(EP) Light Liquid Sampler

SYSTEM SUPPORT MANUAL

Version 05102013

YZ SYSTEMS
MILTON ROY

(EP)Light Liquid Sampler Instruction & Operating Manual

Version 05102013

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Section 1:
First Things To Know About (EP)Light Liquid Samplers

How to Use this Manual

The (EP)Light Liquid Sampler Operations Manual is a step-by-step guide containing the procedures needed to work with the Light Liquid Sampler System.

The (EP)Light Liquid Sampler Series of samplers implement the most advanced technology available in the industry. It is recommended that the technicians working with the (EP)Light Liquid Sampler Systems study the manual prior to initiating work on the system for the first time.

Typographic Conventions

To aide in readability, this manual uses several typographic conventions. References to illustrations, photographs, and other related content will appear in *italicized text* along with the location of where to find the item in the manual. Digital versions of the manual, are available in Adobe Acrobat™ PDF format.

Measurement units are listed in italic parenthesis text following their US standard equivalent. As an example, for defining a distance, 15' *(4.5 meters)*, is how the text will appear throughout the manual.

Items that require action, for example the pressing of a key for programming the controller, will feature the action item in sentence case **Bold Text** followed in normal text by the item such as, the **Up Arrow** key or **Main Power** switch.

Getting Help

This manual provides solutions to typical questions about the Light Liquid Sampler system. If the answer can not be found within this manual, contact YZ Systems at:

T: 1.281.362.6500
T: 1.800.653.9435
F: 1.281.362.6513
Em: Service@yzhq.com

When calling, have this manual close at hand. Whether calling or writing, please include in your communique the following information:

- The serial number of the (EP)Light Liquid Sampler System and the version number of this manual. The serial number is located on the system skid or enclosure. The version number of this manual is located at the bottom of each page.
- A description of the problem and, if applicable the actions of the technical personnel when the problem occurred.

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Section 1:
First Things To Know About (EP)Light Liquid Samplers

Operation Specifications

Maximum Output:	
Std. 3/8" Plunger	6.8 gallons/day *(25.3 liters/day)*
Maximum Operating Pressure:	1,800 psig *(124 Bar (g)*
Pump Displacement:	
Std. 3/8" Plunger	.25 - 1.8 cc/Stroke
Operating Temp Range:	0 to 140 degrees F. *(-17°C to 60°C)*
Power Supply Options:	
Pneumatic	24 VDC
Hydraulic	120 VAC @ 20 AMP 24 VDC Signal
Actuation Gas;	100 psi Instrument Quality Gas

Note: *at temperatures below 32º F (0º C), conditioning of the actuation gas supply may be required. Where the actuation gas supply has a high water content and/or a low hydrocarbon dew point, additional actuation gas filtration or heating of the actuation gas supply may be necessary. Bottled nitrogen can also be used during cold operating conditions to avoid condensation in the actuation gas supply line. In addition, operation at extreme temperatures may affect system performance. To enhance the performance of this system, adequate heat should be provided to maintain an operating environment above 30° F (-1º C).*

** Refer to Manual Section 4, System Control Options*

Section 1:
First Things To Know About (EP)Light Liquid Samplers

Theory of Operation

The Light Liquid sampling systems are designed to sample light liquid hydrocarbons. Thousands of individual samples are captured and combined to develop a representative, composite sample of the flowing pipeline.

Operation of the sampling system centers around the following primary components: the Sample Pump, the Product Accumulator Vessel, the Precharge Gas Vessel, and the Electronic Control System. All equipment, except probe mounted Sample Pumps are mounted on a steel skid. These components are shown in the diagrams on the following pages.

The sampling system operates on a simple concept. When the system receives a proper flow signal (by others), the solenoid valve or Hydraulic Power Pack is energized. Energizing the solenoid valve, or Hydraulic Power Pack allows a pressurized pulse into the actuation cylinder of the sample pump, which in turn causes the pump to stroke. When the pump strokes, a small sample is displaced into the product accumulator vessel. Once the solenoid valve, or Hydraulic Power Pack is de-energized, the sample pump plunger returns to its normal position. This action allows a new sample bite to be captured in the pump.

The purpose of the YZ light liquid hydrocarbon sampling system is to capture and maintain a representative liquid sample of the pipeline product. The sampled product is maintained in a liquid phase by the product accumulator vessel's free floating piston and the precharge gas system. In order for the system to function properly, pipeline product must be single phase, liquid product.

By properly adjusting both the sample size and the sample frequency, the sample vessel will fill to 80% capacity at the end of the sample period. Once the sample period is complete, the product within the sample receiver is thoroughly mixed using the power mixer. A representative sample can then be removed from the product accumulator vessel using the YZ DuraSite, a DOT approved constant pressure sample vessel, refer to page 32-33.

After removing the remainder of the product from the accumulator vessel, the system is then ready for a new sample period.

System Accessories

- **DuraSite**, portable DOT approved constant pressure sample vessels. Available in 150, 300, 500, 800, and 1000 cc sizes.
- **KK-1, KK-2, & KK-3:** carrying cases for DuraSites that meet DOT requirements for transporting portable sample vessels.
- 1/4" stainless steel tubing **Dielectric Isolator Union**. These should be installed in every tubing line that attaches the sampler to the pipeline in any manner. For example the supply gas, product connection to the system, and differential pressure switch connections, *(P/N A1-0182)*.

A complete line of sampling accessories ranging from sample probes to sample vessels is available through YZ - Milton Roy. Please contact your local representative or YZ - Milton Roy toll free at 800.344.5399. For technical support call 800.653.9435.

Section 1:
First Things To Know About (EP)Light Liquid Samplers

Notes

Section 2: System Installation

Standard Probe Mounted Pump (PNR) System Components

Standard primary components of the Probe Mounted Pump System (PNR-2) include the following:

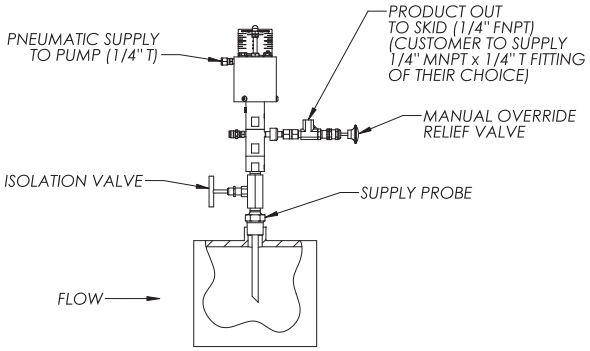
- **Sample Pump,** *figure 1*. Pneumatically or Hydraulically actuated PNR-2 probe mounted Sample Pump.

- **System Skid**, *figure 2 (Pneumatic), figure 3 (Hydraulic), & figure 4 (Both)*. Houses the Accumulator Vessel, Pre-charge Vessel, and System Electronics Enclosure.

- **Product Accumulator Vessel,** *figure 2 (Pneumatic Skid), figure 3 (Hydraulic Skid), figure 4 (Both),* 5 Gallon *(18.93 Liters).*

- **Pre-Charge Vessel,** *figure 2 (Pneumatic Skid), figure 3 (Hydraulic Skid), figure 4 (Both)*.

figure 1



PNR-2P(EP) PUMP MOUNTING DETAIL
(1/4" TUBING CONNECTIONS PROVIDED)

figure 2

Pneumatic

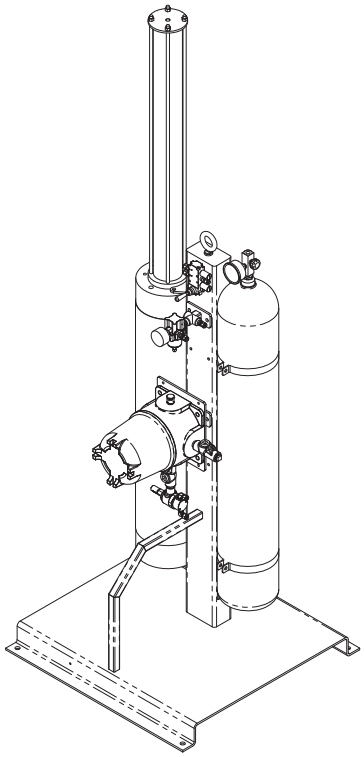
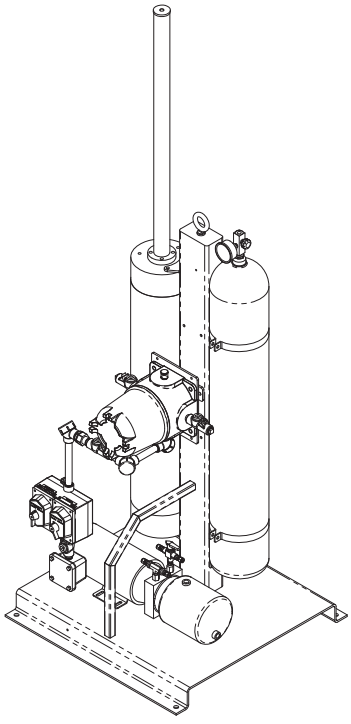


figure 3

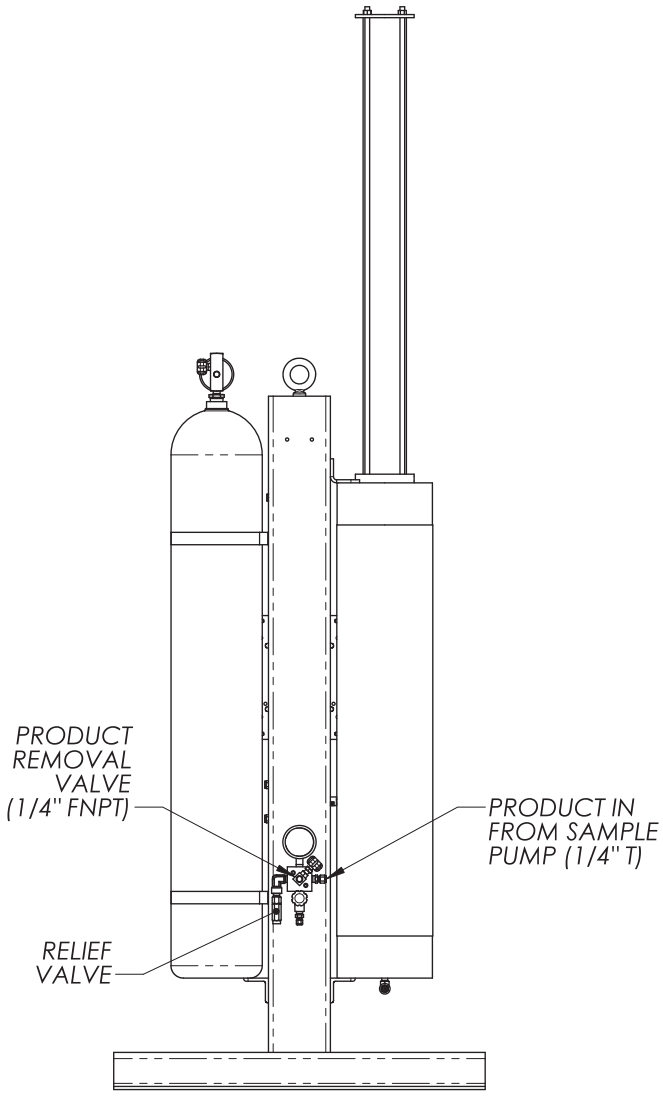
Hydraulic



Standard Probe Mounted Pump (PNR) System Components

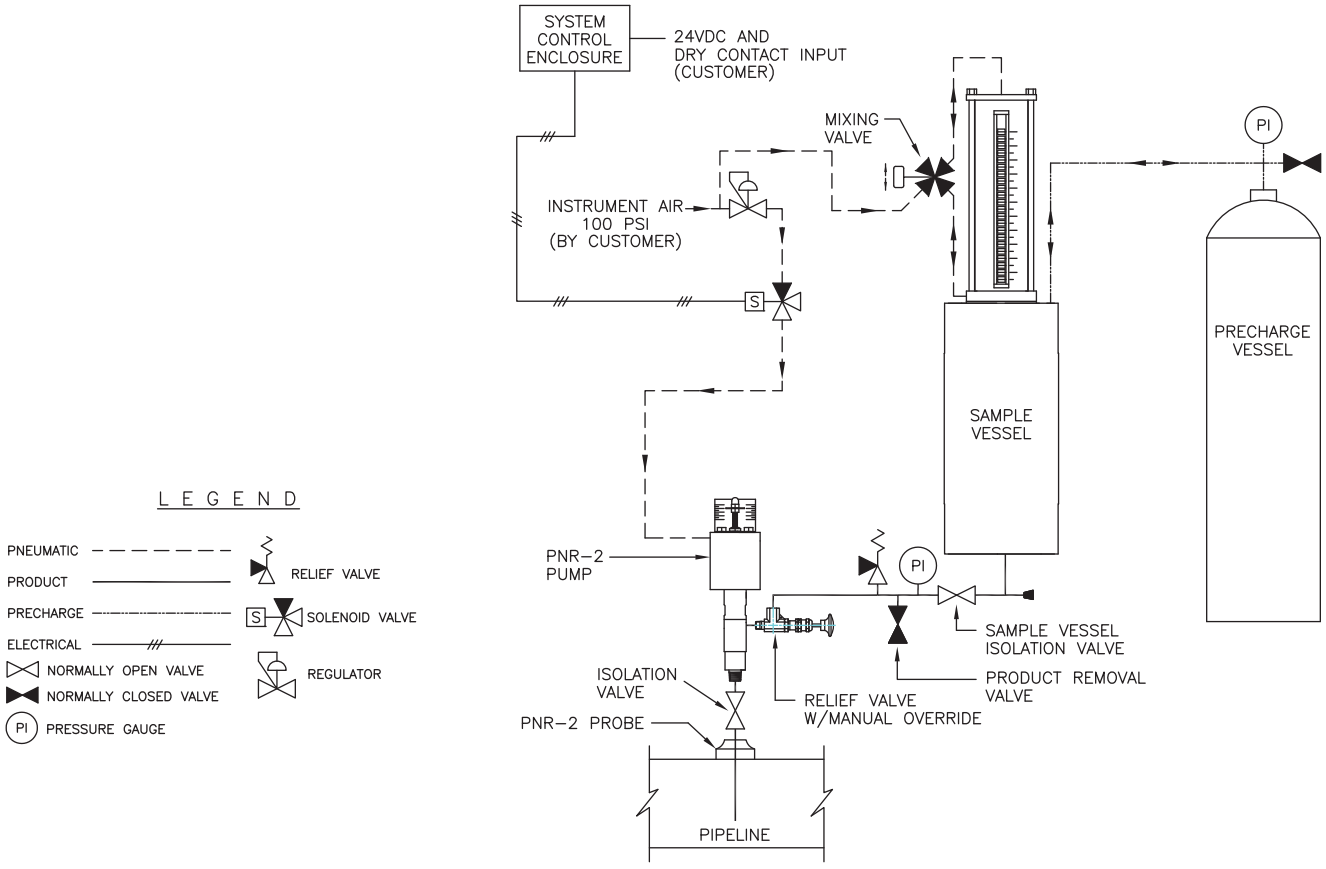
- **Five-Way Cross,** *figure 4,* mounts the Pressure Gage, Relief Valve, Product Isolation, and Product Removal Valves.

figure 4



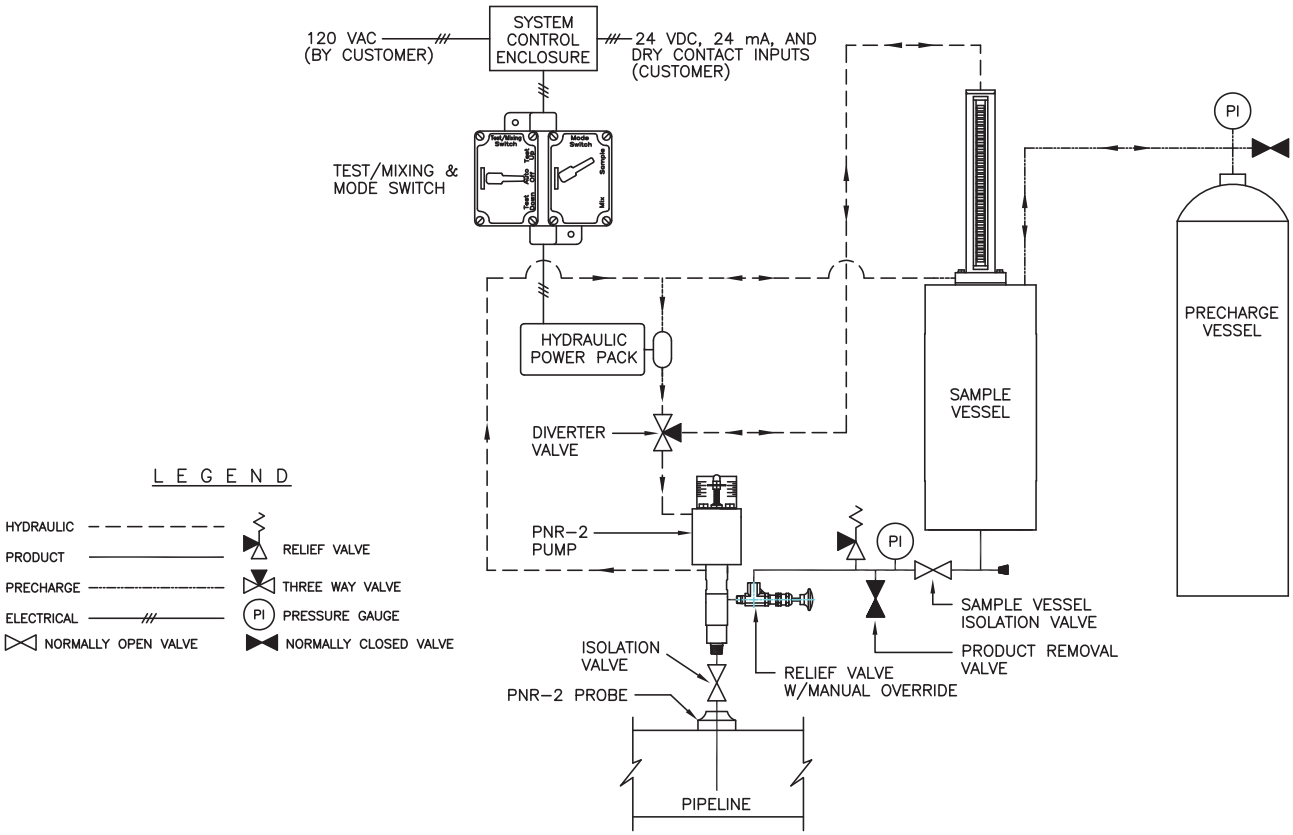
SECTION 2: SYSTEM INSTALLATION
System Pneumatic Actuated Flow Schematic
Probe Mounted PNR-2P (EP)

figure 5



System Hydraulic Actuated Flow Schematic
Probe Mounted PNR-2H (EP)

figure 6



Standard Skid Mounting

1. Bolt down the system skid to a concrete slab using the mounting holes (5/8”) provided in the bottom of the skid. Recommended bolt/stud sizes for mounting the skid is 1/2”, figure 7.

2. Connect a ground wire from the grounding lug located on the skid to a properly installed ground rod, located adjacent to the system skid, figure 7.

figure 7

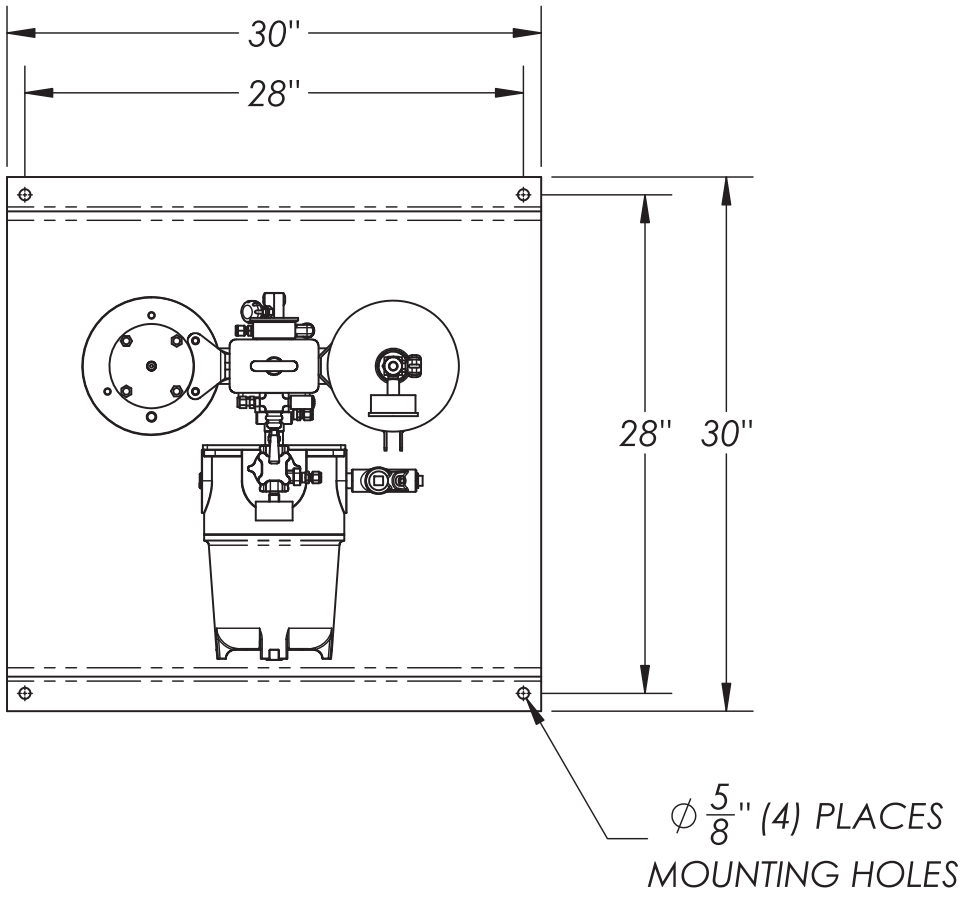


figure 13

Standard Probe Mounted Pneumatic Actuated Skid System (PNR-2S-5P) Connections

Pump Installation

The PNR-2 sample pump is designed to be mounted directly to a threaded connection on the pipeline, *figure 8*. The probe tubing should be cut such that the tip of the probe will be located in the center 1/3 of the pipeline after installation. After the pipeline has been depressurized, the threads on the probe body should be taped and doped and the pump installed into the pipeline connection.

