL ASSEMBLY**







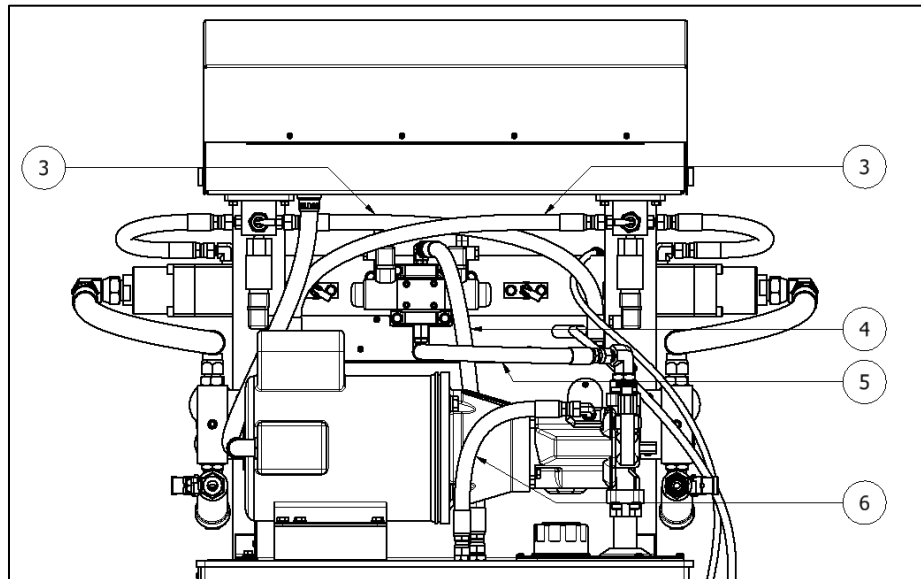
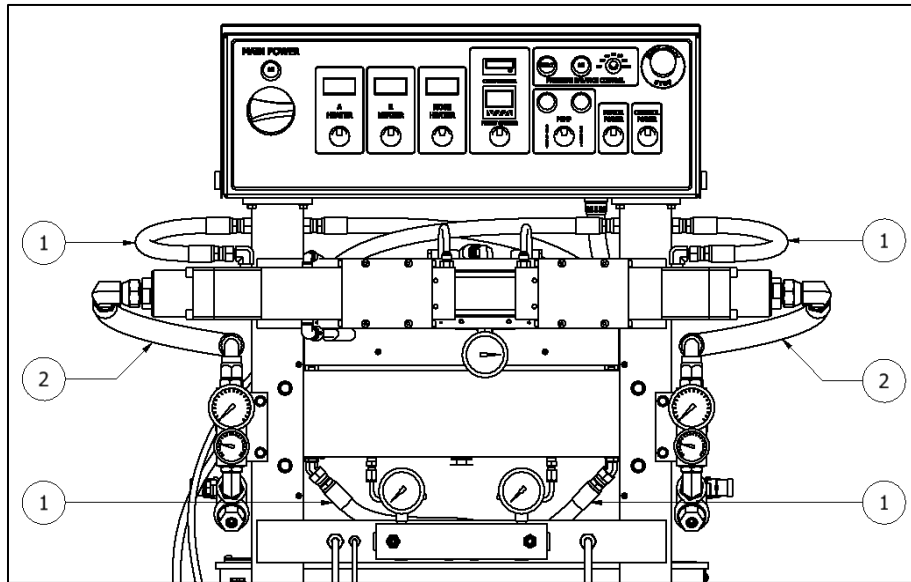
PH-2 (LOW PRESSURE) PHX-2 (HIGH PRESSURE)			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	FR-10	FRAME ASSY, PH(X)-2
2	1	PH-21	HEATER ASSY; 3750 KW
	1	PH-22	HEATER ASSY; 4500 KW
	1	PH-23	HEATER ASSY; 5250 KW
	1	PH-33	8 ROD HEATER ASSY; 7000 KW
3	1	HI-05331	EXIT MANIFOLD ASSY
4	1	PL-9	PUMPLINE, PH-2
	1	PL-10	PUMPLINE; PHX-2
5	1	HI-05335	HYDRAULIC MANIFOLD ASSY
6	2	HI-05304	HYD CYLINDER TUBE
7	1	EL-05237	THERMOCOUPLE HARNESS 4'

