Light Liquid Sampler

SYSTEM SUPPORT MANUAL

LPR-2S-1.5,3,5P-1A

YZ SYSTEMS
MILTON ROY

LPR-2S-1.5,3,5P-1A
INSTRUCTION & OPERATING MANUAL

Version: 07232002 Rev-B

How to Use this Manual

The LPR-2S-1.5,3,5P-1A Operations Manual is a step-by-step guide containing the procedures needed to work with the LPR-2S-1.5,3,5P-1A System.

The LPR-2S System Series of samplers implement the most advanced technology available in the industry. It is recommended that the technicians working with the LPR-2S 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, available in Adobe Acrobat™ PDF format, will be highlighted further in *blue italic text* indicating the copy retains a hyperlink to the referenced item.

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 LPR-2S-1.5,3,5P-1A system. If the answer can not be found within this manual, contact YZ Systems at:

T: 1.936.788.5593
T: 1.800.653.9435
F: 1.936.788.5720
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 PNR-2S System and the version number of this manual. The serial number is located on the inside of the enclosure door. 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.

Operation Specifications

Maximum Output:	6.8 gallons/day *(25.3 liters/day)*
Maximum Operating Pressure:	1,800 psig *(124 Bar (g)*
Pump Displacement:	.25 - 1.8 cc/Stroke
Operating Temp Range:	0 to 140 degrees F. *(17°C to 60°C)*
Pulsed Power Supply:	24 vdc @ 1 AMP
Actuation Gas;	80 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).*

YZ SYSTEMS
MILTON ROY

Table Of Contents

About This Manual...

Introduction:

The purpose of this manual is to provided a step-by-step guide to the operation, installation and maintenance of your YZ Light Liquid Hydrocarbon Sampling System. It should be read by both first-time and experienced measurement technicians who want to learn about the components and operation of the system. The manual has been organized into sections, which are summarized as follows:

- Section 1 - "System Introduction"
  Includes an overview of the system components, a description of how the system operates, a schematic system diagram, and a system layout of the skid.

- Section 2 - "Sample Pump and Balance Valve"

- Section 3 - "Five-way Cross"

- Section 4 - "Product Accumulator Vessel"

- Section 5 - "Precharge Gas System"

- Section 6 - "Actuation/Mixing System Power Source"

- Section 7 - "System Electronic Control"
  These sections include details on the function, location, operation and maintenance of individual components of the sampling system.

- Section 8 - "System Installation and Start-up"
  Includes detailed instruction on the proper way to install your YZ sampler. Likewise, a step-by-step start-up procedure is to guide you through commissioning the unit.

Section 1: System Introduction

Theory of Operation:

The LPR-2S-(1.5,3,5)P-1A is a complete sampling system designed to sample light liquid hydrocarbons. Thousands of individual samples are captured and combined to develop a representative, composite sample of the flowing pipeline.