Skid Installation

The skid should be located as close as possible to the pipeline. 1/4" stainless steel tubing should be field routed from the probe mounted Sample Pump, "product out" connection to the skid mounted 5-Way Cross, port tagged "product in". Likewise, 1/4" stainless steel tubing should be field routed from the pump port tagged "pneumatic supply" back to the Pneumatic Solenoid on the skid. These tubing lines should both incorporate a dielectric isolation fitting between the sample skid and the probe mounted Sample Pump. Care should be taken in routing this tubing to prevent traps, long runs, etc.

CAUTION:

Excessive tubing lengths should be avoided. Installation of the sample system enclosure should be as close to the point of sample removal and the sample pump as possible. If longer tubing lengths are required consult YZ Systems Technical Services at; 800.653.9435 or 1.281.362.6500.

Electrical Connections

A customer supplied power supply must be connected to control the system via the side opening of the electrical enclosure labled for it. The wiring for the flow signal should be connected to the control the system via the side opening of the electrical enclosure labled for signal. All electrical connections are typically designed for ½" NPT conduit connections, refer to Section 4, Electrical Wiring for connection details.

figure 8

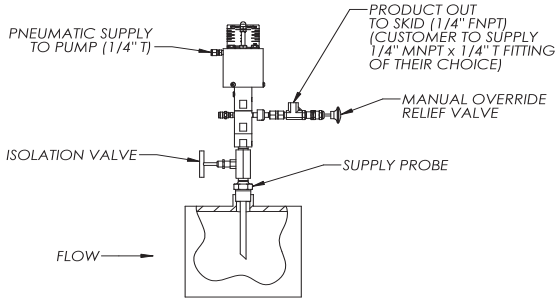


figure 9

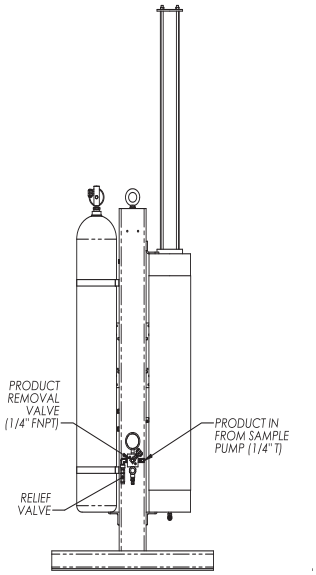
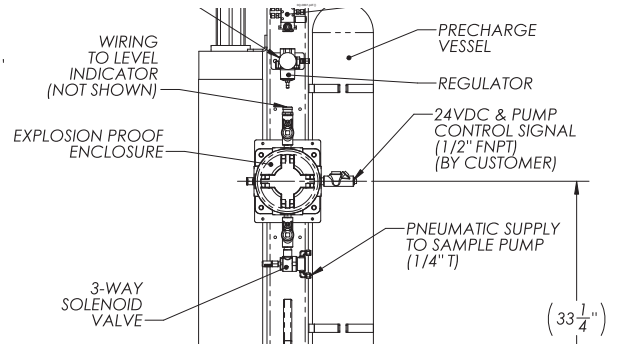


figure 10



Standard Probe Mounted Hydraulic Actuated Skid System (PNR-2S-5H) Connections

Pump Installation

The PNR-2 sample pump is designed to be mounted directly to a threaded connection on the pipeline, *figure 11*. The probe tubing should be cut such that the tip of the probe will be located in the center 1/3 of the pipeline after installation. After the pipeline has been depressurized, the threads on the probe body should be taped and doped and the pump installed into the pipeline connection.

System Skid Installation

The system skid portion of the sampler should be located as close as possible to the sample pump. 1/4" stainless steel tubing should be field routed from the Sample Pump discharge check (product out), *figure 11*, to the Five-Way Cross connection (product in), *figure 12 (front)* on the Skid. Care should be taken in routing tubing to prevent traps, long runs, etc.

1/4" - 3/8" stainless steel tubing should also be field routed from the connection on the Sample Pump labeled hydraulic supply (from skid), *figure 13,* to the hydraulic supply to pump connection on the system Skid, *figure 13 (rear)*. Additionally1/4" - 3/8" stainless steel tubing should also be field routed from the connection on the Sample Pump labeled hydraulic return (from skid), *figure 13,* to the hydraulic return from pump connection on the system skid, *figure 13(rear)*.

CAUTION:

Excessive tubing lengths should be avoided. Installation of the sample system Skid should be as close to the point of sample removal and the sample pump as possible. If longer tubing lengths are required consult YZ Systems Technical Services at; 800.653.9435 or 1.281.362.6500.

figure 11

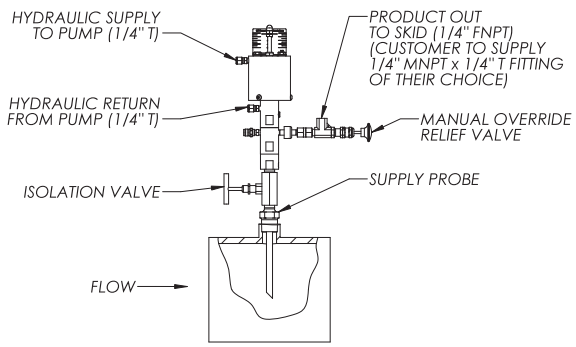


figure 12

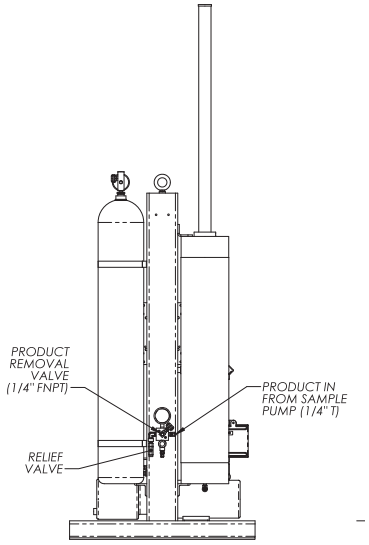
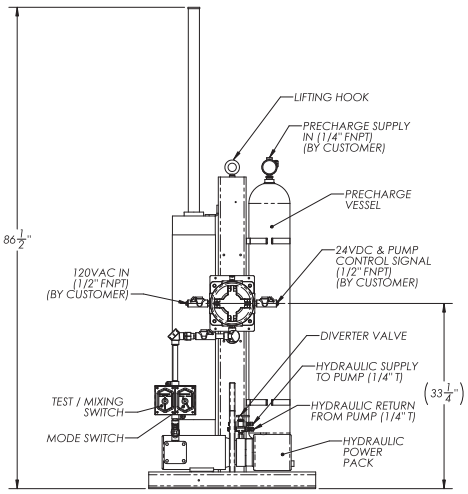


figure 13



Standard Probe Mounted Hydraulic Actuated Skid System (PNR-2S-5H) Connections

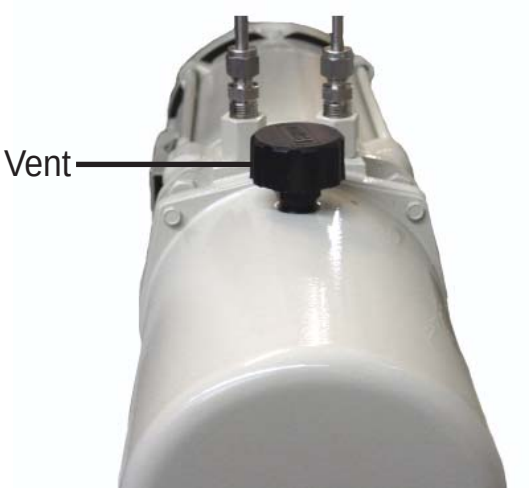
Electrical Connections
120 VAC, 60 Hz electrical power, and the flow signal should be connected to the left side opening for the electrical Skid *figure 13 (rear)*.

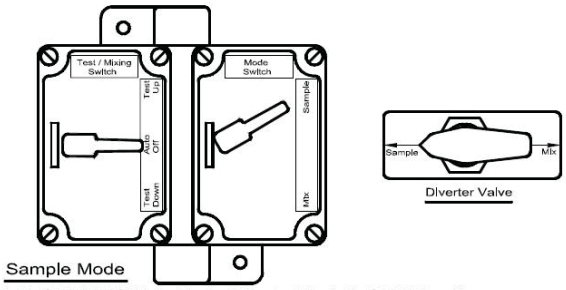
Pump Sample Size
The sample size of the PNR-2 is adjustable. The sample grab size of the pump is adjusted by loosening the lock/seal nut on top of the pump and turning the volume adjustment screw in to decrease the sample volume or out to increase the sample volume. Once the new sample size has been set, the lock/seal nut should be retightened. Refere to section 2 Page 13.

Hydraulic Power Pack Breather
Remove the 3/8" NPT plug located in the top of the power pack reservoir. Install the breather provided with the skid.

Hydraulic Pump Line Purging
During this process, check the fluid level in the hydraulic oil reservoir frequently to assure that you do not run low on fluid. Slightly loosen the return connection tubing connection on the System Skid. When the Hydraulic Power Pack is actuated in this mode air will escape at this connection. Verify that the electrical Mode Switch is in the **Mix Mode**, and the manual Diverter Valve is set to **Sample**. Now use the electrical Test Switch to actuate the Hydraulic Power Pack. Hold in the **Test** position until you get hydraulic fluid at the hydraulic return connection. As soon as you get fluid at this connection, release the Test switch, and tighten the connection.

figure 14

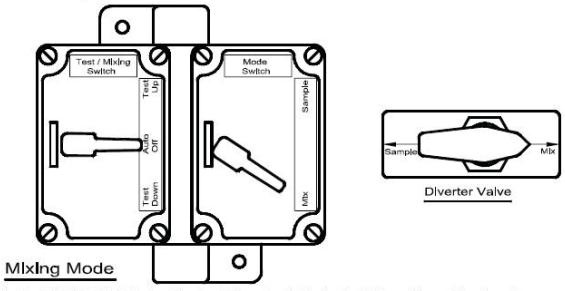




Sample Mode

In the SAMPLE MODE, the Diverter Valve should be in the SAMPLE position. Likewise, the mode switch should be in the SAMPLE position. This will enable the Test / Mixing switch to be used as a test switch to verify proper operation of the sample pump.

To verify the operation of the sample pump, move the Test / Mixing switch either up or down to test position and release.



Mixing Mode

In the MIXING MODE, the Diverter Valve should be in the MIX position. Likewise, the mode switch should be in the MIX position. This will enable the Test / Mixing switch to be used as a mixing switch. In this position, the mixing rod and disc can be moved up and down through the product stored in the sample vessel to insure a homogeneous mixture.

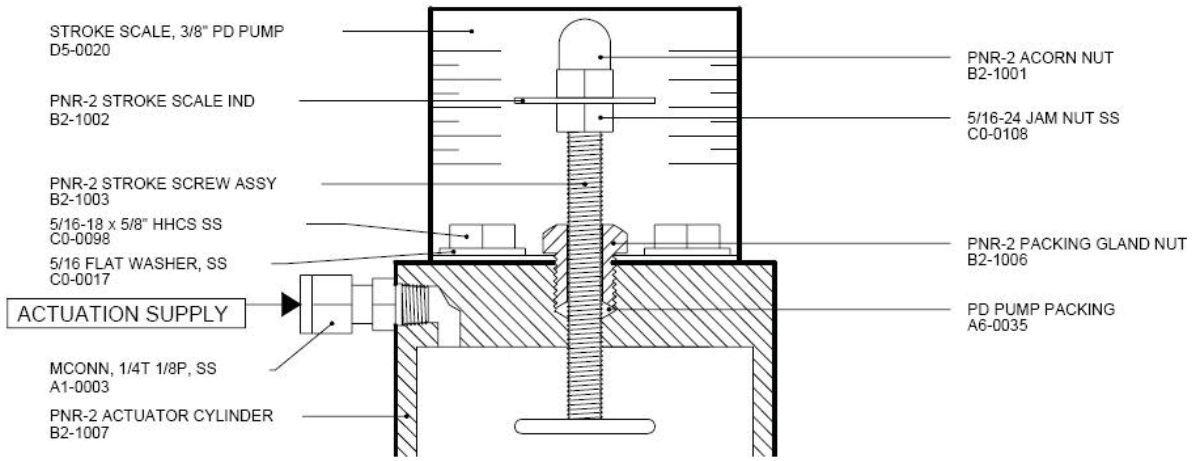
Pump Sample Size

The sample size of the PNR-2 Pump is adjustable. Sample grab size of the pump is adjusted by loosening the 5/16 jam nut on top of the pump and turning the volume adjustment screw acorn nut in to decrease the sample volume or out to increase the sample volume. Once the new sample size has been set, the jam nut should be retightened.

Pump Displacement:

Std. 3/8" Plunger	.25 - 1.8 cc/Stroke
Opt.1/2" Plunger	0.8 - 3.2 cc/Stroke
Opt.5/8" Plunger	1.25 - 5.0cc/Stroke
Opt.1" Plunger	1.6 - 12.8cc/StrokeThe

figure 15



Notes

Section 3: Filling the Pre-Charge Vessel

The purpose of the precharge system is to keep the sampled product in a liquid phase. This is accomplished by maintaining a precharge pressure on top of the accumulator vessel piston. The precharge vessel provides additional volume to the precharge system, which minimizes the pressure increase within the product accumulator as it fills.

Prior to placing the sampler into service, it is necessary that the precharge system be charged to a pressure at least 100 psi greater than the product vapor pressure. For example, if a product with a vapor pressure of 300 psi is being sampled, a precharge pressure of 400 psi would be required. Servicing the precharge vessel is done using the isolation valve located on top of the precharge vessel. Please note that the valve isolates the precharge system from the atmosphere, and does not separate the precharge vessel from the accumulator vessel. Also, the precharge vessel is shipped with 10 psi of blanket pressure. Normally this Pre-Charge vessel should only need to be filled one time at the installation of the sampler system, as the gas is not consumed in the sampling process.

CAUTION:

Take necessary precautions when working with Nitrogen Vessels, as the high pressure contained within is dangerous Additionally, all personnel should wear protective clothing, and use equipment as recommended by the manufacturer during this time. If you are uncertain about any aspect of the Nitrogen Vessel itself, you should contact the manufacturer of your Vessel prior to proceeding.

Filling the Vessel

1. Connect the precharge gas source (normally nitrogen) to the isolation valve 1/4" NPT connection located on top of the precharge vessel.

2. Open the isolation valve.

3. Fill the precharge vessel with gas until the pressure in the vessel is 100 to 150 psi above the vapor pressure of the product to be sampled.

4. Once the vessel is filled, close the isolation valve and remove the precharge gas source.

5. Leak test all connections between the precharge vessel and the product accumulator vessel.

6. Continue through the remaining procedures in this manual.

Section 3: Filling the Pre-Charge Vessel

Notes

Section 4: System Control & Electronics

Overview

The electronic control package provided with your sampling system consist of a simple solenoid or Hydraulic Powerpack which interfaces with a 24 VDC pulse from an outside control system to operate it, The control system must send a mimimum 3 second actuation pulse to the sample pump for pneumatic operation, or a 5 sec.pulse for Hydraulic operation. This allows sufficient time to stroke the sample pump and retrieve a single sample.

SAFETY NOTES

- Always use extreme care when performing maintenance on Sampling Systems. Always take necessary measures to assure that electrical classification in the area is considered, before, and during all repairs, and that necessary steps are taken to maintain proper electrical procedures for the classification of the area.

All electronic controls are housed in explosion proof enclosures and are rated for use in Class I, Division 1, Groups C and D hazardous locations, or are Intrinsically Safe for installation in Class I, Division 1, Groups C and D hazardous locations.

By properly adjusting both the sample size and the sample frequency, the sample vessel will fill to 80% capacity at the end of the sample period.

Refer to apropriate control option wiring information on the following pages.

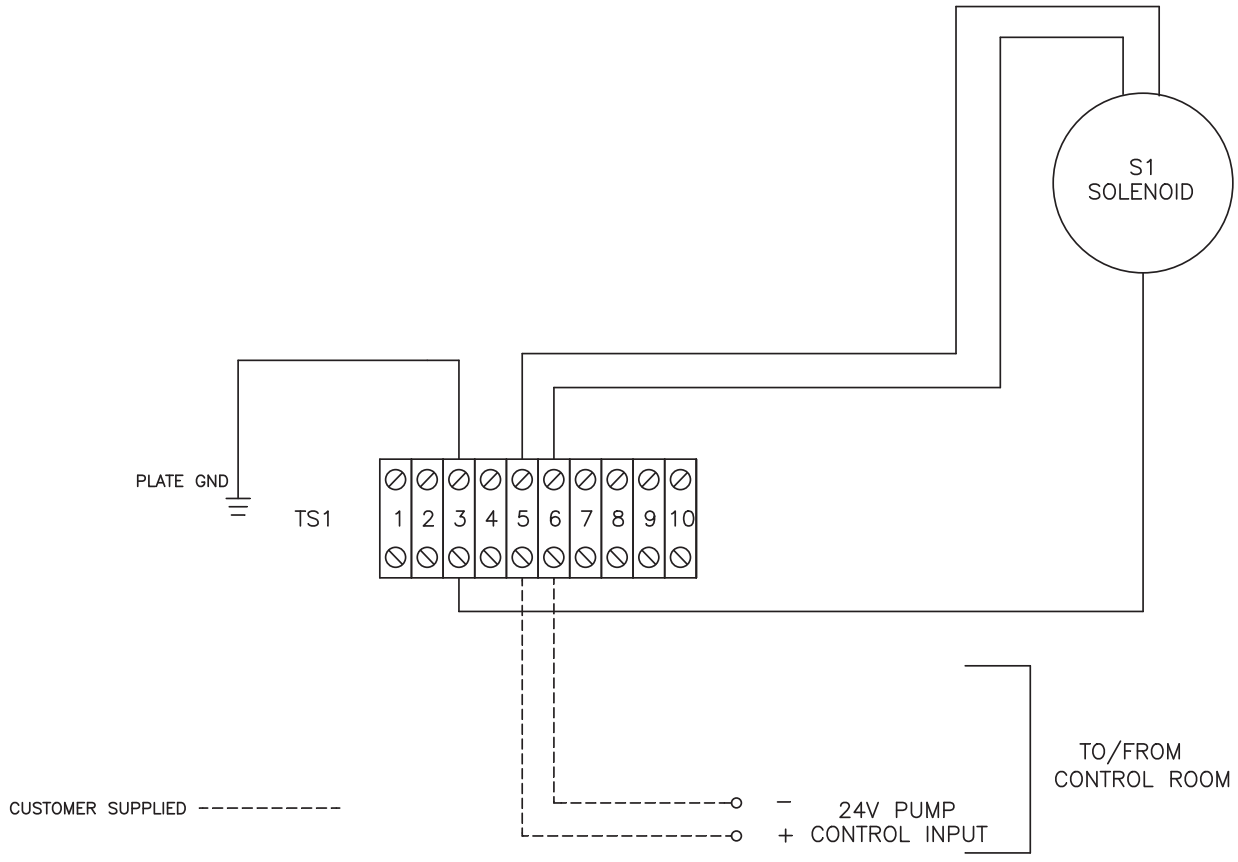
Section 4: System Control & Electronics

Pneumatic Actuated "- 0A-P" Control Option

The electronic control package provided this sampling system consist of a simple solenoid which interfaces with an outside customer supplied power supply/control system to operate it. The control system must send a mimimum 3 second 24 VDC actuation pulse to the solenoid connections at terminals 5 and 6. This 3 second duration allows sufficient time for the solenoid to actuate the sample pump and retrieve a single sample.