PH-2 (LOW PRESSURE) PHX-2 (HIGH PRESSURE)			
ITEM	QTY	PART NUMBER	DESCRIPTION
8	2	KT-00029A-1	HOSE HEAT; CONNECTOR BODY
9	2	PU-07000	CLEAR PUMP COVER
10	1	YS-6-PHX	A INLET MANIFOLD ASSY
11	1	YS-7-PHX	R INLET MONIFOLD ASSY
12	1	EL-35-1	HEAT SINK
13	1	EL-35	HOSE HEAT RELAY
14	1	EL-00118A-00-1	HOSE BREAKER MOUNTING PLATE
15	1	EL-192	TERMINAL BLOCK
16	1	EL-193	INRUSH CURRENT LIMITER
17	1	EL-150	CIRCUIT BRAKER, 63AMP
18	1	EL-05228	70V TRANSFORMER
	1	EL-05225	90V TRANSFORMER
	1	EL-05226	120V TRANSFORMER
19	1	RA-00066A	MALE ELBOW 3/8 X 1/4
20	1	RA-00067A	MALE ELBOW 1/2 X 3/8
21	1	MQ-01009-01A	LUBE BOTTLE
22	1	MQ-01009-02A	LUBE BOTTLE LID
23	1	HI-05003	DIRECTIONAL VALVE
24	2	EL-05220-01	CONSOLE KNOBS
25	2	CL-03009	HEATER HOLE COVER 2
26	4	EL-00052	SOLENOID VALVE CONNECTOR
27	4	EL-00053	SOLENOID VALVE GASKET
28	4	EL-158	MICRO CORDSET 90 DEGREE
29	2	HI-05339	12 JIC X 16 NPTM 90 DEG (PH-2)
	2	HI-05342	12 JIC X 12 NPTM 90 DEG (PHX-2)
30	1	EL-400-31	CONSOLE ASSY; 1PH
	1	EL-400-33	CONSOLE ASSY; 3PH
31	2	EL-42-2200	PRESSURE SWITCH; 2200 PSI
	2	EL-42-3200	PRESSURE SWITCH; 3200 PSI
32	2	HI-05347	3/8 NPT X 6 JIC 90 DEG
33	1	ML-1	MOTORLINE ASSY 18CC, 3HP, 3PH
	1	ML-2	MOTORLINE ASSY 18CC, 3HP, 1PH
	1	ML-3	MOTORLINE ASSY 18CC, 5HP, 1PH
	1	ML-4	MOTORLINE ASSY 18CC, 5HP, 3PH
34	1	EL-05230-03	RT ANGLE CONDUIT CONNNECTOR
35	1	CL-03004	HEATER COVER TOP
36	1	CL-03005	HEATER COVER FRONT
37	1	CL-03007	THERMOCOUPLE COVER
38	2	CL-03006	HEATER COVER ENDS
39	1	CL-03008	HEATER HOLE COVER 1