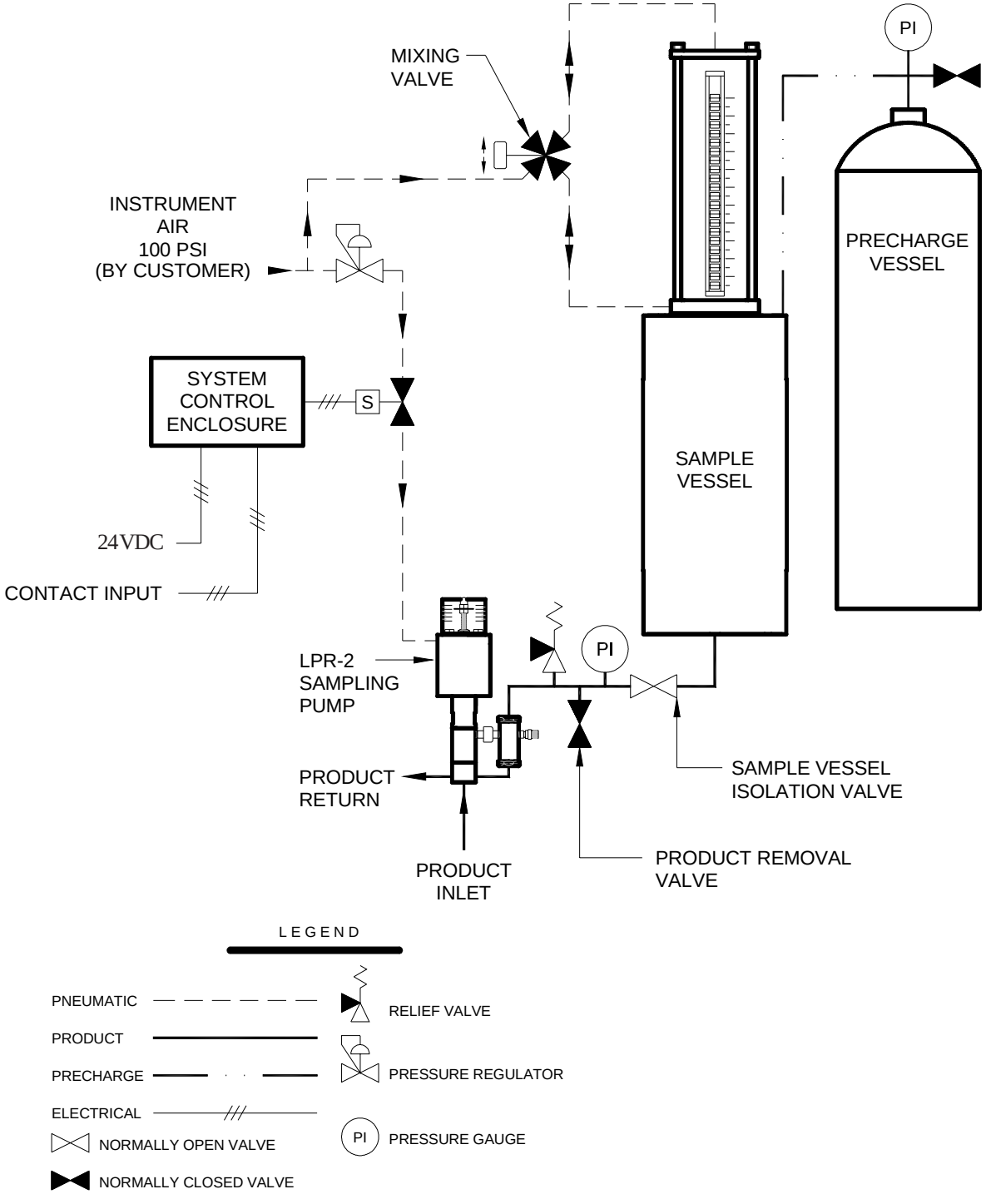
Operation of the sampling system centers around the following primary components: the LPR-2 Sample Pump, the Product Accumulator Vessel, the Electronic Control System, and the Precharge Gas Vessel. All equipment is mounted on a 2' x 2' structural steel skid. These components are shown in the diagram on the following page.

The sampling system operates on a simple concept. When the system receives a closed contact signal by others, the time delay relay electronic control unit energizes the system solenoid valve. Energizing the solenoid valve forces a pneumatic signal 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 is de-energized, the sample pump plunger returns to its normal position. This action captures a new sample into the pump. When the system receives the next closed contact signal, the cycle begins again.