Proper programing of the customer supplied control unit should allow the sample vessel to fill to 80% capacity at the end of the sample period.

figure 16



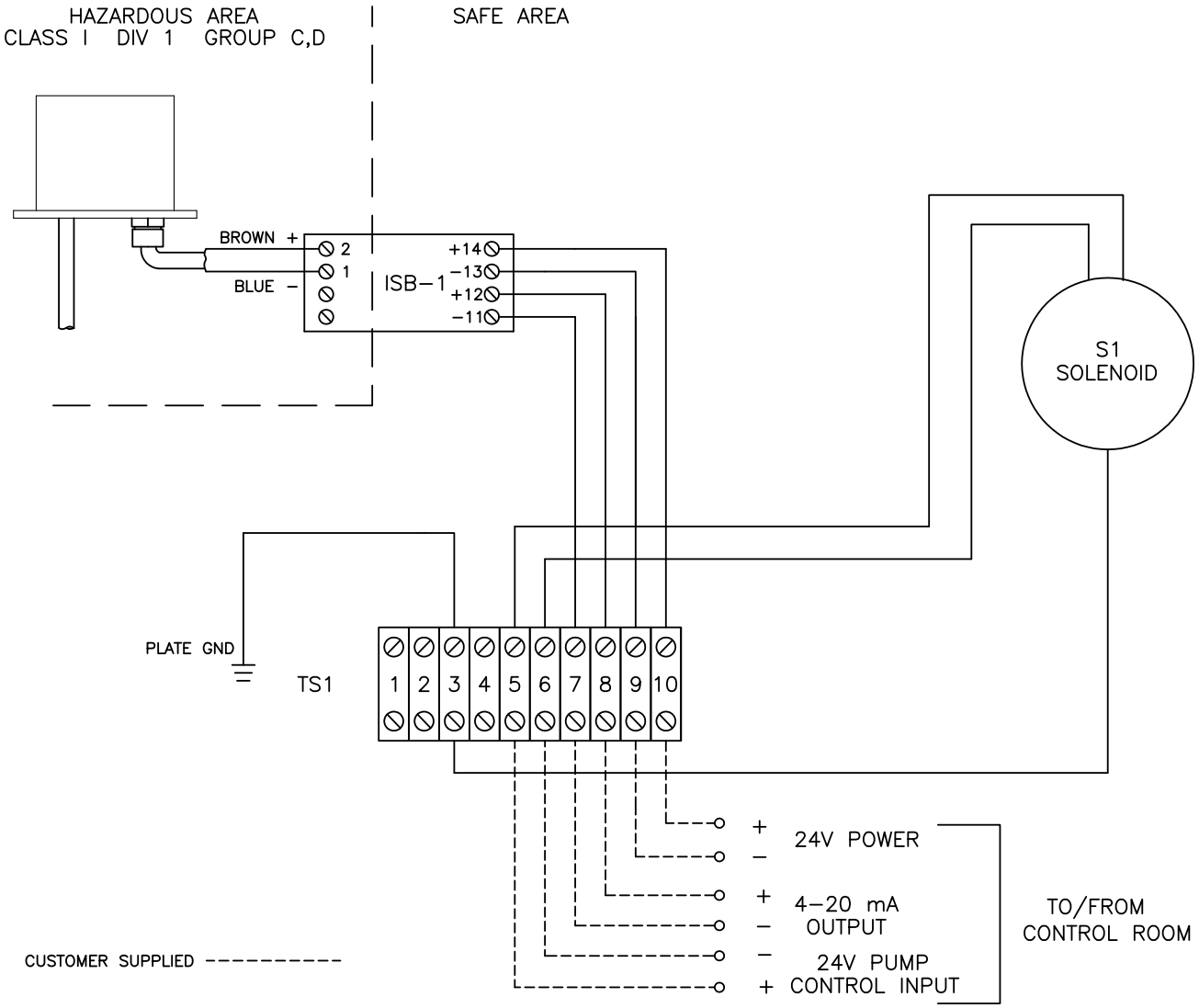
Section 4: System Control & Electronics

Pneumatic Actuated "- 0A-PL" Control Option

The electronic control package provided this sampling system consist of a simple solenoid which interfaces with an outside customer supplied power supply/control system to operate it. The control system must send a mimimum 3 second 24 VDC actuation pulse to the solenoid connections at terminals 5 and 6. This 3 second duration allows sufficient time for the solenoid to actuate the sample pump and retrieve a single sample.

Proper programing of the customer supplied control unit should allow the sample vessel to fill to 80% capacity at the end of the sample period.

This control option also includs an electronic level monitoring system for the 5 gallon vessel. It must be suuplied with a 24 VDC power source at terminals 9 and 10, and returns a 4-20mA level monitoring signal via terminals 7 and 8.
figure 17



Section 4: System Control & Electronics

Hydraulic Actuated "- 0A-H" Control Option

The electronic control package provided with this sampling system consists of a solid state Relay. The converts the 24 VDC pulse from your flow monitoring interface into a 5 second 120 VAC voltage output to the hydraulic power pack, everytime a contact closure occurs. This 5 second duration allows sufficient time to actuate the sample pump and retrieve a single sample.

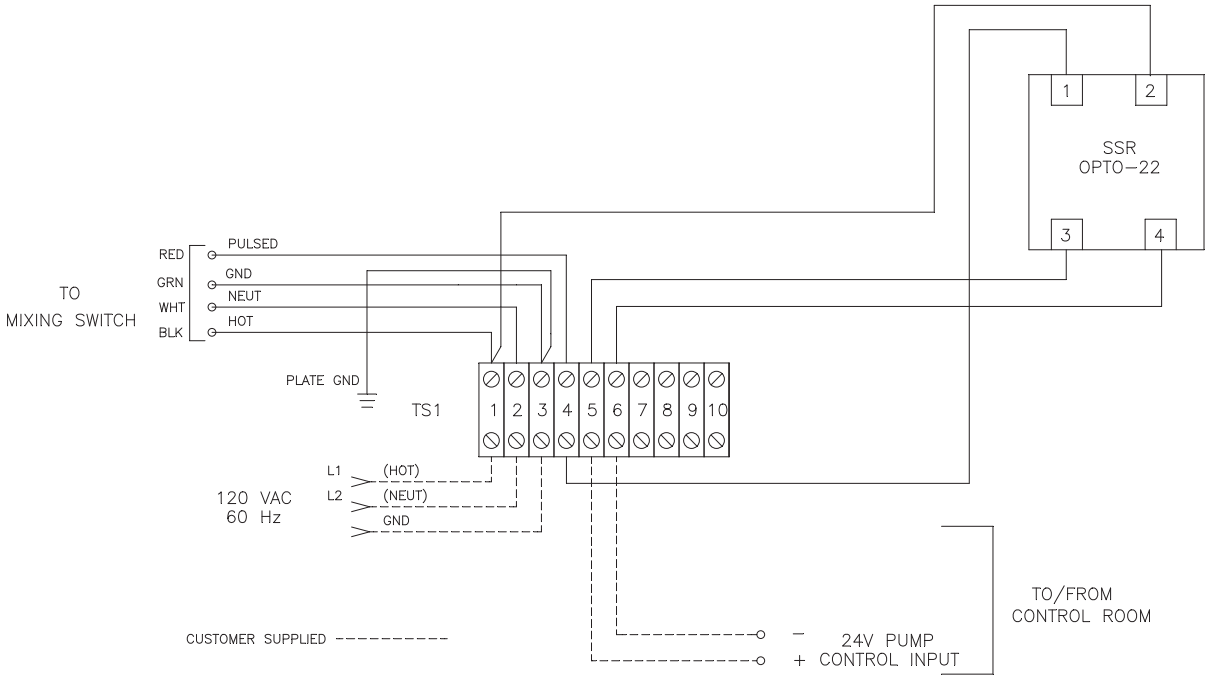
SAFETY NOTES

- Always use extreme care when performing maintenance on Sampling Systems. Always take necessary measures to assure that electrical classification in the area is considered, before, and during all repairs, and that necessary steps are taken to maintain proper electrical procedures for the classification of the area.

The control package requires you to provide 120 VAC at terminals 1, 2 and 3. You are also required to provide 24 VDC pulse from your flow monitoring interface to terminals 5 and 6, in order to stroke the pump. All electronics are housed in explosion proof enclosures and are rated for use in Class I, Division 1, Groups C and D hazardous, locations.

This control option also includes an electronic level monitoring system for the 5 gallon vessel. It must be suuplied with a 24 VDC power source at terminals 9 and 10, and returns a 4-20mA level monitoring signal via terminals 7 and 8.

figure 18



Section 4: System Control & Electronics

Hydraulic Actuated "- 0A-HL" Control Option

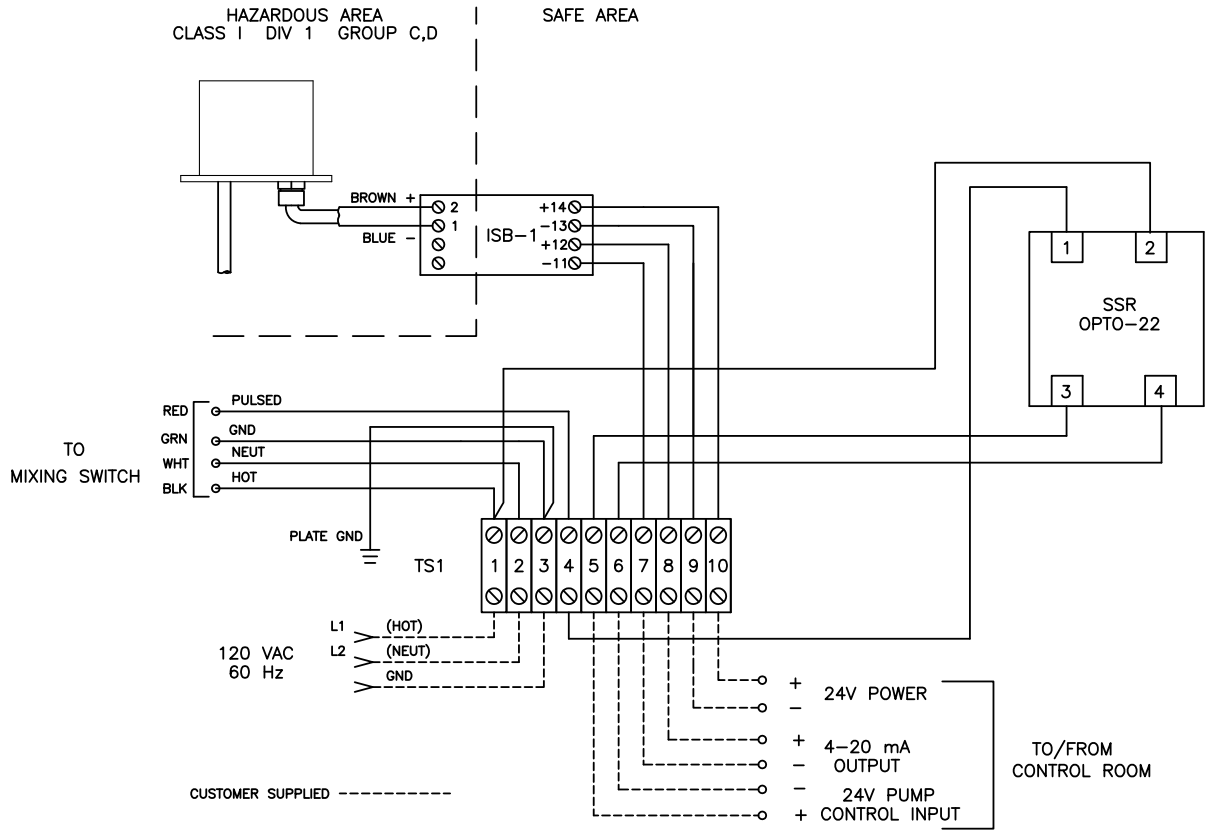
The electronic control package provided with this sampling system consists of a solid state Relay. The converts the 24 VDC pulse from your flow monitoring interface into a 5 second 120 VAC voltage output to the hydraulic power pack, everytime a contact closure occurs. This 5 second duration allows sufficient time to actuate the sample pump and retrieve a single sample.

SAFETY NOTES

- Always use extreme care when performing maintenance on Sampling Systems. Always take necessary measures to assure that electrical classification in the area is considered, before, and during all repairs, and that necessary steps are taken to maintain proper electrical procedures for the classification of the area.

The control package requires you to provide 120 VAC at terminals 1, 2 and 3. You are also required to provide 24 VDC pulse from your flow monitoring interface to terminals 5 and 6, in order to stroke the pump. All electronics are housed in explosion proof enclosures and are rated for use in Class I, Division 1, Groups C and D hazardous, locations.

This control option also includes an electronic level monitoring system for the 5 gallon vessel. It must be suuplied with a 24 VDC power source at terminals 9 and 10, and returns a 4-20mA level monitoring signal via terminals 7 and 8.
figure 19



Section 4: System Control & Electronics

Notes

Section 5: Programming for Operation

Setting Operator Input Parameters

The Light Liquid sampling systems are designed to sample light liquid hydrocarbons. Thousands of individual samples are captured and combined to develop a representative, composite sample of the flowing pipeline.

Operation of the sampling system centers around the following primary components: the Sample Pump, the Product Accumulator Vessel, the Precharge Gas Vessel, and the Electronic Control System. The following pages provide specific details for setting up your system for operation.

The sampling system operates on a simple concept. When the system receives a proper flow signal (by others), the electronic control unit energizes either a solenoid valve, or a Hydraulic Power Pack. Energizing the solenoid valve, or Hydraulic Power Pack allows a pressurized pulse into the actuation cylinder of the sample pump, which in turn causes the pump to stroke. When the pump strokes, a small sample is displaced into the product accumulator vessel. Once the solenoid valve, or Hydraulic Power Pack is de-energized, the sample pump plunger returns to its normal position. This action allows a new sample into the pump.

The purpose of the YZ light liquid hydrocarbon sampling system is to capture and maintain a representative liquid sample of the pipeline product. The sampled product is maintained in a liquid phase by the product accumulator vessel's free floating piston and the precharge gas system. In order for the system to function properly, pipeline product must be single phase, liquid product.

By properly adjusting both the sample size and the sample frequency, the sample vessel will fill to 80% capacity at the end of the sample period.

Section 5: Programming for Operation

Setting Operator Input Parameters "-0"

Control Options

The electronic control package for this sampling system is completely customer provided. The system is provided with a Solenoid or Hydraulic Power Pack to actuate the sample pump which requires a voltage pulsed signal with a dwell time of 3-5 seconds to properly actuate the sample pump. This 3-5 second duration allows sufficient time to stroke the sample pump and retrieve a single sample.

SAFETY NOTES

- Always use extreme care when performing maintenance on Sampling Systems. Always take necessary measures to assure that electrical classification in the area is considered, before, and during all repairs, and that necessary steps are taken to maintain proper electrical procedures for the classification of the area.

All electronics control components are housed in explosion proof enclosures and are rated for use in Class I, Division 1, Groups C and D hazardous locations.

The customer supplied control system should be programed to operate in the following manner.

figure 20

Calculating Metered Volume per Pulse:

A = 4,542 cc (80% of 1.5 gallon vessel)
B = 2,000 Barrels of Product/Day
C = 30 Days
D = Pump Displacement per Stroke

$$\frac{4{,}545\ cc}{30\ Days} = 151.4cc\ of\ Sample\ Volume/Day$$

$$\frac{151.4cc\ of\ Sample\ Volume/Day}{1.8\ cc/Pump\ Stroke} = 84\ Pump\ Strokes/Day$$

$$\frac{2{,}000\ BBl/Day}{84\ Pump\ Strokes/Day} = 23.8\ Barrels\ per\ Pulse\ Setting$$

Notes

Section 6: Mechanical System

PNR-2 Sample Pump & Discharge Valve

The PNR-2P Sample Pump, refer to Apendix A, page 45, is a positive displacement plunger pump designed to be mounted directly on the pipeline. It has an adjustable displacement of 0.25 to 1.8cc and achieves proportional-to-flow sampling through adjustment of the system electronic control discussed in Section 5.

As the plunger returns upward after completing a stroke, the pump chamber fills with product through the inlet check valve. The inlet check valve is a dart type valve designed to seat on an o-ring. The inlet check valve is spring loaded to ensure a positive seating action after every stroke. When the pump is actuated , the plunger moves downward, displacing product through the discharge check valve.

The Discharge Valve, requres adjustment to maintain pipeline pressure or above to ensure that product is not allowed to free flow to the product vessel. When the pipeline pressure is greater than the precharge pressure on the accumulator vessel, the discharge valve dart is pushed against the seat. As the pump strokes, the pressure created in the pump chamber forces the discharge valve dart off the seat, allowing product to be pumped to the accumulator vessel. Once the pump completes its stroke, the pressure across the discharge valve equalizes and the dart is returned to a sealing position by its spring.

In the event that the accumulator vessel precharge pressure is greater than the pipeline pressure, the balance valve dart and seat are pushed apart by the product pressure in the accumulator vessel. In this situation the check valve wafer located between the balance valve and the sample pump acts as a back check to prevent the escape of product previously captured in the accumulator vessel. As the pump strokes, the pressure created in the pump chamber forces the check valve wafer off the seat, allowing product to be pumped to the accumulator vessel. Once the pump completes its stroke, the pressure across the check valve equalizes and the wafer is returned to a sealing position by its spring.

Section 6: Mechanical System

Accumulator Vessel

The YZ Product Accumulator Vessel, refer to Apendix A, page 49 & 52, is designed to maintain a composite sample in the liquid phase. This is accomplished by using a free-floating piston design and an inert precharge gas system, refer to Apendix A, page 48. As product is collected in the accumulator vessel, the precharge gas system maintains a constant pressure on top of the vessel piston. If this pressure is at least 100 to 150 psi above the vapor pressure of the product being sampled, the sampled product will be prevented from flashing to the vapor phase.

Product enters the cylinder through the head in the bottom of the cylinder. This head is the accumulator vessel product head. The precharge gas is communicated to the accumulator vessel through the precharge head, which is located on the top of the accumulator cylinder.

The actuator assembly is located on the top of the accumulator cylinder and serves two functions. The first is to provide mixing of the sampled product by moving the mixing disc up and down within the product portion of the accumulator cylinder. This is done by introducing pressure to one side of the mixer piston assembly and then by applying pressure to the opposite side of the mixer piston assembly.

The second function of the actuator assembly is to provide indication of the amount of product collected within the vessel. This is shown locally on the magnetic volume scale mounted on the actuator assembly cylinder.

Section 6: Mechanical System

5-Way Cross

The Five-way Cross Assembly, refer to Apendix A, page 47, is located on the front of the skid and includes the following items: product inlet tubing fitting, pressure gauge, relief valve, rob valve, accumulator vessel isolation valve/discharge tubing fitting, and the five-way cross.

The pressure gauge is used during normal operation to indicate the pressure within the accumulator vessel. During start-up and troubleshooting procedures it is used in conjunction with the accumulator vessel isolation valve to check pump performance.

The YZ relief valve is a reseating type valve which is factory set to relieve at 1800 psi. Also incorporated into the relief valve design is a positive indication feature which indicates that it has relieved. If the system reaches a pressure greater than the relief valve setting, the resulting release of product pushes the black relief valve indicator outside the relief valve body. This informs the system operator during his next system check that an over pressure condition has occurred. The indicator is reset by pushing it back into the relief valve body.

The rob valve is a YZ needle valve which is used to remove product from the accumulator vessel at the end of the sample period. This valve is normally closed.

The accumulator vessel isolation valve is used to isolate the accumulator vessel from the rest of the product carrying portion of the sampling system. This valve is normally open.

Section 6: Mechanical System

Actuation/Mixing System (Pneumatic)

The function of the 80 psi instrument air supply is to provide an actuation power source for the sample pump and the accumulator vessel mixing system, refer to Apendix A, page 50 - 54. Constructed as an integral component of the entire sampling system, the entire system is pressure tested at the factory prior to shipment.

The instrument air source is internally connected to individual components within the sampler system. These split the pneumatic source between sample pump actuation and accumulator vessel mixing. The “actuation” leg is piped to a pressure regulator (factory set at 38 psi) and on to a three-way proof solenoid valve. This solenoid valve is normally closed and is mounted in the sample system enclosure. It is opened when energized by the sampler electronic control package. Opening the solenoid valve allows pneumatic pressure to actuate the sample pump. The actuation tubing to the Sample Pump from the solenoid connection must be field installed by the customer.

The “mixing” leg of the system is tubed directly to the inlet of the accumulator mixing valve. The inlet is located on the right side of the switch. The mixing switch is a three position switch, with the center position being the off position. When the mixing switch is moved to the up position, the mixing disc is moved up in the product accumulator. Moving the mixing switch to the down position causes the product accumulator mixing disc to move down in the product accumulator. The sample in the accumulator vessel is mixed by moving the mixing handle alternately up and then down. Four or fives passes through the sample should provide sufficient mixing.