PH-2 (LOW PRESSURE) PHX-2 (HIGH PRESSURE)			
ITEM	QTY	PART NUMBER	DESCRIPTION
40	2	HI-05351	PRESSURE MANIFOLD
41	2	EL-195	0-5000 PRESS TRANSDUCER
42	4	HI-05011	6 ORB X 6 JIC
43	1	FLOOR STOCK	#8-32 X 1 CROSS RECESSED PAN HEAD MACHINE SCREW
44	2	FLOOR STOCK	#8-32 X 3/4 CROSS RECESSED PAN HEAD MACHINE SCREW
45	28	FLOOR STOCK	#8-32 X 1/4 HEX SOCKET BUTTON HEAD CAP SCREW
46	4	FLOOR STOCK	#8-32 X 7/8 HEX SOCKET BUTTON HEAD CAP SCREW
47	2	FLOOR STOCK	#8-32 HEX NUT
48	4	FLOOR STOCK	#10-32 X 5/16 CROSS RECESSED PAN HEAD MACHINE SCREW
49	4	FLOOR STOCK	#10-24 X 2 HEX SHCS
50	22	FLOOR STOCK	1/4 WASHER
51	30	FLOOR STOCK	1/4 LOCK WASHER
52	10	FLOOR STOCK	1/4-20 X 1 HEX CAP SCREW
53	8	FLOOR STOCK	1/4-20 X 3/4 HEX SOCKET BUTTON HEAD CAP SCREW
54	12	FLOOR STOCK	1/4-20 X 3/4 HEX CAP SCREW
55	4	FLOOR STOCK	1/4-20 X 3/4 HEX SOCKET FLAT COUNTERSUNK HEAD CAP SCREW
56	12	FLOOR STOCK	1/4-20 X 1 HEX BOLT
57	4	FLOOR STOCK	5/16 WASHER
58	4	FLOOR STOCK	5/16 LOCK WASHER
59	4	FLOOR STOCK	5/16-18 X 7/8 HEX CAP SCREW
60	10	FLOOR STOCK	3/8 WASHER
61	10	FLOOR STOCK	3/8 LOCK WASHER
62	6	FLOOR STOCK	3/8-16 X 1 HEX CAP SCREW
63	4	FLOOR STOCK	3/8-16 x 2-1/2 HEX BOLT

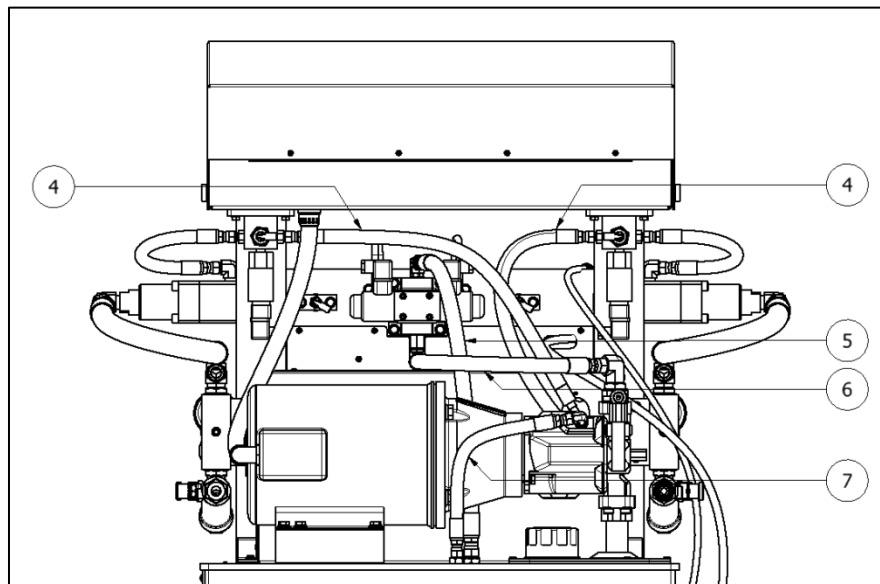
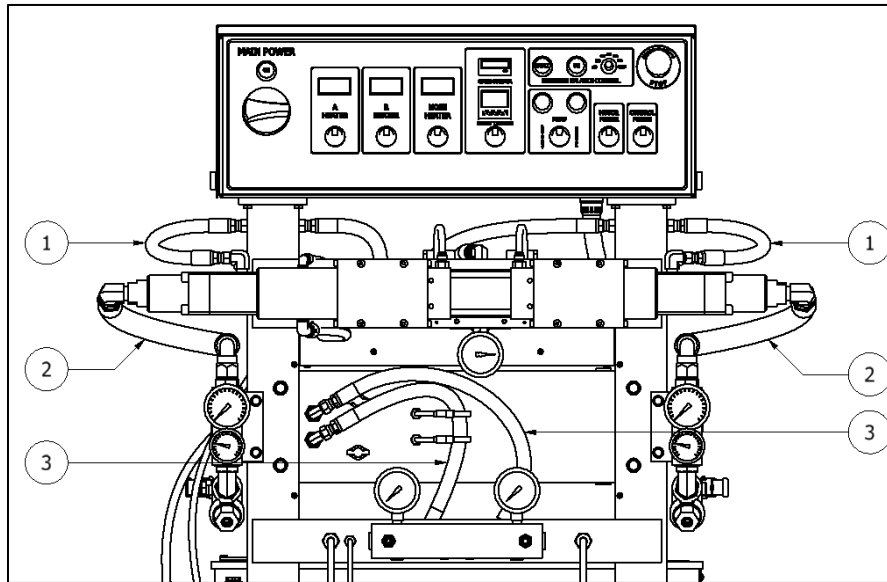
**PH-2 HOSES**