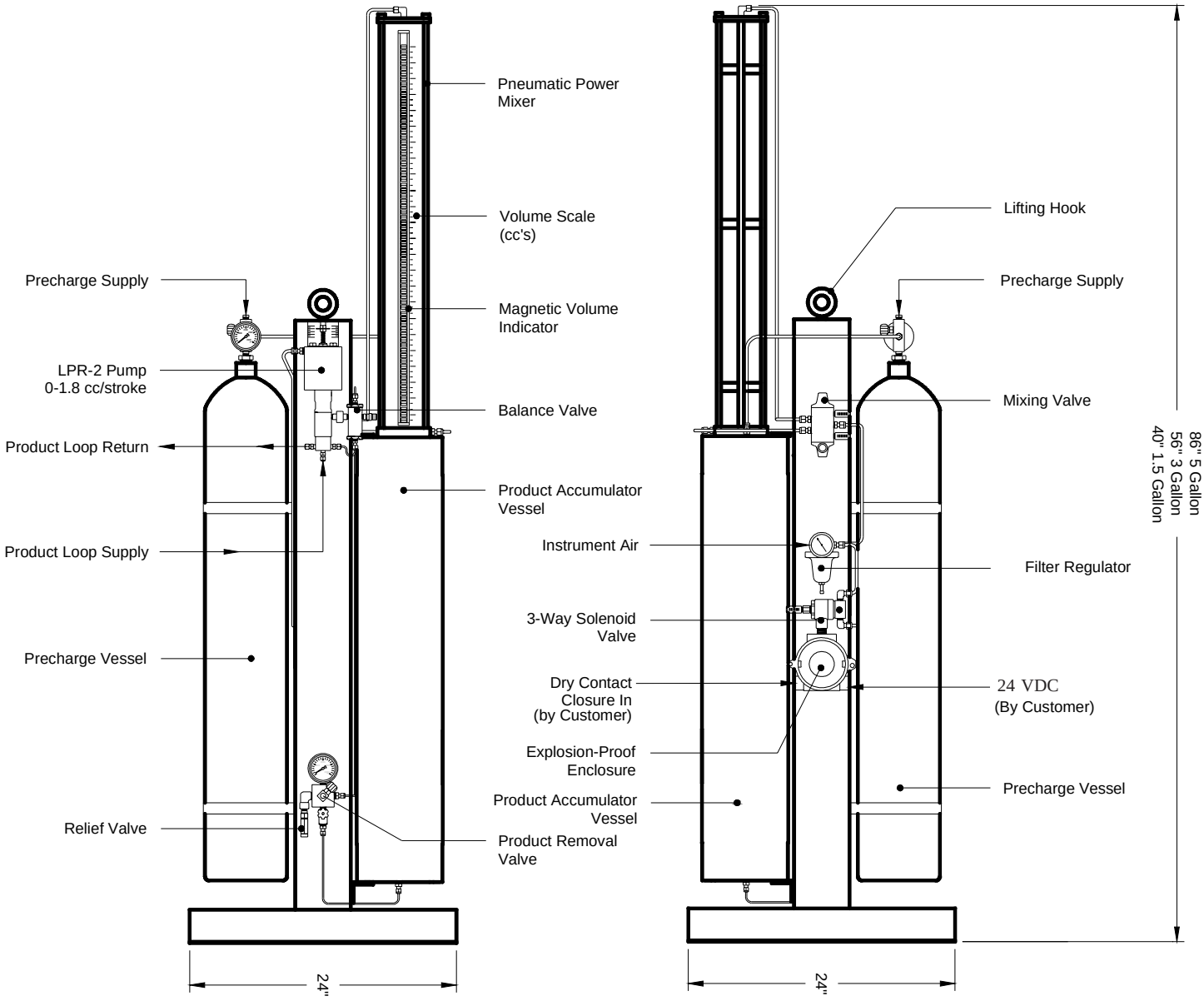
The purpose of the YZ light liquid hydrocarbon sampling system is to capture and maintain a representative liquid sample of the pipeline product. The sampled product is maintained in a liquid phase by the product accumulator vessel's free floating piston and the precharge gas system. In order for the 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 accumulator vessel 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. After removing the remainder of the product from the accumulator vessel, the system is then ready for a new sample period.