Section 6: Mechanical System

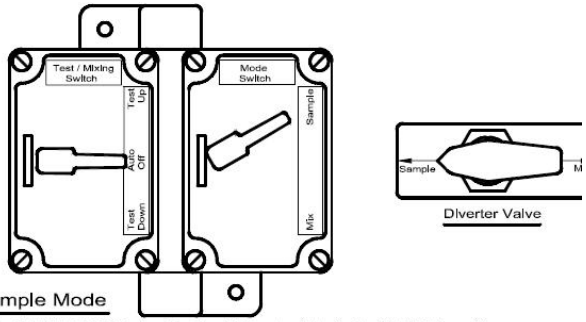
Actuation/Mixing System (Hydraulic)

The function of the hydraulic power pack is to provide a hydraulic actuation power source to the sample pump and the power mixing system on the product accumulator vessel, refer to Apendix A, page 52. The power pack is a unitized system that consists of a pump, motor, and four (4) quart reservoir. Mounted directly on the sample skid, the power pack is factory wired to the Mix/Mode switch, and the Counter. It is ready for wiring to the power supply and control function device (customer supplied). The Hydraulic Power Pack has been factory tested as an integral component of the entire sampling system, the power pack is filled with hydraulic fluid at the factory prior to shipment; however, after you install the sampler skid check the fluid level, and add additional fluid if required.

The oil level should be about 3/4" below the vent fitting on the oil reservoir. The system was originally filled with Phillips *MAGNUS "A"KV 5W-20* oil. This oil or equivalent should be used. If another type oil is desired, the entire system should be drained. Acceptable oils are clean hydraulic oil with a viscosity range of 150-300 SSU at 100° F. Recommended operating temperatures are 10° F to 165° F.

The power pack operates in one of two modes - the Sample mode or the Mix mode. In the Sample mode, the power pack actuates the sample pump when the electrical control device (customer supplied) determines it is time to take a sample. In the Mix mode, the power pack is used to move the mixing disc in the product accumulator vessel.

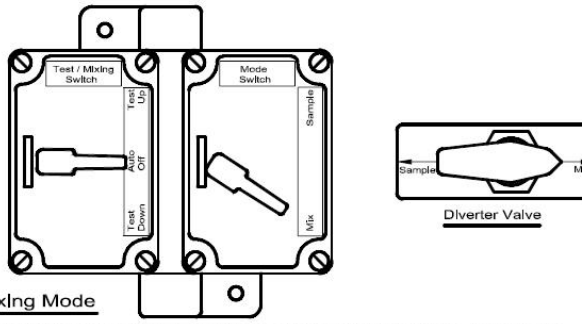
Control of the power pack is accomplished using a hydraulic fluid diverter valve, two electrical switches, and the Counter. The diverter valve is mounted on the discharge side of the power pack pump and has two positions-**Sample** and **Mix**. The electrical switches are located above the Hydraulic Power Pack. The switch on the right side is the mode switch and has two positions - "**Sample**" and "**Mix**". The switch on the left side is the Test/Mixing Switch and has three positions. The function of this three position switch is dependent upon the position of the mode switch and the diverter valve.



Sample Mode

In the SAMPLE MODE, the Diverter Valve should be in the SAMPLE position. Likewise, the mode switch should be in the SAMPLE position. This will enable the Test / Mixing switch to be used as a test switch to verify proper operation of the sample pump.

To verify the operation of the sample pump, move the Test / Mixing switch either up or down to test position and release.



Mixing Mode

In the MIXING MODE, the Diverter Valve should be in the MIX position. Likewise, the mode switch should be in the MIX position. This will enable the Test / Mixing switch to be used as a mixing switch. In this position, the mixing rod and disc can be moved up and down through the product stored in the sample vessel to insure a homogeneous mixture.

To mix product, move the Test / Mixing switch to the UP position. this will move the mixing disc up. Move the Test / Mixing switch to the DOWN position to move the mixing disc down.

Section 7: System Operation
Preparing The System for Operation

Sample Pump Priming
Before the pump begins normal operation after initial installation or maintenance, the sample pump must be purged of all air in the sample chamber. The purge valve on the Sample Pump/ Balance Valve, refer to Apendix A, page 49-46, is used to evacuate the air from the chamber and to make sure the pump is liquid-packed. If the pump is not purged before being placed into operation, it will not function properly.

To purge the pump, open the purge valve located on the side of the Sample Pump/Discharge Valve assembly. The product supply valve can then be opened to allow pipeline product to purge the air within the pump. Once product begins exiting the purge valve, close the purge valve. The sample pump is now ready to begin operation.

Product Line Test
Close the isolation valve located on the bottom of the Five-way Cross Assembly, refer to Apendix A, page 47. Stroke the sample pump until the system pressure reaches 1800 psi on the Five-Way Cross Assembly Gauge. The pressure should hold steady between pump strokes. Once the system is at 1800 psi, leak test all connections. Once the system has been tested, open the isolation valve located on the bottom of the Five-Way Cross Assembly.

Sample Vessel Connection
Connect a constant pressure portable sample vessel (DuraSite) to the rob valve located on the Five-way Cross Assembly, refer to Apendix A, page 47 using a short section of 1/8” or 1/4” stainless steel tubing. The portable sample vessel must also be precharged to 100-150 psi above the vapor pressure of the product, refer to page 32. Open the rob valve allow product into the DuraSite as the pump takes samples. Close the rob valve and remove the sample vessel from the rob valve, at the end of each sample cycle, and replace it with a clean empty vessel for the next cycle.

Section 7: System Operation

DuraSite Sample Vessel Connection
Purpose: The DuraSite Portable Sample Vessel permits the user to remove a liquid or gas hydrocarbon sample from a pipeline or a sampling device. This is accomplished without changing the pressure of the product or exposing it to a
contaminant fluid. If properly used and maintained the DuraSite will provide many years of safe, accurate and clean sampling.

Use: The DuraSite is a very safe device to use. As with any equipment dealing with flammable products, it is mandatory that a good, thorough operator training procedure be established prior to use.

Typical use of the cylinder would be as follows:

Step 1: (In The Lab) Connect a regulated inert gas supply to the pre-charge valve. The product valve should be open. By carefully controlling the pre-charge valve and the regulator, the cylinder can be slowly charged with pre-charge gas (NOTE: This should be done slowly to prevent slamming the piston down to the opposite end). The pressure on the pre-charge pressure gauge should be brought to a reading of 10-50 psi above the expected pressure of the product in the field . Close the pre-charge valve and disconnect the gas supply. Check the pre-charge valve, relief device, and the pre-charge pressure gauge for leaks. Any leaks should be stopped before continuing. The vessel should be placed in a padded carrying case and made ready for field use.

STEP 2: FOR COLLECTION OF SAMPLE FROM COMPOSITE ACCUMULATOR VESSEL.

2a: Connect the product end of the pre-charged sample vessel to the product supply. (Sampler product removal valve)
NOTE: the pre-charge pressure gauge reading should be greater than the product supply pressure reading. If not, repeat Step 1 above.

2b: Once the vessel is connected to the product supply, it is necessary to vent a small amount of product prior to filling the vessel. This assures fresh product and removes any air or gas when dealing with liquids. This can be done by loosening the product purge valve a very small amount until the product is purged. After thorough purging, the product purge valve should be tightened.

2c: The product pressure gauge reading should be 10-50 psi below the pre-charge pressure gauge reading. By carefully opening the pre-charge valve, the pressure becomes equalized, then begins to drop below the product pressure. The pre-charge valve should be carefully controlled so as to not vent the pre-charge gas too fast.

2d: When the cylinder becomes a maximum of 80% full (see volume indicator), all valves should be closed. The product connection is slowly broken in order to vent any trapped product. After vessel removal, all connections should be checked for leaks and the pre-charge and product valve ports capped to prevent leakage.

2e: Pack the DuraSite in appropriate carrying case to meet D.O.T. guideline, with D.O.T. paperwork and transport to lab for analysis.

Step 3: (In The Lab) Prior to analysis, the product should be mixed. This is accomplished simply and efficiently by inverting the cylinder end-over-end, causing the mixing ball to fall through the product. Approximately 10-12 trips of the mixing ball through the product assures a homogenous solution.

Step 4: The regulated pre-charge gas should be reconnected to the pre-charge side of the cylinder. The pre-charge gas supply should remain open during analysis.

Step 5: Purging a small amount of product from the vessel removes unmixed product from the tee, relief device, gauge, etc. The unit can now be connected to a chromatograph and the product analyzed.

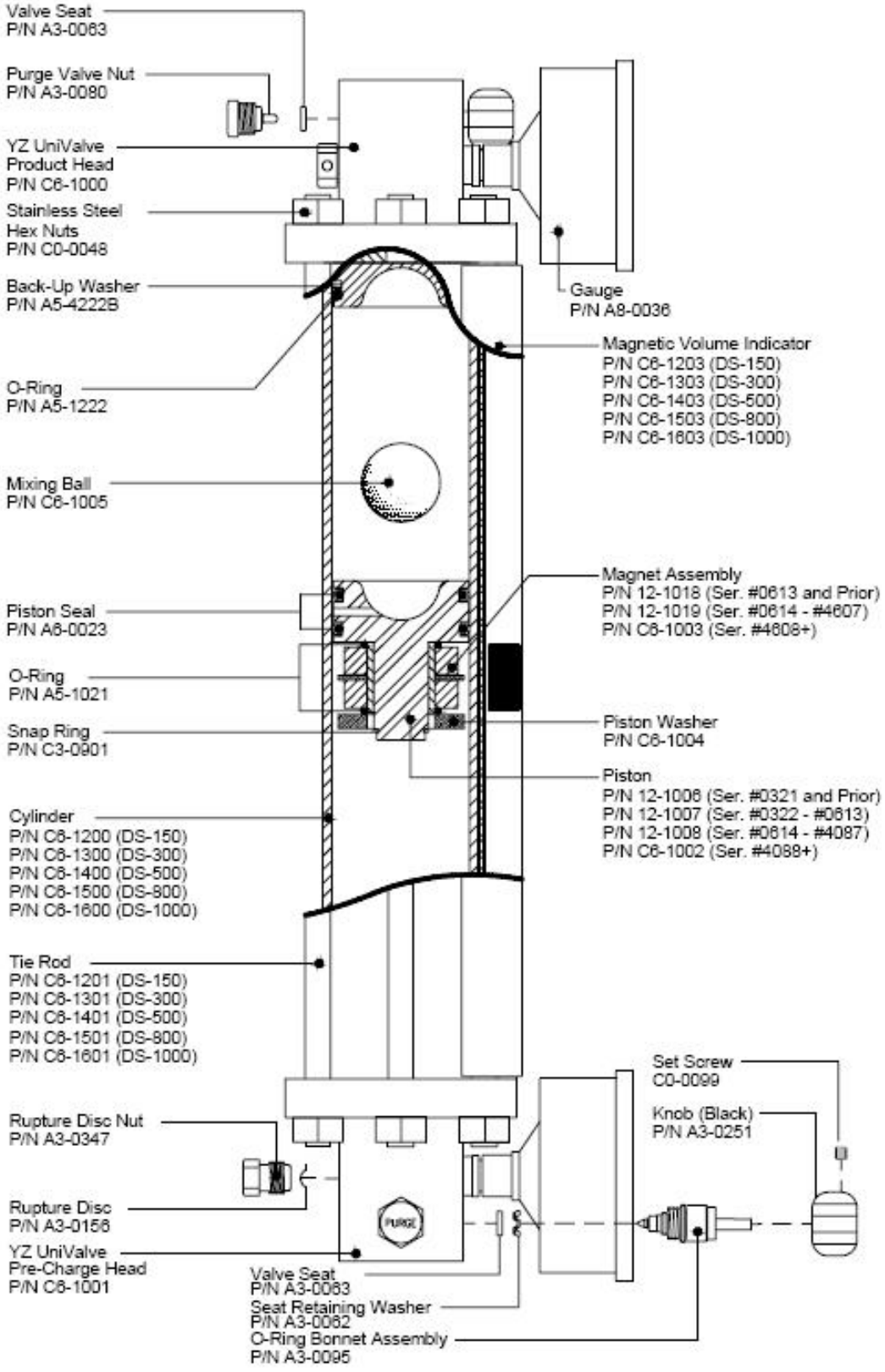
Step 6: After analyzing, the remainder of the product should be dumped and the vessel properly cleaned. Normal cleaning can be accomplished by rinsing the product end with a petroleum solvent and flushing with acetone. If a more thorough cleaning is required, the vessel should be disassembled.

WARNING: A portable sample vessel should never be filled to more than 80%. This allows a 20% pre-charge cushion to absorb thermal expansion of the product.

Shipping: Extreme care should be taken when preparing a vessel for shipment. Both valves should be capped to prevent possible leakage. The vessel should be placed in a snug-fitting, well-padded and durable case. All applicable DOT regulations should be adhered to.

Section 7: System Operation

figure 21



Section 7: System Operation

Notes

Section 8: System Maintenance

Preventative Maintenance Schedule

A preventative maintenance program serves to anticipate maintenance issues prior to waiting until the system requires service. Like changing the oil & filters in an automobile, by choosing to service the various parts and operation in the Sampling System at regular intervals, the technician can perform the maintenance service when desired, rather than when required, such as in the middle of night.

The key is to perform maintenance before it is required. The preventative maintenance schedule implemented should consider the application of the sampler. Many of these considerations include: the weather environment; the condition of, the actuation gas, the product condition and quality, and the pump stroke frequency. All of these issues must be considered when establishing a preventative maintenance schedule.

Recommended Maintenance Schedule Monthly Inspection

1. Verify system pressures
2. Check for leaks

Annual Inspection

1. Rebuild pump
2. Clean and service the pneumatic mixing valve if so equipped
4. Test the relief valve and service, as needed
5. Test regulators and service, as needed
6. Test the Light Liquid Sampler System performance

Bi-Annual Inspection

1. Perform the annual inspection listed above
2. Replace solenoid if so equipped
3. Rebuild Accumulator Vessel

Recommended Spare Parts List

Part #	Description	Recommended Quantity
D3-0152	PNR-2P/LPR-2P pump seal replacement kit	1
	OR	
D3-0153	PNR-2H/LPR-2H pump seal replacement kit	1

Section 8: System Maintenance

Notes

Section 9: System Troubleshooting - pneumatic systems

How to Use This Section

The recommendations contained in this section should be used as a preliminary information resource to remedy operational issues with the PNR-2P Sampling System. It is important to read all of the definitions and notes prior to initiating work.

Each subsection contains a description of the indicators followed by a step-by-step trouble shooting procedure.

For Additional Help

Any issue that can not be resolved through the use of this reference, please contact YZ Technical Service at:

T: 1.800.653.9435
T: 1.281.362.6500, International Calls
F: 1.281.362.6513
Em: Service@yzhq.com

SAFETY NOTES

- Always use extreme care when performing maintenance on Sampling Systems. Always take necessary measures to assure that electrical classification in the area is considered, before, and during all repairs, and that necessary steps are taken to maintain proper electrical procedures for the classification of the area.

- Take special care when disconnecting any fitting, to assure that product and/or pressure will not be released when the connection is broken. This system may contain liquid and/or gas at high pressures.

Step-by-Step Resolution

Using a step-by-step method to resolve issues on the Sampling System will reduce maintenance time and assist in returning the system to service quicker.

The following represent the recommended chronology to resolve issues:

Resolve issues to the following order:

a. *Actuation Gas Pressure*, page 37
b. *Electrical Power*, page 38
c. *Sample Pulse,* page 39
d. *Pump Performance,* page 39
e. *Pre-Charge Pressure /Product Accumulator Vessel ,* page 40

Actuation Gas Pressure

This section should be used to troubleshoot sampler performance, when the Sample Pump will not actuate, and/or when the pneumatic power mixing system on the Accumulator Vessel will not function.

Actuation Gas Troubleshooting Steps

1. Verify the supply gas valves, and regulators supplying gas to the sampler system are properly functioning, and adjusted.

2. Disconnect the Pneumatic Supply connection at the top of the Sample Pump.

   a. There should NOT be any gas pressure present. Gas pressure should be present for ONLY 3 seconds each time a sample pulse is received by the sample systems from the flow monitoring device, that signals the sampler when to take a sample.

   b. Initiate a sample with the flow monitoring device pulse, and observe to see if a 3 second burst of gas is expelled from the connection loosened in step 2 above.

c. If a 3 second burst of gas is expelled from the connection loosened in step 2, the actuation system to the pump is functioning properly. Reconnect the Pneumatic Supply connection to the top of the Sample Pump. Proceed to pump performance troubleshooting, if the problem seems to be with your pump, or proceed to step 3, if you are having difficulties with the power mixing of your sample system.

3. Disconnect the tubing at the top of the Actuator Head of the Product Accumulator vessel. There should not be any pressure there until the Mixing Valve is placed in the down mixing position.

   a. If gas is flowing continually when this line is disconnected, the Mixing Valve should be repaired, or replaced.

   b. If gas does not flow to the loosened connection when the Mixing Valve is actuated to the down position, try moving the valve to the up position, and see if you get gas flow at the loosened connection. If you still have no gas flow to the loosened connection, the Mixing Valve should be repaired, or replaced.

   c. If gas does flow properly, to the loosened connection, when the Mixing Valve is placed in the down mixing position, check the vent/muffler on the Mixing Valve to see if it may be stopped up. Clean or replace the vent/muffler as required.

Electrical Power

IMPORTANT NOTE:

All electronics are housed in explosion proof enclosures and are rated for use in Class I, Division 1, Groups C and D hazardous locations.

The power supply to the sampler must be properly connected and supplying power to the sample system, before it can be expected to perform. Often electrical storms, or other electrical surges that occur at the sampler site may cause interruption of the power supply to the sampler. The power is used to drive the solenoid for a duration of 3 seconds each time a sample is called for by the flow monitoring device connected to the sampler system. Electrical power troubleshooting will include steps to assure the power is actually getting to the solenoid for the required duration, and that the solenoid is activating the sample pump. The typical symptom to lead a technician to this step would be that the sample pump is not being actuated when a pulse from the flow monitoring device sends a dry contact sample pulse to the sampler.

Electrical Power Troubleshooting Steps

CAUTION:

Prior to opening the electrical enclosure be sure to disconnect all power and pulse connections at the safe end of wiring or perform test to assure the area of the enclosure is safe to open the enclosure.

1. Verify the power is actually reaching the solenoid in the Sample System electrical enclosure. Test for power at the solenoid by connecting your Voltmeter to the solenoid terminal pins, refer System Control and Electronics in Section 4.

Section 9: System Troubleshooting - Pneumatic Systems

Sample Pulse

IMPORTANT NOTE:

All electronics are housed in explosion proof enclosures and are rated for use in Class I, Division 1, Groups C and D hazardous locations.

The Sample Pulse to the sampler must be properly connected and supplying power to the pneumatic solenoid, before the sampler system can be expected to perform. Often electrical storms, or other electrical surges that occur at the sampler site may cause interruption of the Sample Pulse to the sampler. The pulse power is used to drive the solenoid for a duration of 3 seconds each time a sample is called for by the flow monitoring device connected to the sampler system. Sample Pulse troubleshooting will include steps to assure the power is actually getting to the solenoid for the required duration, and that the solenoid is activating the sample pump. The typical symptom to lead a technician to this step would be that the sample pump is not being actuated when a pulse from the flow monitoring device sends a Sample Pulse signal to the sampler. The origin of this Sample Pulse is in the flow monitoring equipment, that is not actually a part of the sampler system; therefore troubleshooting will be limited to verifying that the sampler system does respond properly when an appropriate pulse is generated.

Sample Pulse Troubleshooting Steps

CAUTION:

Prior to opening the electrical enclosure be sure to disconnect all power and pulse connections at the safe end of wiring or perform test to assure the area of the enclosure is safe to open the enclosure. These connections carry power supply voltage.

1. Verify the power is actually reaching the Solenoid on the Sample Skid.

    a. Test for power at the solenoid connection by connecting your Voltmeter to the solenoid wires.

    b. If there is not power at the solenoid for 3 seconds when a sample signal is being sent to the sampler system by the flow monitoring device, check the breaker, and wiring back to the flow monitoring device. Repair any loose or broken wires, reset or replace circuit breaker as required.

2. If step 1 above does not resolve your problem, proceed to troubleshooting the output from your flow monitoring device.

Pump Performance

There are many factors that affect pump performance. Some are within the pump, while others are outside factors that affect pump performance.

Pump Performance Troubleshooting Steps

1. Actual performance of the Actuation Gas, and Electrical Power issues should have already been dealt with, If not , perform those troubleshooting steps before proceeding to step 2.