**PH-2 HOSES**

ITEM	QTY	PART NUMBER	DESCRIPTION
1	4	HI-05047-2	HOSE 9" HYDRAULIC PUMP TO TANK
2	2	HI-05340-1	HOSE ASSY, PHX-2
3	2	HI-05047	HOSE; PUMP TO HEATER
4	1	HI-05047-8	HOSE ASSY
5	1	HI-05013	HYD. TANK RETURN HOSE; 1/2 X 2
6	1	HI-05047-4	HOSE 13" TOP PUMP CYL TO LEFT

**PHX-2 HOSES**

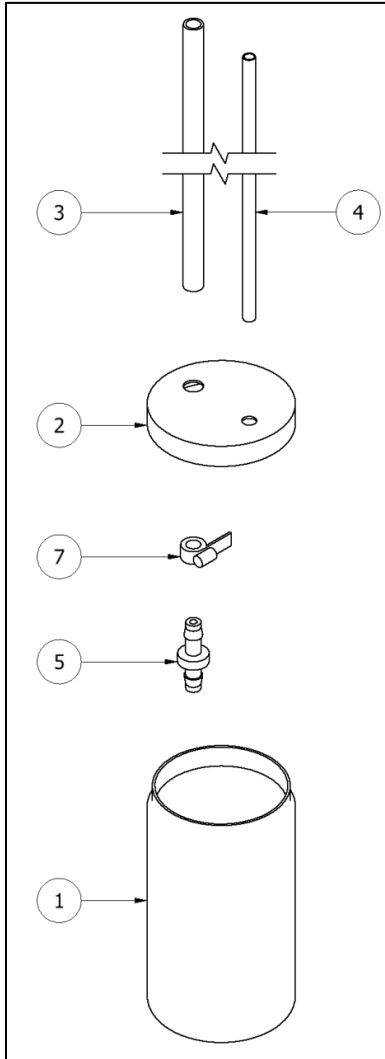


**PH-2 HOSES**

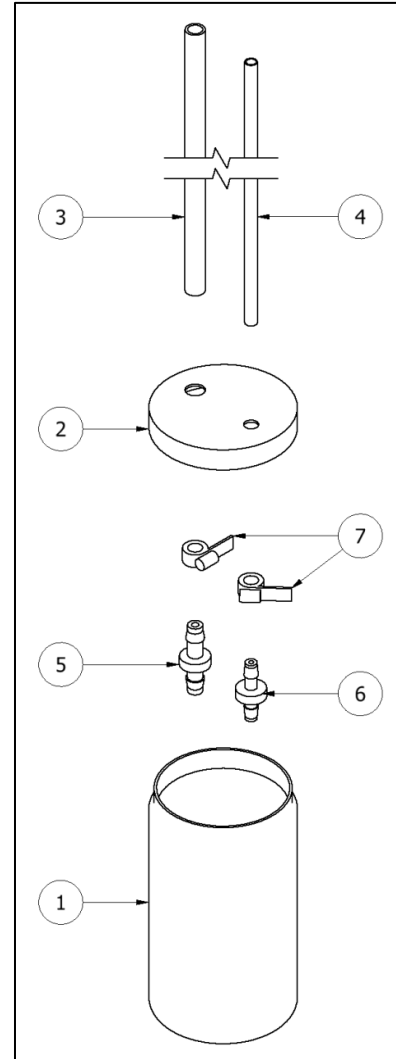
ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	HI-05047-2	HOSE 9" HYDRAULIC PUMP TO TANK
2	2	HI-05340-1	HOSE ASSY, PHX-2
3	2	HI-05047-6	HOSE 13" TOP PUMP CYL TO LEFT M
4	2	HI-05047-7	HOSE ASSY HYDRAULIC PUMP TO TA
5	1	HI-05047-8	HOSE ASSY
6	1	HI-05013	HYD. TANK RETURN HOSE; 1/2 X 2
7	1	HI-05047-4	HOSE 13" TOP PUMP CYL TO LEFT