2. Close the isolation valve located on the bottom of the Five-way Cross Assembly. Stroke the sample pump while observing the pressure reading on the Five-way Cross Assembly Gauge. The system pressure should steadily build to 1800 psi . The pressure should hold steady between pump strokes. Once the system is at 1800 psi, leak test all connections. Once the system has been tested, open the isolation valve located on the bottom of the Five-way Cross Assembly. Completion of this test verifies the pump performance is O.K.

3. The next step, if the pump did not pass the test in step 2, is to verify that the pump is fully liquid packed with liquid product to be pumped. The Sample Pump must be purged of all air in the sample chamber, before it can pump liquid product. The purge valve on the sample pump is used to evacuate the air from the chamber and to make sure the pump is liquid-packed. If the pump is not purged properly, it will not function properly.

   a. Open the purge valve located on the left side of the sample pump.

   b. Next open the product supply valve to allow pipeline product to purge the air within the pump.

   c. Once product begins exiting the purge valve, close the purge valve. The sample pump is now ready to begin operation. Perform pump test #2 again. If your product is not consis tently in a single phase liquid state the pump will vapor lock again, and repriming will be necessary, repeatedly, till the phase condition of the product is resolved.

4. If during the pump troubleshooting step 2, you observed the pressure on the Five-way Cross Assembly Gauge jumping from pipeline pressure to a higher pressure, during the pump stroke, but immediately returning to pipeline pressure after the stroke, the Discharge Valve Assembly should be replaced.
5. If during the pump troubleshooting step 2, you observed the pressure on the Five-way Cross Assembly Gauge build steadily to pipeline pressure, then stop building at pipeline pressure, the Sample Pump inlet check is not holding. Typically installing a YZ Repair Kit P/N D3-0152, will resolve this situation.

Pre-Charge/ Product Accumulator

The Product Accumulator works in conjunction with the Pre-Charge Vessel to maintain the integrity of captured sample in the sampler system. The Product Accumulator Vessel may be repaired on site, but requires some special tools to do so, and it is recommended that if this vessel needs service, you should contact YZ - Milton Roy Technical Service @ 1.281-362-6500 to obtain a Return Authorization Number to return the Product Accumulator Vessel to YZ for reconditioning. The pre-charge vessel pressure must remain at a pressure that exceeds the critical vapor pressure of the product being sampled. A typical pressure setting should be 100 PSI over the pipeline pressure.

Pre-Charge/Product Accumulator Troubleshooting Steps

1. If the charge in the vessel is low, recharge it to the proper pressure, by connecting an external source of inert gas to the Pre-Charge Isolation Valve, and open the valve until the Pre-Charge Vessel pressure is once again at the desired pressure.

2. Close the Pre-Charge Isolation Valve.

3. Disconnect the external source of inert gas.

4. Wrap a 1/4” MNPT plug with TFE tape, and install it in the Pre-Charge Isolation Valve.

5. Use liquid soap to leak test all connections on the Pre-Charge Vessel, Pre-Charge Isolation Valve, Tubing to the Accumulator Vessel, and Pre-Charge connection to the Accumulator Vessel. Fix any leak detected.

6. If no leaks were found in step 5, look at the most recent analysis report on product taken from this sampler, to see if an abnormal amount of inert gas of the type used for Pre-Charge was present in the sample. If Pre-Charge gas is found in the sample, contact YZ - Milton Roy Technical Service @ 1.281-362-6500 to obtain a Return Authorization Number to return the Sample Accumulator Vessel to YZ for reconditioning.

Section 9: System Troubleshooting - HYDRAULIC SYSTEMS

How to Use This Section

The recommendations contained in this section should be used as a preliminary information resource to remedy operational issues with the LPR-2H Sampling System. It is important to read all of the definitions and notes prior to initiating work.

Each subsection contains a description of the indicators followed by a step-by-step trouble shooting procedure.

For Additional Help

Any issue that can not be resolved through the use of this reference, please contact YZ Technical Service at:

T: 1.800.653.9435
T: 1.281.362.6500, International Calls
F: 1.281.362.6513
Em: Service@yzhq.com

SAFETY NOTES

- Always use extreme care when performing maintenance on Sampling Systems. Always take necessary measures to assure that electrical classification in the area is considered, before, and during all repairs, and that necessary steps are taken to maintain proper electrical procedures for the classification of the area.

- Take special care when disconnecting any fitting, to assure that product and/or pressure will not be released when the connection is broken. This system may contain liquid and/or gas at high pressures.

Step-by-Step Resolution

Using a step-by-step method to resolve issues on the Sampling System will reduce maintenance time and assist in returning the system to service quicker.

The following represent the recommended chronology to resolve issues:

Resolve issues to the following order:

a. *Electrical Power*, *page 41*
b. *Hydraulic Power, page 43*

Electrical Power

CAUTION:

Prior to opening the electrical enclosure be sure to disconnect all power and pulse connections at the safe end of wiring or perform test to assure the area of the enclosure is safe to open the enclosure.

The 120 VAC power supply to the sampler must be properly connected and supplying power (120 VAC @ 20 amps) to the sample system, before it can be expected to perform. Often electrical storms, or other electrical surges that occur at the sampler site may cause interruption of the power supply to the sampler. The power is used to drive the Hydraulic Power Pack for a minimum duration of 5 seconds each time a sample is called for by the pulse as provided by a flow monitoring device connected to the sampler system, and to run the power pack longer during the sample mixing mode of operation. Electrical power troubleshooting will include steps to assure the 120 VAC power is actually getting to the Power Pack for the required duration. The typical symptom to lead a technician to this step would be that the sample pump is not being actuated when a pulse from the flow monitoring device sends a sample pulse to the sampler.

Section 9: System Troubleshooting - HYDRAULIC SYSTEMS

Electrical Power Troubleshooting Steps

CAUTION:

Prior to opening the electrical enclosure be sure to disconnect all power and pulse connections at the safe end of wiring or perform test to assure the area of the enclosure is safe to open the enclosure.

1. Verify the 120VAC power is actually reaching the Hydraulic Power Pack, and Control System. (The power to the Hydraulic Power Pack is directly connected to the Control System power connection; therefore if power is getting to the Control System, it should be getting to the Hydraulic Power Pack).

    a. Test for continuous 120 VAC to the Hydraulic Power Pack/counter, by connecting your AC Voltmeter to the Neutral and Hot 120 VAC wiring connections to the Test Switch, refer to Appendix A Electrical Wiring, Hydraulic Power Pack/Test Switch, Page 55.

    b. If there is not 120VAC continuous power to the Test Switch, check the breaker, and AC wiring back to the AC source. Repair any loose or broken wires, reset or replace circuit breaker as required.

Sample Pulse

1. The next Electrical Power test is to see if the Control System functions properly when a 24 VDC pulse is applied.

    Once continuous 120 VAC power is verified at the Control System, (step #1 above); Connect your AC Voltmeter to the RELAY Input Pulsed 24 VDC wiring connection, and the 24 VDC Neutral wiring connection, refer to Appendix A Electrical Wiring, Hydraulic Power Pack/Test Switch, Page 55. This should be a pulsed 24 VDC with a MINIMUM duration of 5 Sec. ONLY when the Control System is activated, by your flow monitoring equipment.

2. The final step in troubleshooting the electrical power for the sampler, would be to replace the relay or Hydraulic Power Pack itself. They are available from YZ - Milton Roy.

Section 9: System Troubleshooting - Hydraulic Systems
Hydraulic Power

Hydraulic power is measured in terms of hydraulic pressure. There are several factors that may cause your systems to not provide sufficient hydraulic pressure, as outlined below.

CAUTION:

The Hydraulic Power Pack should NEVER be operated without recommended oil in the reservoir. Do not operate the Power Pack at temperatures over 140 F., or less than 0 F.

Hydraulic Power Troubleshooting Steps

1. Verify the Hydraulic Power Pack is properly filled with the oil.

   a. Remove the oil reservoir Filler/Breather Cap.

   b. Check the oil level. It should be approximately 1" below the lip of the oil reservoir.

   c. If additional oil is required add oil of a similar type as has been previously installed in the Hydraulic Power Pack.

IMPORTANT NOTE:

Oil type should be 10 WT. Phillips Magna-A hydraulic oil, automatic transmission fluid, or any clean hydraulic oil with a viscosity range of 150-300 SSU @ 100 F.

2. If the hydraulic system begins making an unusual screeching noise, and the oil level is correct, check and clean, or replace the reservoir filter.

   a. Drain the oil from the oil reservoir, utilizing the oil drain plug at the lower end on the oil reservoir, opposite the power pack electrical motor.

   b. Remove the (4) hex head cap screws that hold the oil reservoir to the Power Pack coupler housing, and slide the reservoir off.

   b. Examine, clean, and/or replace the filter on the end of the oil pump suction pipe.

3. Verify hydraulic power system pressure. This may be done in two ways, as detailed below.

   a. Pressure Test Method #1:
      - Disconnect the pressure out line from the Hydraulic Power Pack, refer to illustration, page 55.
      - Install a pressure gage into the pressure out port from the Power Pack.

CAUTION:

The use a high quality gage capable of with standing at least 1,000 psi of pressure.

      - Test run the Power Pack, and observe the dead headed pressure on the gage. Pressure should be between 350 psi - 400 psi.
      - If the pressure is not sufficient contact YZ - Milton Roy
      - Remove the gage, and reconnect the original tubing to the Sample Pump.
      - This is a bidirectional Power Pack, so now repeat the process with the pump running the other direction, and with the gage in the other port from the Power Pack.

   b. Pressure Test Method #2:
      - Disconnect the pressure in line to the Sample Pump, from the Hydraulic Power Pack, refer to illustration, page 55.
      - Install an inline Tee, with a pressure gage into the pressure in port of the Sample Pump, and re-connect the tubing from the Power Pack.

CAUTION:

Use a high quality gage capable of with standing at least 1,000 psi of pressure.

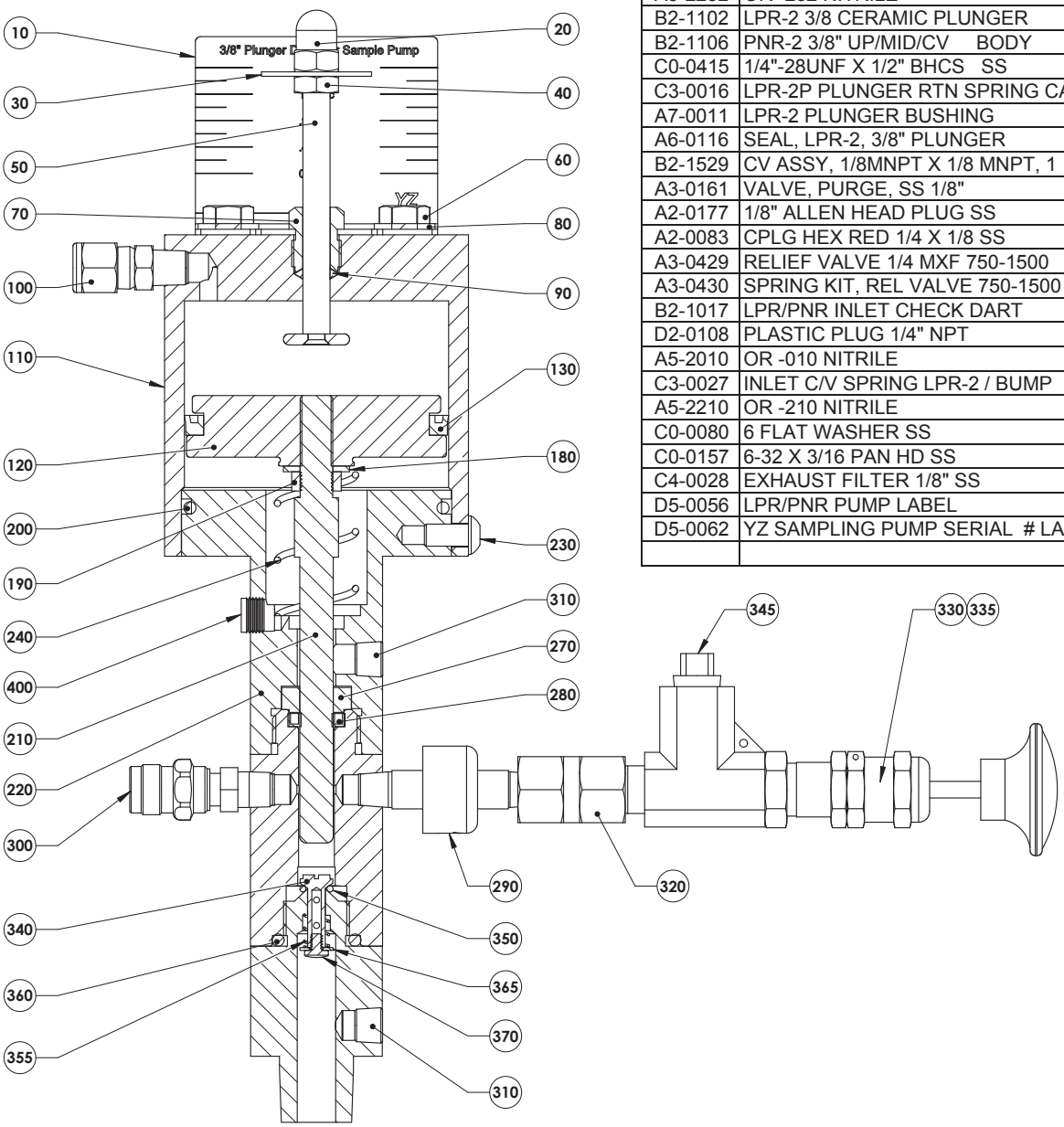
Notes

Appendix A: Illustrations

PNR-2P (EP) Sample Pump, Assembled

Figure 22

	BILL OF MATERIAL FOR PNR-2P(EP)	
Part#	**Description**	**Bubble**
D5-0020	STROKE SCALE 3/8" PD PUMP	10
B2-1001	LPR-2 ACORN NUT	20
B2-1002	LPR-2 STROKE SCALE IND	30
C0-0108	5/16-24 JAM NUT SS	40
B2-1003	LPR-2 STROKE SCREW ASSY	50
C0-0098	5/16-18 X 5/8" HHCS SS	60
B2-1006	LPR-2 PACKING GLAND NUT	70
C0-0017	5/16 FLAT WASHER SS	80
A6-0035	PD PUMP NON-ASBESTOS PACKING	90
A1-0003	MCONN 1/4T 1/8P SS	100
B2-1041	LPR-2 ACTUATOR CYLIN, SCREWED	110
B2-1009	LPR-2 PNEU ACT PISTON	120
A6-0036	U-CUP WIPER SEAL (LPR-2 ACT PI	130
C0-0117	3/8 STAR WASHER (EXT) SS	180
C0-0118	3/8-24 JAM NUT SS	190
A5-2232	OR -232 NITRILE	200
B2-1102	LPR-2 3/8 CERAMIC PLUNGER	210
B2-1106	PNR-2 3/8" UP/MID/CV BODY	220
C0-0415	1/4"-28UNF X 1/2" BHCS SS	230
C3-0016	LPR-2P PLUNGER RTN SPRING CAD	240
A7-0011	LPR-2 PLUNGER BUSHING	270
A6-0116	SEAL, LPR-2, 3/8" PLUNGER	280
B2-1529	CV ASSY, 1/8MNPT X 1/8 MNPT, 1	290
A3-0161	VALVE, PURGE, SS 1/8"	300
A2-0177	1/8" ALLEN HEAD PLUG SS	310
A2-0083	CPLG HEX RED 1/4 X 1/8 SS	320
A3-0429	RELIEF VALVE 1/4 MXF 750-1500	330
A3-0430	SPRING KIT, REL VALVE 750-1500	335
B2-1017	LPR/PNR INLET CHECK DART	340
D2-0108	PLASTIC PLUG 1/4" NPT	345
A5-2010	OR -010 NITRILE	350
C3-0027	INLET C/V SPRING LPR-2 / BUMP	355
A5-2210	OR -210 NITRILE	360
C0-0080	6 FLAT WASHER SS	365
C0-0157	6-32 X 3/16 PAN HD SS	370
C4-0028	EXHAUST FILTER 1/8" SS	400
D5-0056	LPR/PNR PUMP LABEL	410
D5-0062	YZ SAMPLING PUMP SERIAL # LAB	420

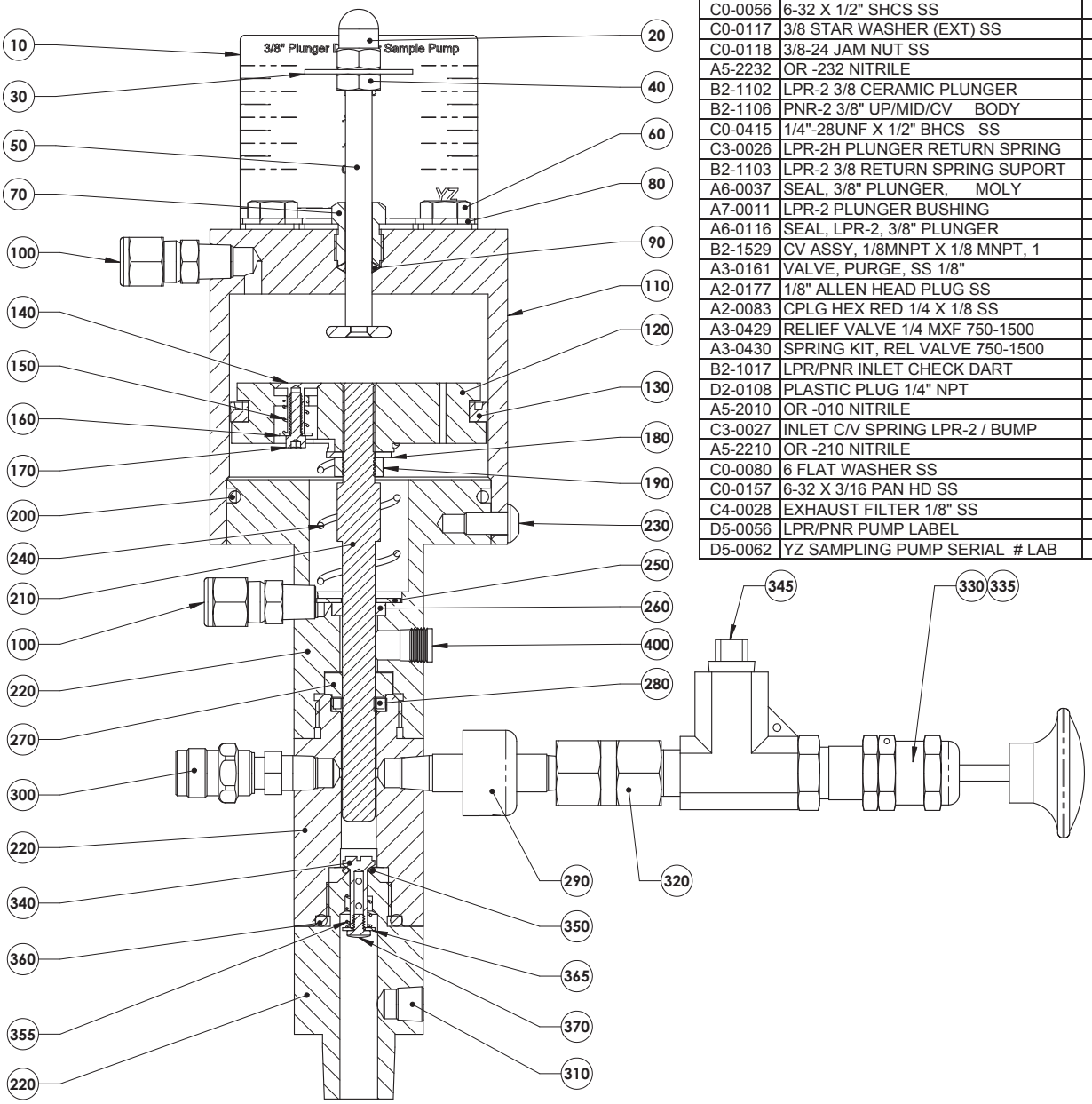


Appendix A: Illustrations

PNR-2H (EP) Sample Pump, Assembled

Figure 23

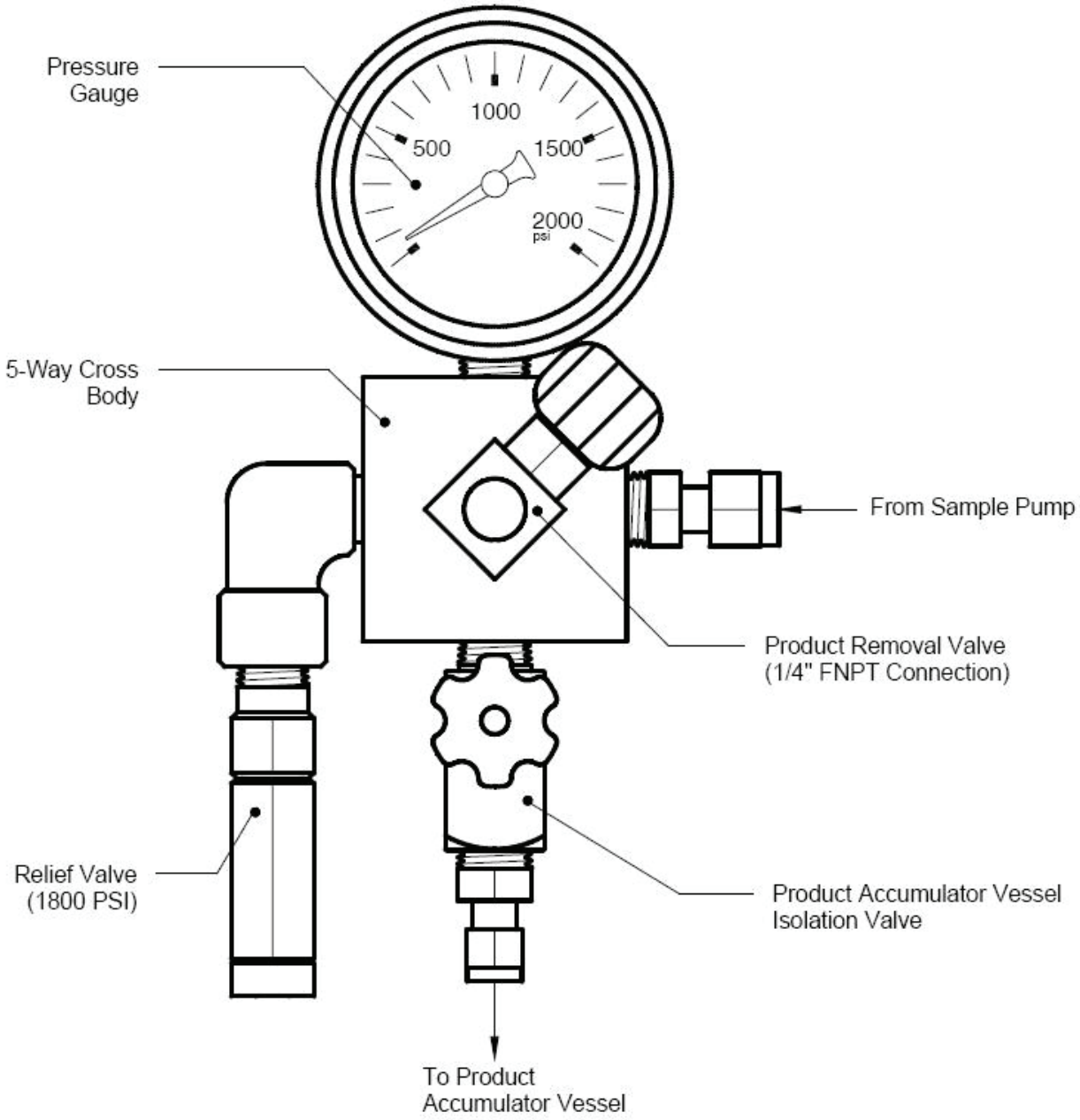
	BILL OF MATERIAL FOR PNR-2H(EP)	
Part#	**Description**	**Bubble**
D5-0020	STROKE SCALE 3/8" PD PUMP	10
B2-1001	LPR-2 ACORN NUT	20
B2-1002	LPR-2 STROKE SCALE IND	30
C0-0108	5/16-24 JAM NUT SS	40
B2-1003	LPR-2 STROKE SCREW ASSY	50
C0-0098	5/16-18 X 5/8" HHCS SS	60
B2-1006	LPR-2 PACKING GLAND NUT	70
C0-0017	5/16 FLAT WASHER SS	80
A6-0035	PD PUMP NON-ASBESTOS PACKING	90
A1-0003	MCONN 1/4T 1/8P SS	100
B2-1041	LPR-2 ACTUATOR CYLIN, SCREWED	110
B2-1008	LPR-2 HYD ACTUATOR PISTON	120
A6-0036	U-CUP WIPER SEAL (LPR-2 ACT PI	130
B2-1010	LPR-2 BUMP VALVE DART	140
C3-0027	INLET C/V SPRING LPR-2 / BUMP	150
C0-0080	6 FLAT WASHER SS	160
C0-0056	6-32 X 1/2" SHCS SS	170
C0-0117	3/8 STAR WASHER (EXT) SS	180
C0-0118	3/8-24 JAM NUT SS	190
A5-2232	OR -232 NITRILE	200
B2-1102	LPR-2 3/8 CERAMIC PLUNGER	210
B2-1106	PNR-2 3/8" UP/MID/CV BODY	220
C0-0415	1/4"-28UNF X 1/2" BHCS SS	230
C3-0026	LPR-2H PLUNGER RETURN SPRING	240
B2-1103	LPR-2 3/8 RETURN SPRING SUPORT	250
A6-0037	SEAL, 3/8" PLUNGER, MOLY	260
A7-0011	LPR-2 PLUNGER BUSHING	270
A6-0116	SEAL, LPR-2, 3/8" PLUNGER	280
B2-1529	CV ASSY, 1/8MNPT X 1/8 MNPT, 1	290
A3-0161	VALVE, PURGE, SS 1/8"	300
A2-0177	1/8" ALLEN HEAD PLUG SS	310
A2-0083	CPLG HEX RED 1/4 X 1/8 SS	320
A3-0429	RELIEF VALVE 1/4 MXF 750-1500	330
A3-0430	SPRING KIT, REL VALVE 750-1500	335
B2-1017	LPR/PNR INLET CHECK DART	340
D2-0108	PLASTIC PLUG 1/4" NPT	345
A5-2010	OR -010 NITRILE	350
C3-0027	INLET C/V SPRING LPR-2 / BUMP	355
A5-2210	OR -210 NITRILE	360
C0-0080	6 FLAT WASHER SS	365
C0-0157	6-32 X 3/16 PAN HD SS	370
C4-0028	EXHAUST FILTER 1/8" SS	400
D5-0056	LPR/PNR PUMP LABEL	410
D5-0062	YZ SAMPLING PUMP SERIAL # LAB	420