## LUBE BOTTLE COMPONENTS

### PH-2



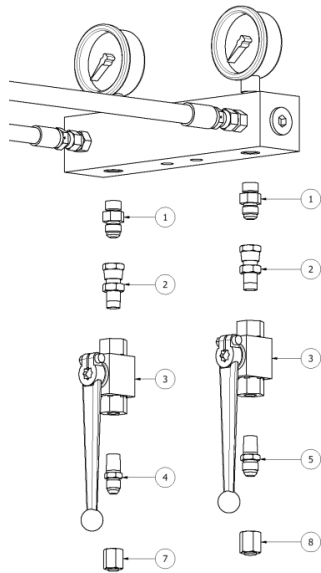
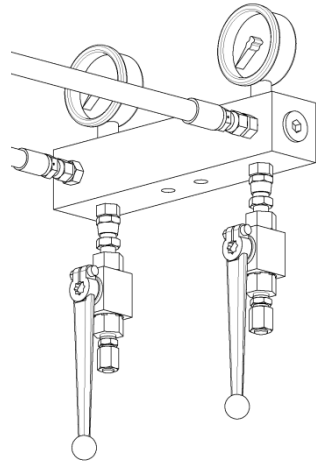
### PHX-2



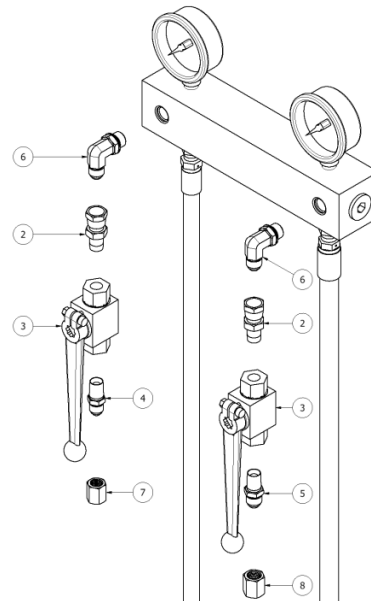
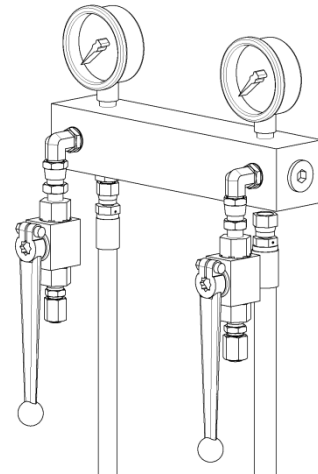
LUBE BOTTLE ASSEMBLY			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	MQ-01009-01A	LUBE BOTTLE
2	1	MQ-01009-02A	LUBE BOTTLE LID
3	1	MA-00024A	1/2" X 3' PLASTIC TUBING RETURN
4	1	MA-00025A	3/8" X 3' PLASTIC TUBING SUPPLY
5	1	RA-00068A	CHECK VALVE
6	1	RA-06008	CHECK VALVE <b>(PHX-2 ONLY)</b>
7	1	TN-04196	HOSE CLAMP <b>(QTY=2 FOR PHX-2)</b>
-	1	GP-00960-1-GAL	PUMP LUBE GALLON (NOT SHOWN)
-	1	GP-00960-1-QRT	PUMP LUBE QUART (NOT SHOWN)

## EXIT MANIFOLD ACCESSORY

### In-Plant Option



### In-Trailer Option



<b>KT-05300</b>			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	HI-05011	6 ORB X 6 JIC
2	2	EL-00051A-5	1/4 NPT X #6 SWIVEL
3	2	GP-00100-2	BALL VALVE 1/4 5000PSI
4	1	EL-00051A-4	1/4 NPT X #5 JIC
5	1	EL-00051A-6	1/4 NPT X #6 JIC
6	2	HI-05007	6 ORB X 6 JIC 90 DEG
7	1	200226	JIC-5 CAP
8	1	200227	JIC-6 CAP