Appendix A: Illustrations

5-Way Cross Assembly,

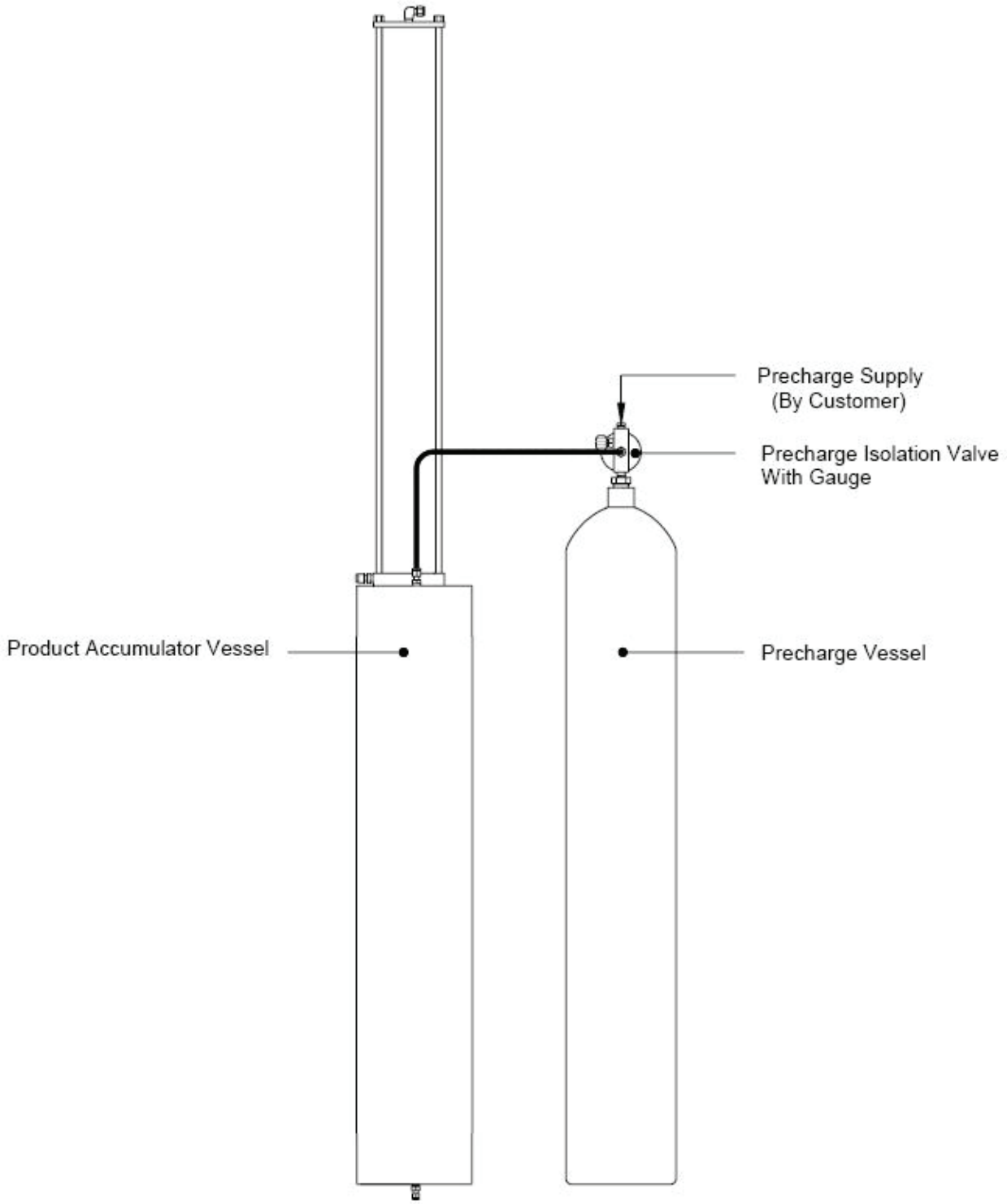
Figure 24



Appendix A: Illustrations

Pre-Charge Assembly,

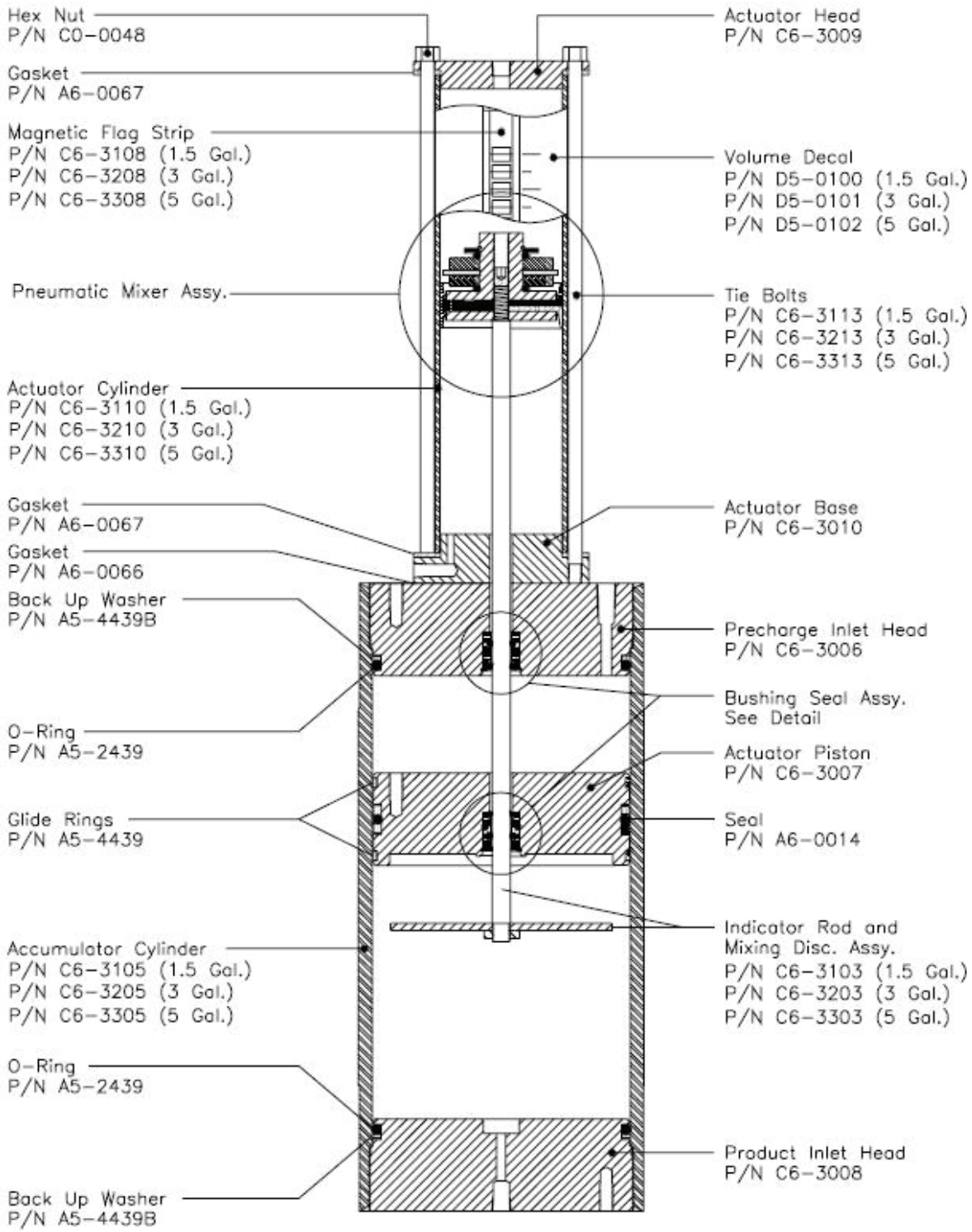
Figure 25



Appendix A: Illustrations

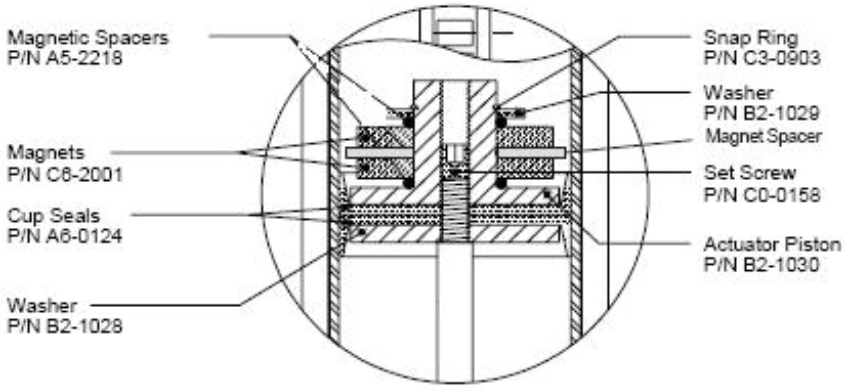
Pneumatic Mixed Accumulator Vessel,

Figure 26

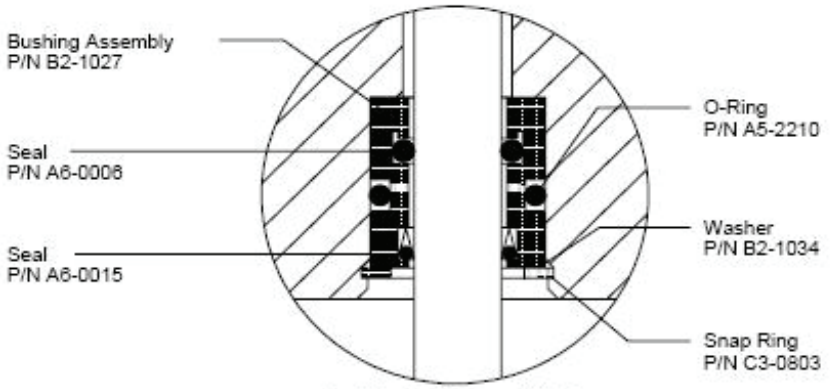


Appendix A: Illustrations
Pneumatic Mixing System-Accumulator,

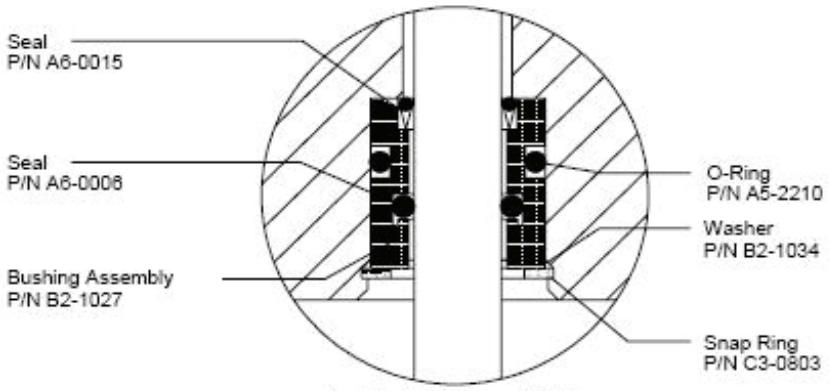
Figure 27



Pneumatic Mixer
Piston Assembly



Bushing Seal Assembly for
Precharge Inlet Head

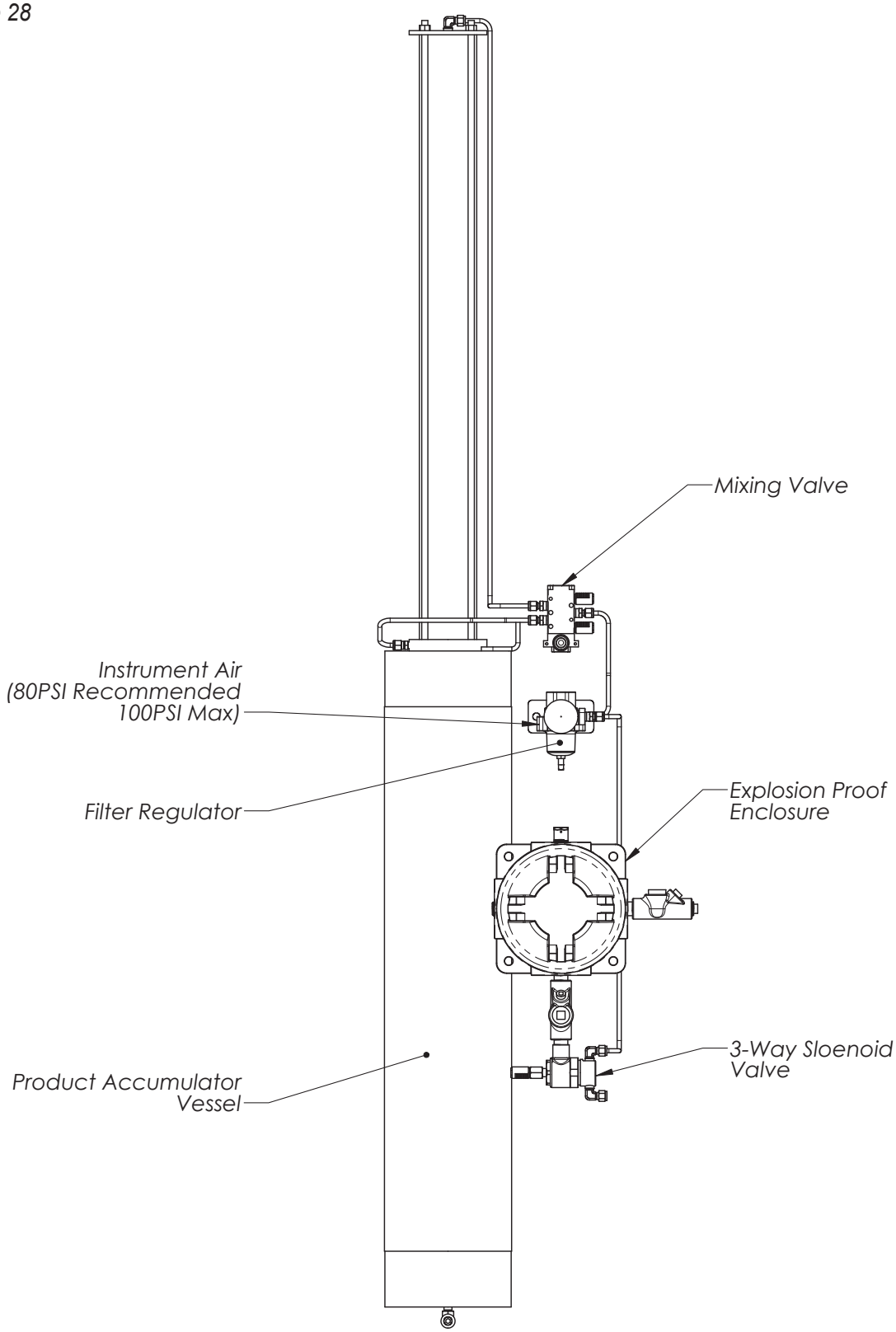


Bushing Seal Assembly for
Actuator Piston

Appendix A: Illustrations

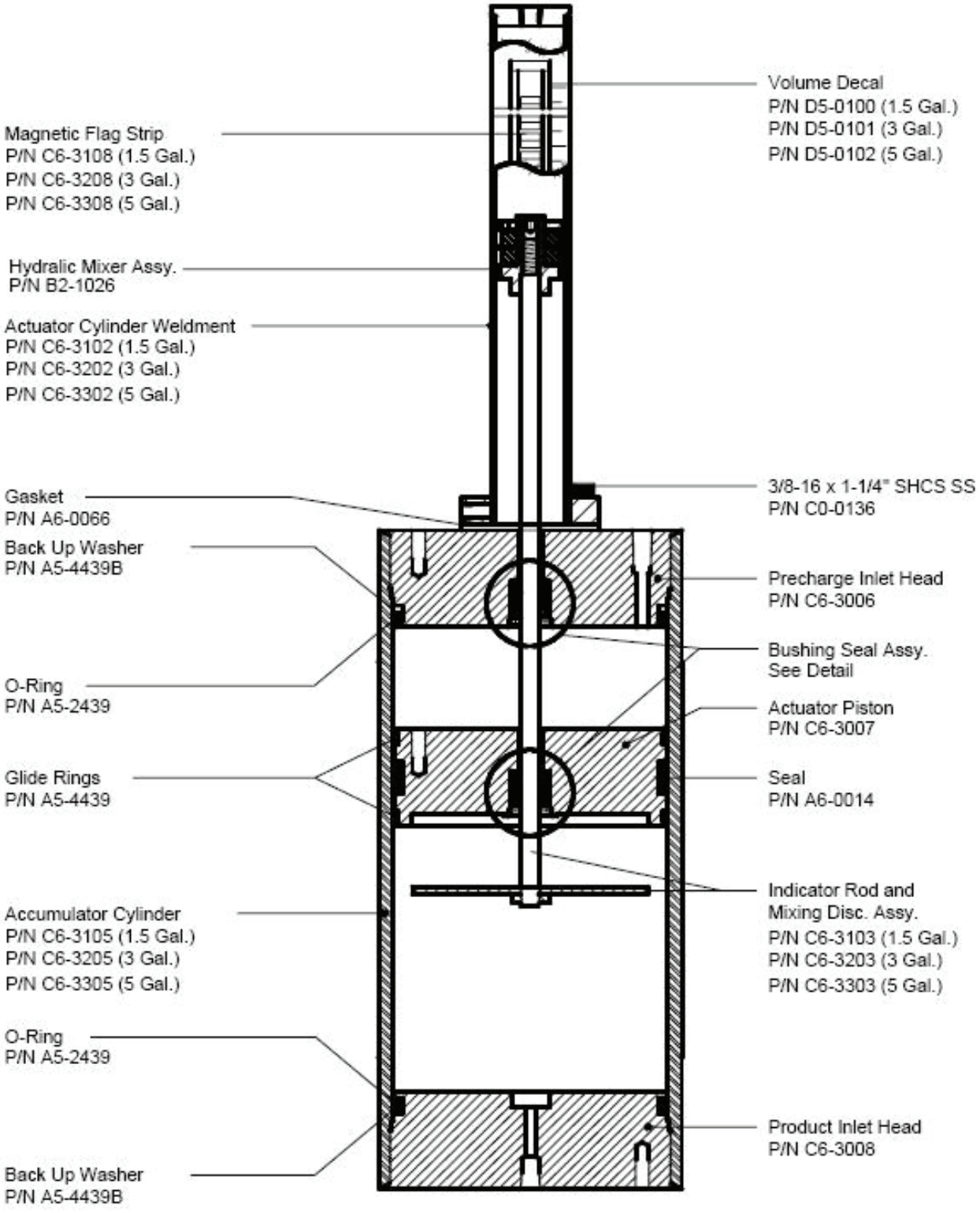
Mixing System

Figure 28



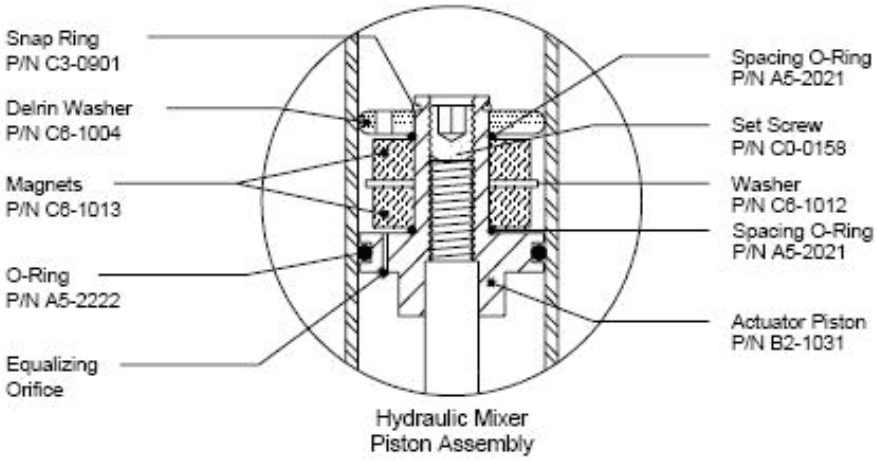
Appendix A: Illustrations
Hydraulic Mixed Accumulator Vessel,

Figure 29

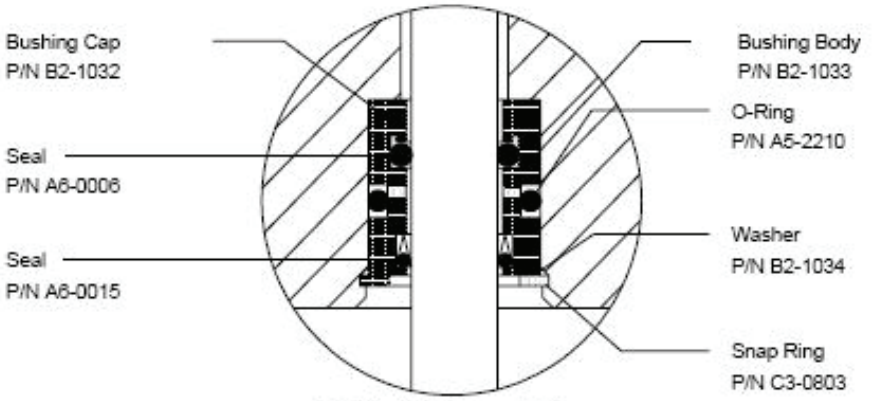


Appendix A: Illustrations
Hydraulic Mixing System-Accumulator,

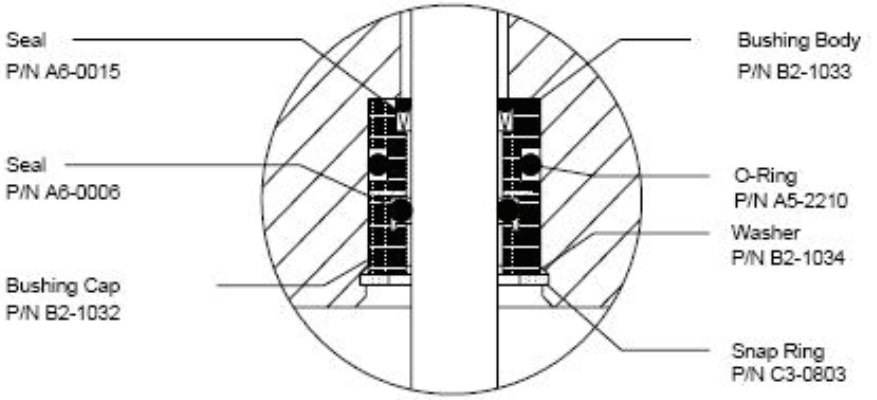
Figure 30



Hydraulic Mixer
Piston Assembly



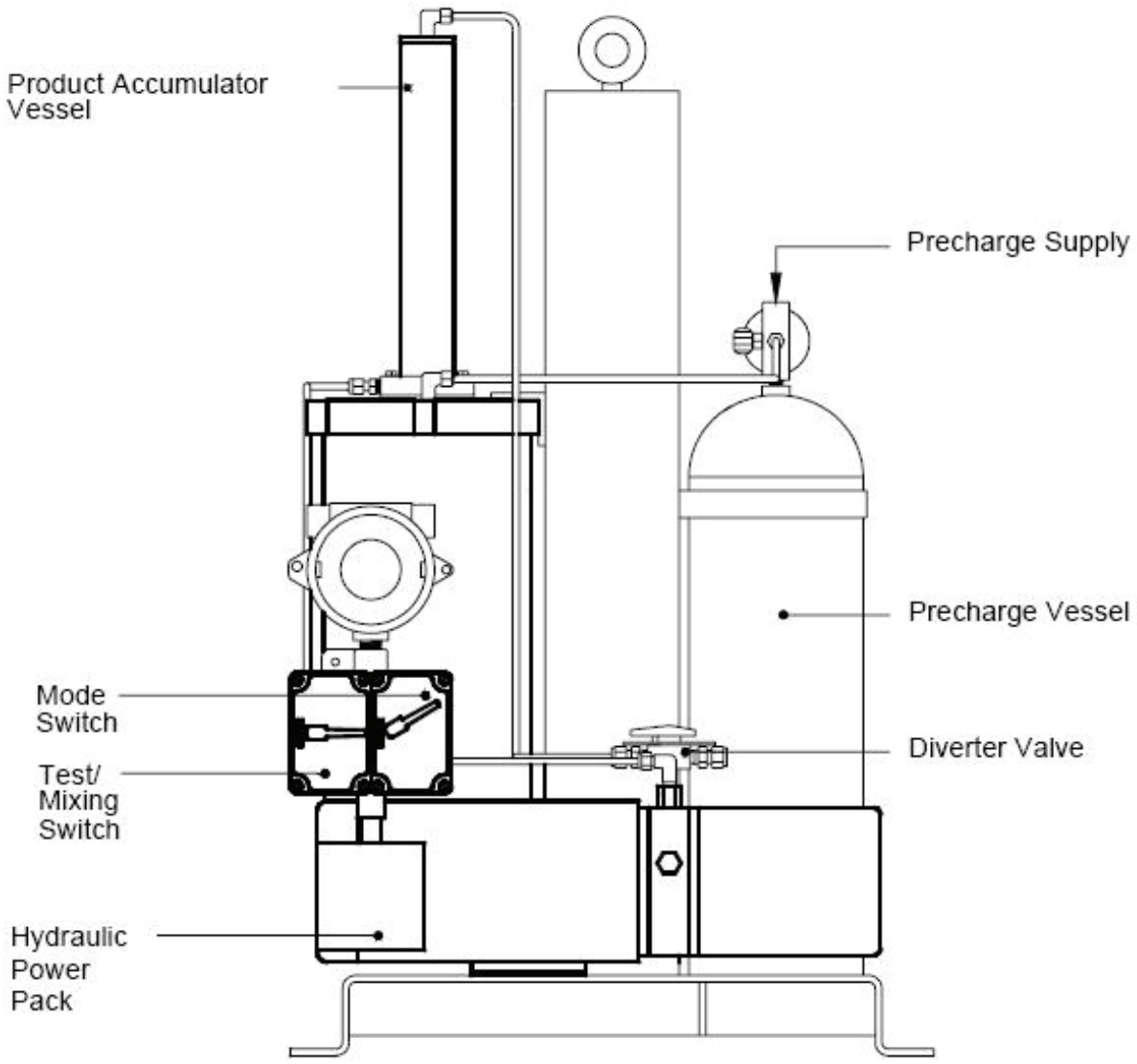
Bushing Seal Assembly for
Precharge Inlet Head



Bushing Seal Assembly for
Actuator Piston

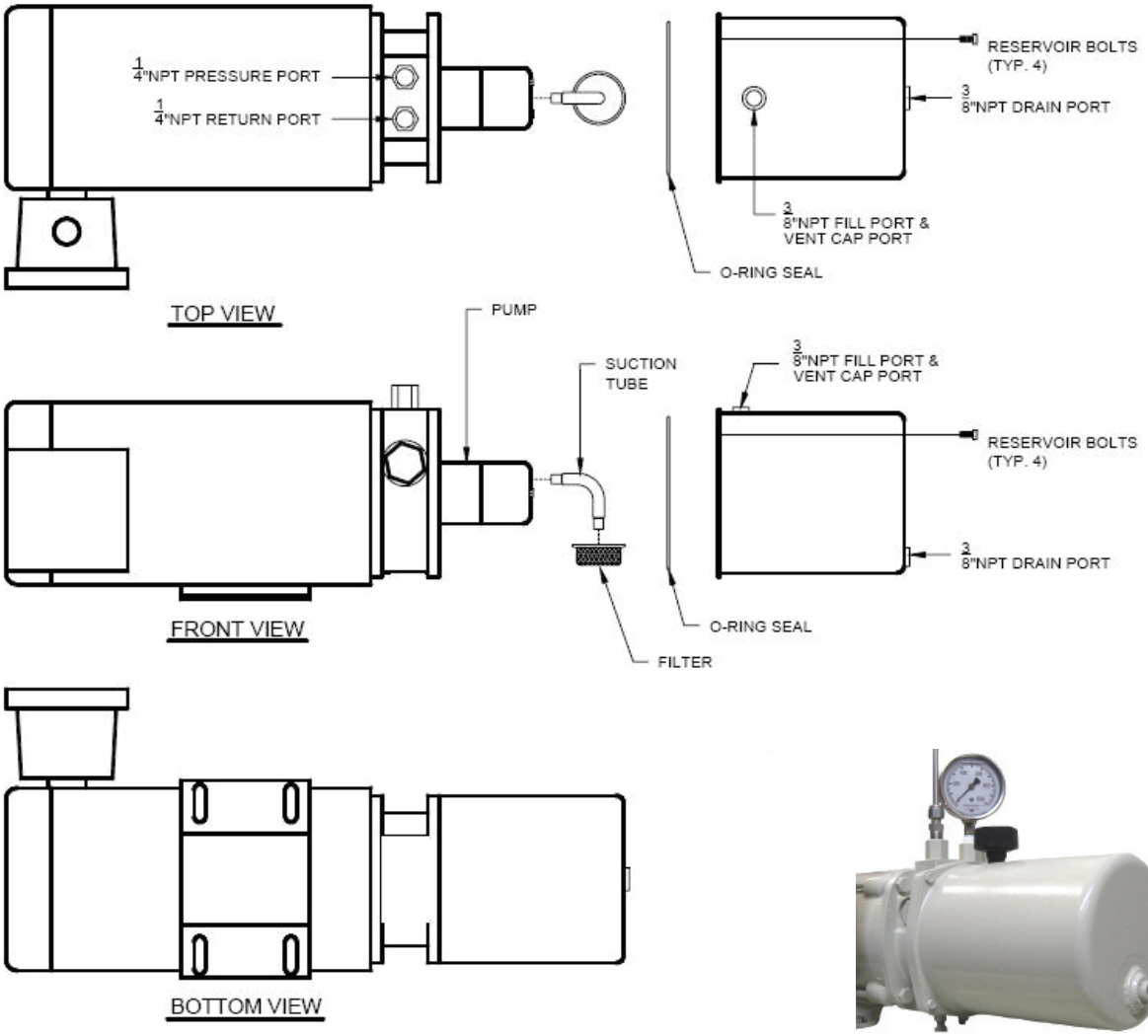
Appendix A: Illustrations
Hydraulic Mixing System

Figure 31



Appendix A: Illustrations
Hydraulic Power Pack

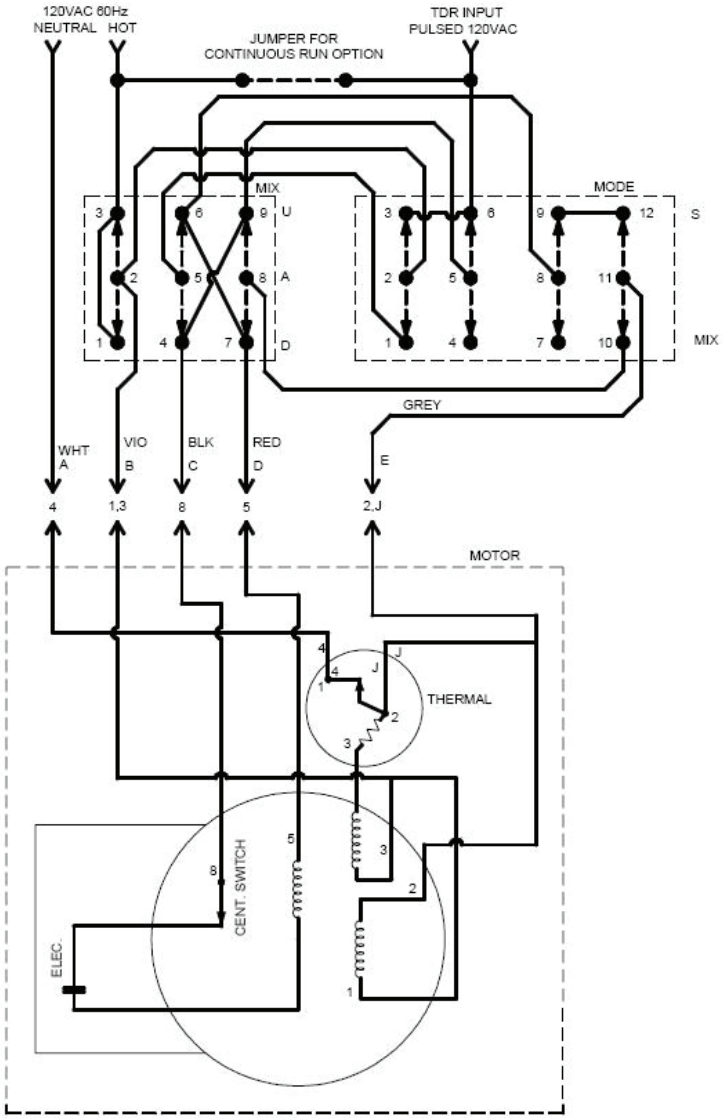
Figure 32

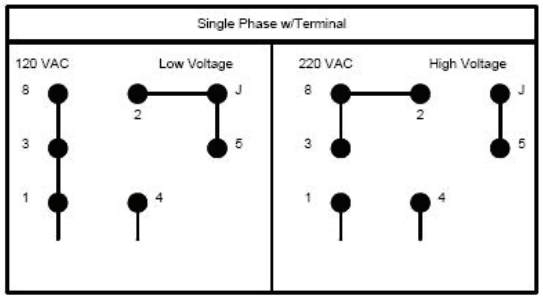


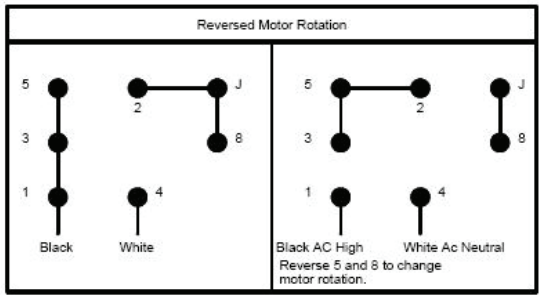
Pressure Test #1

Pressure Test #1a

Appendix A: Illustrations
Electrical Wiring, Hydraulic Power Pack/Test Switch







5 AND 8 ARE USED TO CORRECT FOR PROPER ROTATION OF THE MOTOR.
IF THE MOTOR DOES NOT ROTATE IN THE PROPER DIRECTION, SWITCH
5 AND 8 TO REVERSE.

Appendix A: Illustrations

Notes

(EP)Light Liquid Sampler ELM Addendum

YZ - Milton Roy • 201 Ivyland Road • Ivyland, Pa. • USA • 18974 • P: 281.362.6500 • F: 281.362.6513

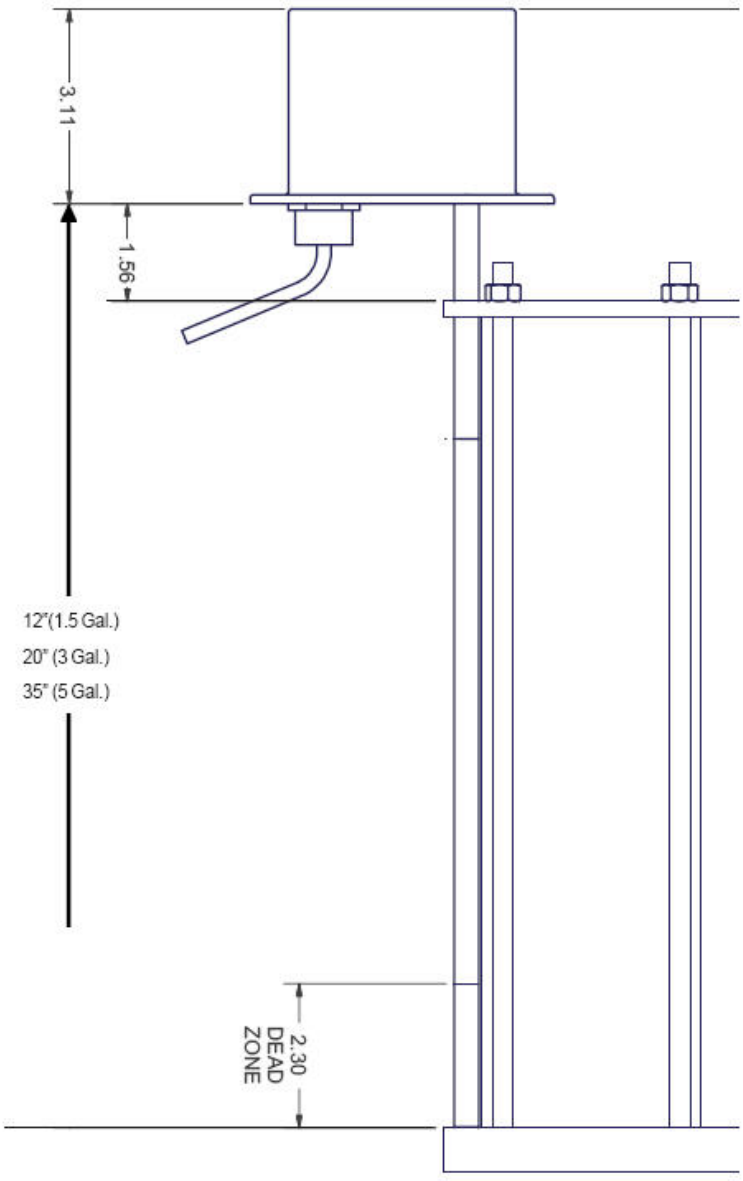
Electronic Level Monitor

PRODUCT DESCRIPTION

The Level Plus MC420 liquid level sensor is a multifunctional transmitter with a 4-20 mA loop and HART (Highway Addressable Remote Transducer) communications. It provides one analog output for level or interface. The output can be monitored using the 4-20 mA signal or a HART device (hand-held or MTS PC-compatible software).

the Level Plus MC420 transmitter housing is a NEMA 4X electropolished stainless steel and I.S. Approval.

The outer pipe is constructed of 10 mm diameter rigid outer pipe (316L satinless steel).



Electronic Level Monitor

MC420 Transmitter Specifications

PARAMETER	*SPECIFICATIONS*
LEVEL OUTPUT	
Measured Variable:	Product level/ interface depending on float selection
Non-linearity:	0.02% F.S. (Independent BSL) or 1/32 in. (0.794 mm)*
Repeatability:	0.005% F.S. or 0.005 in. (0.127 mm)*
Time Constant:	1 second
Sensor Operating Temperature:	-30 to 248°F (-34 to 120°C)
Transmitter Loop	
Input Voltage Range:	10.5 to 36.1 Vdc
Reverse Polarity Protection:	Series diodes
Transient Protection:	Stage 1: line-to-ground surge suppressor; 2500 Amps peak (8/20 µsec.) Stage 2: line-to-line and line-to-ground transient suppressors; 1500 Watts peak (10/1000 µsec.)
Safety Approval:**	CSA/FM approval intrinsically safe for Class 1, Division 1, Groups A, B, C, D, E, F, and G
Calibration	
Zero Adjust Range:	Anywhere within the active length
Span Adjust Range:	Full scale≥ 6.0 in. (152 mm) from zero
Environmental	
Humidity:	0 to 100% R.H.
Electronic Operating Temperature:	- 30 to 160°F (-34 to 71°C)
Materials (wetted parts):	316L stainless steel
	)
Mounting:	Custom to vessel
Wiring:	15' (457cm), 2-wire connection
Digital "0" Frequency:	2200 Hz.
Digital "1" Frequency:	1200 Hz.
Data Byte Structure:	1 Start Bit, 8 Data Bits, 1 Odd Parity Bit, 1 Stop Bit
Digital Process Variable Rate:	Poll/Response Model 2.0 per second
AGENCY APPROVALS	
Canadian Standards (CSA) **Factory Mutual (FM)**	*Intrinsically Safe***: Class I, Groups A, B, C, D Class II, Groups E, F, G Division 1, NEMA 4X Models: All

** Whichever is greater*
*** When installed with approved I.S. barriers*
All specifications are subject to change without notice.

Electronic Level Monitor

Accuracy

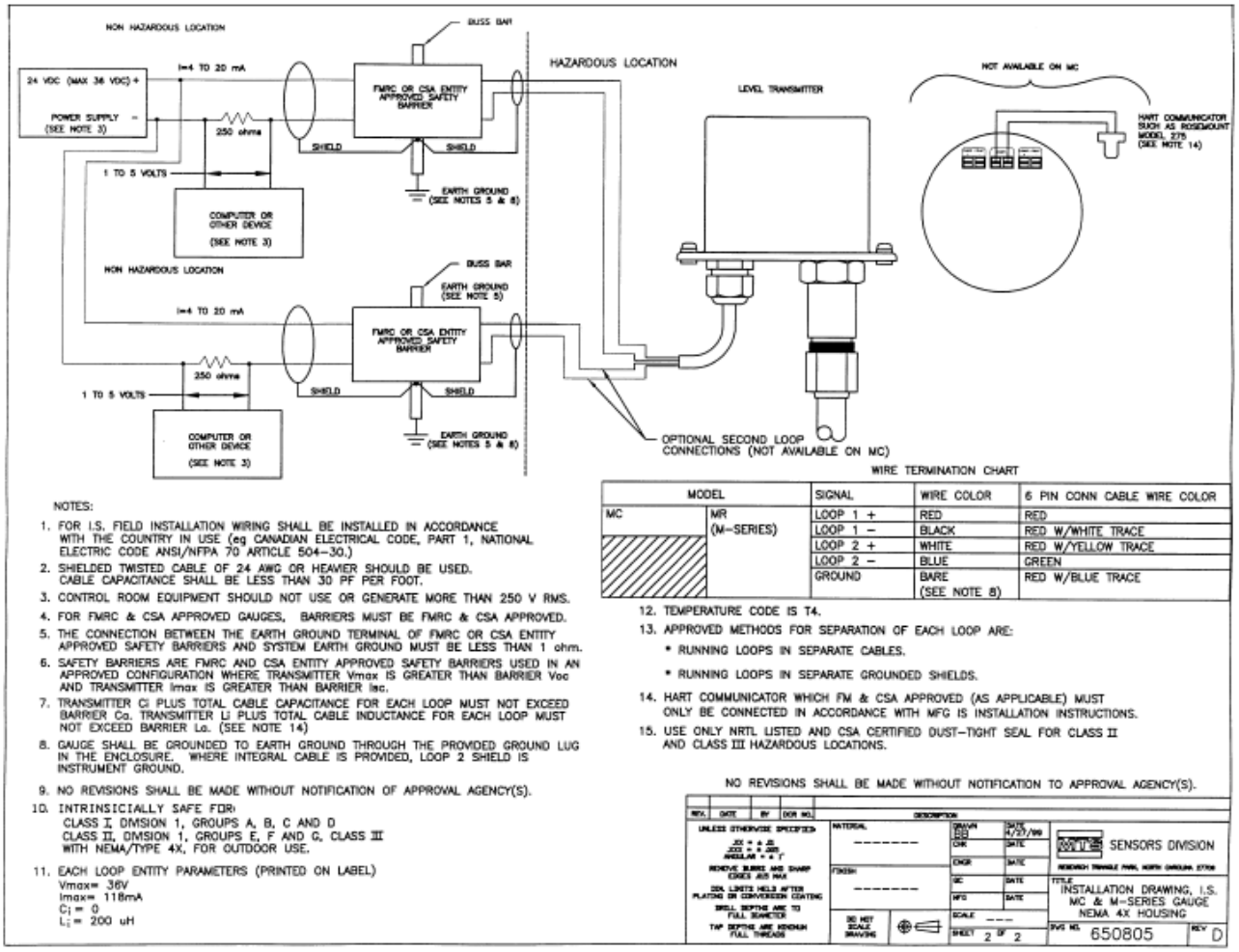
The absolute accuracy of the transmitter is a function of the manufacture of the waveguide. That is, any imperfections in the waveguide are reflected in the linearity of its output. Tolerances reflect a maximum non-linearity of 0.02% of full scale. Due to its high degree of repeatability, the differential accuracy is extremely high.

Theory of Operation

The magnetostrictive Level Plus transmitters precisely sense the position of an external float by applying an interrogation pulse to a waveguide medium. This current pulse causes a magnetic field to instantly surround the waveguide. The magnet installed within the vessel also creates a magnetic field. Where the magnetic fields from the waveguide and vessel intersect, a rotational force is created (waveguide twist). This, in turn, creates a torsional sonic pulse that travels along the waveguide.

The head of the transmitter houses the sensing circuit, which detects the torsional sonic pulse and converts it to an electrical pulse. The distance from a reference point to the float is determined by measuring the time interval between the initiating current pulse and the return pulse and precisely knowing the speed of these pulses. The time interval is converted into a 4 - 20 mA loop signal.

Electronic Level Monitor



NOTES:

1. FOR I.S. FIELD INSTALLATION WIRING SHALL BE INSTALLED IN ACCORDANCE WITH THE COUNTRY IN USE (eg CANADIAN ELECTRICAL CODE, PART 1, NATIONAL ELECTRIC CODE ANSI/NFPA 70 ARTICLE 504–30.)
2. SHIELDED TWISTED CABLE OF 24 AWG OR HEAVIER SHOULD BE USED. CABLE CAPACITANCE SHALL BE LESS THAN 30 PF PER FOOT.
3. CONTROL ROOM EQUIPMENT SHOULD NOT USE OR GENERATE MORE THAN 250 V RMS.
4. FOR FMRC & CSA APPROVED GAUGES, BARRIERS MUST BE FMRC & CSA APPROVED.
5. THE CONNECTION BETWEEN THE EARTH GROUND TERMINAL OF FMRC OR CSA ENTITY APPROVED SAFETY BARRIERS AND SYSTEM EARTH GROUND MUST BE LESS THAN 1 ohm.
6. SAFETY BARRIERS ARE FMRC AND CSA ENTITY APPROVED SAFETY BARRIERS USED IN AN APPROVED CONFIGURATION WHERE TRANSMITTER Vmax IS GREATER THAN BARRIER Voc AND TRANSMITTER Imax IS GREATER THAN BARRIER Isc.
7. TRANSMITTER Ci PLUS TOTAL CABLE CAPACITANCE FOR EACH LOOP MUST NOT EXCEED BARRIER Ca. TRANSMITTER Li PLUS TOTAL CABLE INDUCTANCE FOR EACH LOOP MUST NOT EXCEED BARRIER La. (SEE NOTE 14)
8. GAUGE SHALL BE GROUNDED TO EARTH GROUND THROUGH THE PROVIDED GROUND LUG IN THE ENCLOSURE. WHERE INTEGRAL CABLE IS PROVIDED, LOOP 2 SHIELD IS INSTRUMENT GROUND.
9. NO REVISIONS SHALL BE MADE WITHOUT NOTIFICATION OF APPROVAL AGENCY(S).
10. INTRINSICIALLY SAFE FOR:
    CLASS I, DIVISION 1, GROUPS A, B, C AND D
    CLASS II, DIVISION 1, GROUPS E, F AND G, CLASS III
    WITH NEMA/TYPE 4X, FOR OUTDOOR USE.
11. EACH LOOP ENTITY PARAMETERS (PRINTED ON LABEL)
    Vmax= 36V
    Imax= 118mA
    C_i = 0
    L_i = 200 uH

WIRE TERMINATION CHART

MODEL		SIGNAL	WIRE COLOR	6 PIN CONN CABLE WIRE COLOR
MC	MR (M-SERIES)	LOOP 1 +	RED	RED
		LOOP 1 −	BLACK	RED W/WHITE TRACE
		LOOP 2 +	WHITE	RED W/YELLOW TRACE
		LOOP 2 −	BLUE	GREEN
		GROUND	BARE (SEE NOTE 8)	RED W/BLUE TRACE

12. TEMPERATURE CODE IS T4.
13. APPROVED METHODS FOR SEPARATION OF EACH LOOP ARE:
    - RUNNING LOOPS IN SEPARATE CABLES.
    - RUNNING LOOPS IN SEPARATE GROUNDED SHIELDS.
14. HART COMMUNICATOR WHICH FM & CSA APPROVED (AS APPLICABLE) MUST ONLY BE CONNECTED IN ACCORDANCE WITH MFG IS INSTALLATION INSTRUCTIONS.
15. USE ONLY NRTL LISTED AND CSA CERTIFIED DUST-TIGHT SEAL FOR CLASS II AND CLASS III HAZARDOUS LOCATIONS.

NO REVISIONS SHALL BE MADE WITHOUT NOTIFICATION TO APPROVAL AGENCY(S).

REV.	DATE	BY	DCR NO.	DESCRIPTION

UNLESS OTHERWISE SPECIFIED
.XX = ± .05
.XXX = ± .020
ANGULAR = ± 1°
REMOVE BURRS AND SHARP EDGES .005 MAX
COIL LIMITS HELD AFTER PLATING OR CONVERSION COATING
SHELL DEPTHS ARE TO FULL DIAMETER
TAP DEPTHS ARE MINIMUM FULL THREADS

MATERIAL: --------
FINISH: --------
DO NOT SCALE DRAWING
DRAWN: EB 4/27/99
CHK
ENGR
QC
MFG
DATE
SCALE: ---
SHEET 2 OF 2

SENSORS DIVISION
TITLE: INSTALLATION DRAWING, I.S. MC & M-SERIES GAUGE NEMA 4X HOUSING
DWG NO. 650805
REV D

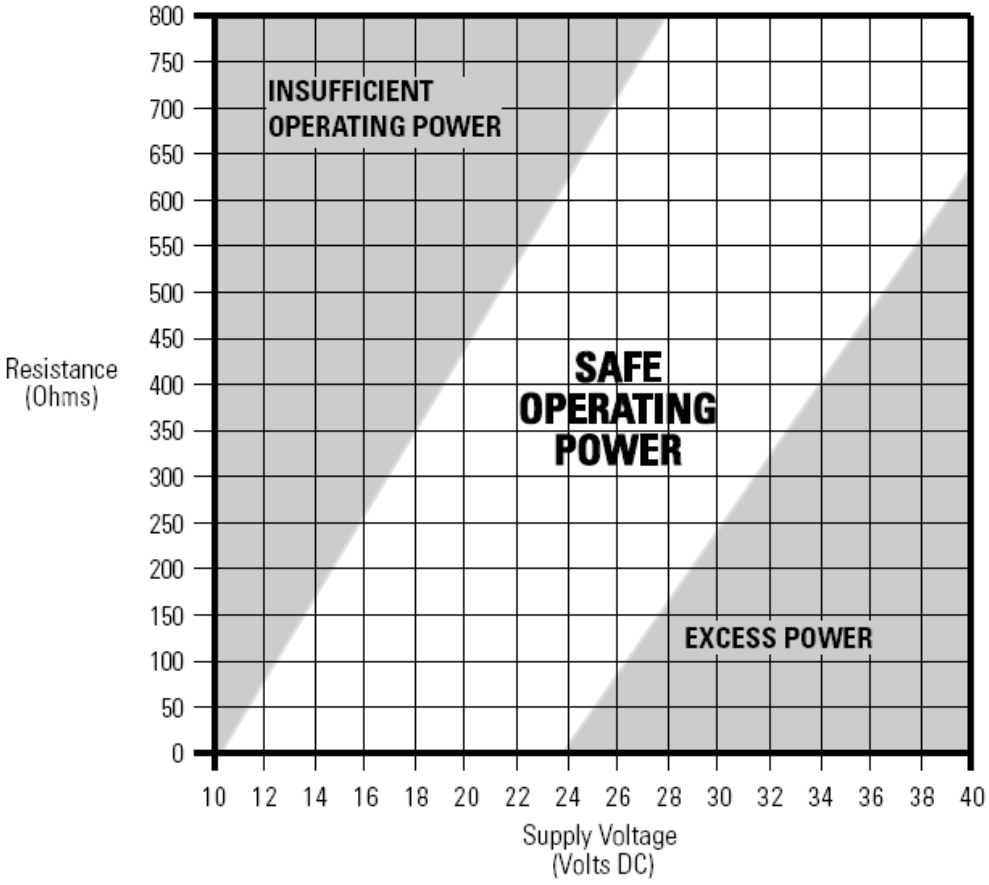
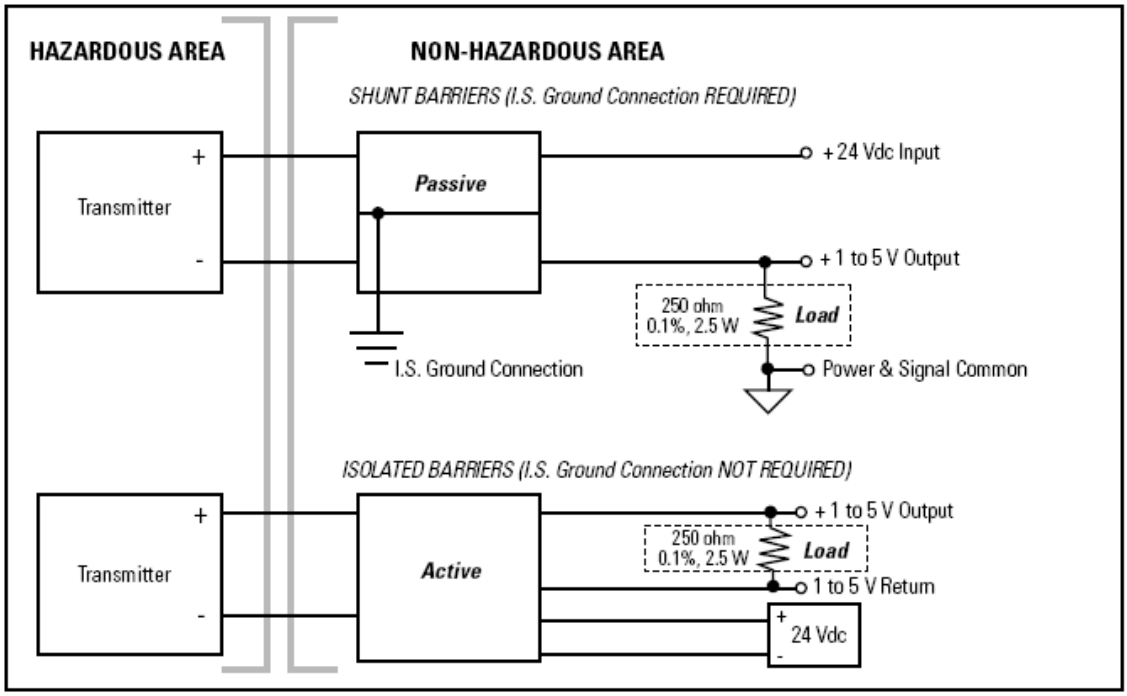


Figure 5-2
Loop Resistance vs. Power Supply

Recommended Safety Barriers for IS Installation



NOTES:

- *When selecting barrier types, the electrical specifications for the MC420 transmitter are: Vmax = 36.1 Vdc, Imax = 118 mA (total current), Ci = 0.0 µF, Li = 0.0 µHy*

Figure 5-3
Suggested Safety Barrier Types for MC420 Transmitter

SYSTEM CHECK

After completing the MC420 wiring, the system is ready to be checked out. Apply power to the unit. Using a DC volt meter, measure the voltage at loop #1 connections. The voltage must be ≥ 10.5V. If the voltage levels are too low, shut down the system. Check for shorts, power supply voltage, and excessive loop resistance. Refer to the Safe Operating Power chart (Fig. 5-2) which shows the relationship between loop resistance and operating voltage.

Loop #1 Test

To test loop #1 on a bench, move the mixer magnet along the operational range of the MC420 transmitter. If functioning properly, the output current will change as the float moves.

An output current of less than 4 mA or greater than 20 mA could indicate a problem with the MC420 transmitter.

MAINTENANCE

The Electronic Level Monitors use magnetostrictive technology and only have one moving part—the float. This technology ensures no scheduled maintenance or recalibration is required.

However, we recommend that you check the sensor pipe annually for build up of process material. Routine cleaning should be performed as required.

ADJUSTMENTS FOR LEVEL/PLUS MC420 TRANSMITTER

NOTE:
To ensure that the new settings are correct, place a current meter in line with the MC420 so that is is visible during the calibration process.

Calibration

The MC420 level transmitter comes calibrated from the factory per the application data sheet which was submitted with the order. To change the zero (4 mA) or Span (20 mA) settings, use the following procedure:

To set zero (4 mA):

1. Place mixer in desired position for the zero (4 mA) point.
2. Locate the recess marked (Z) on the underside of the baseplate.
3. Using the provided magnet briefly tap the (Z) to enable the CAL mode.
4. Place the magnet in the recess marked (Z) and hold for 3 seconds, then release.

To set the Span (20 mA) position

1. Move the mixer to the desired span (20 mA) location.
2. Locate the recess marked (S) on the underside of the base plate.
3. Using the provided magnet, briefly tap the recess marked (S) to enable the CAL mode.
4. Place the magnet in the recess marked (S) for 3 seconds, then release.

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