Section 1: System Introduction



Section 1: System Introduction



Section 2: LPR Sample Pump

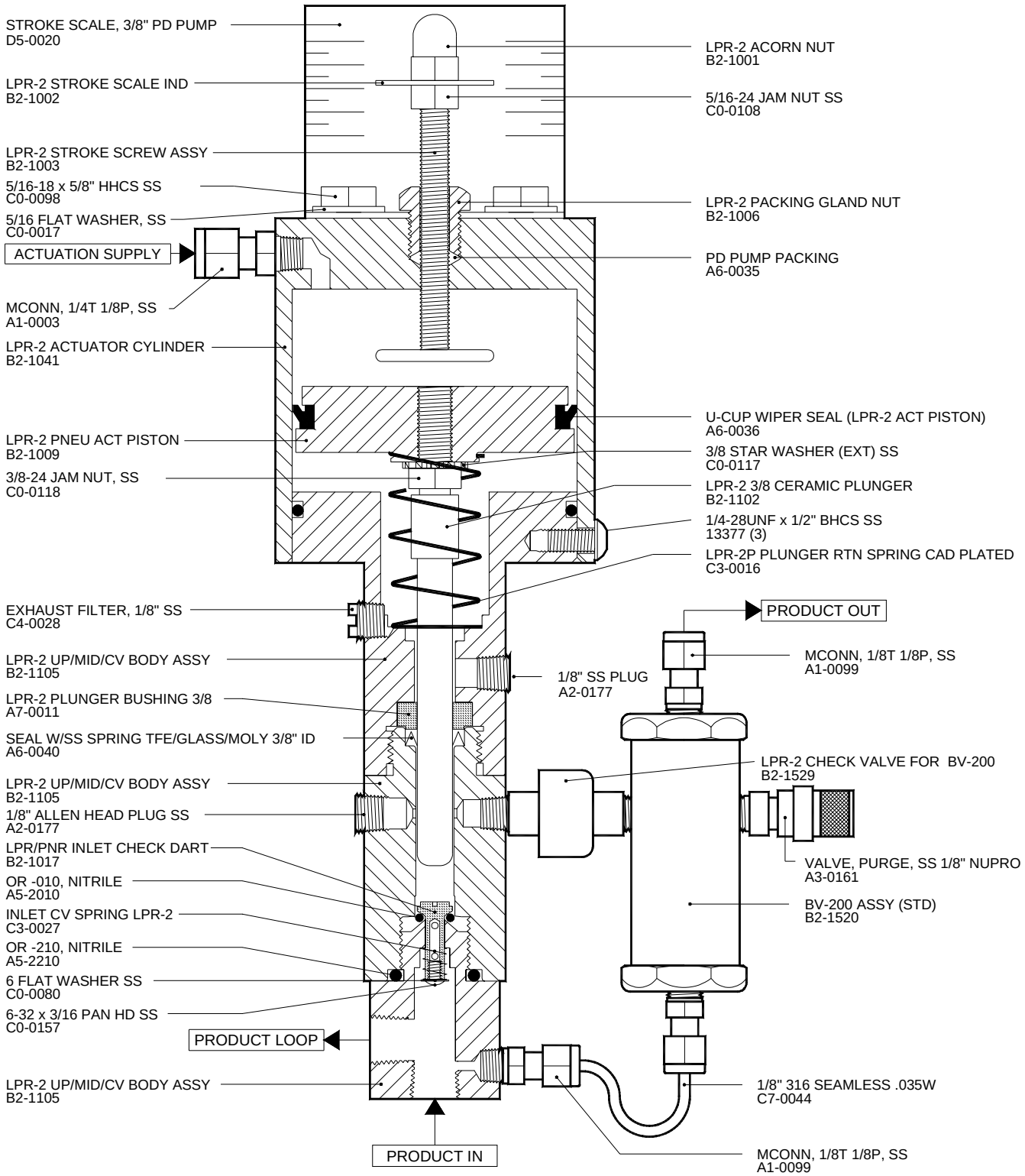
The LPR-2P Sample Pump is a positive displacement plunger pump designed to mount on the sampler, refer to page 7. It has an adjustable displacement of 0.25 to 1.8 cc and achieves proportional-to-flow sampling through a proportional to flow signal provided from some other flow monitoring device.

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 by the pneumatic actuation system, the plunger moves downward, displacing product through the discharge check valve known as the balance valve.

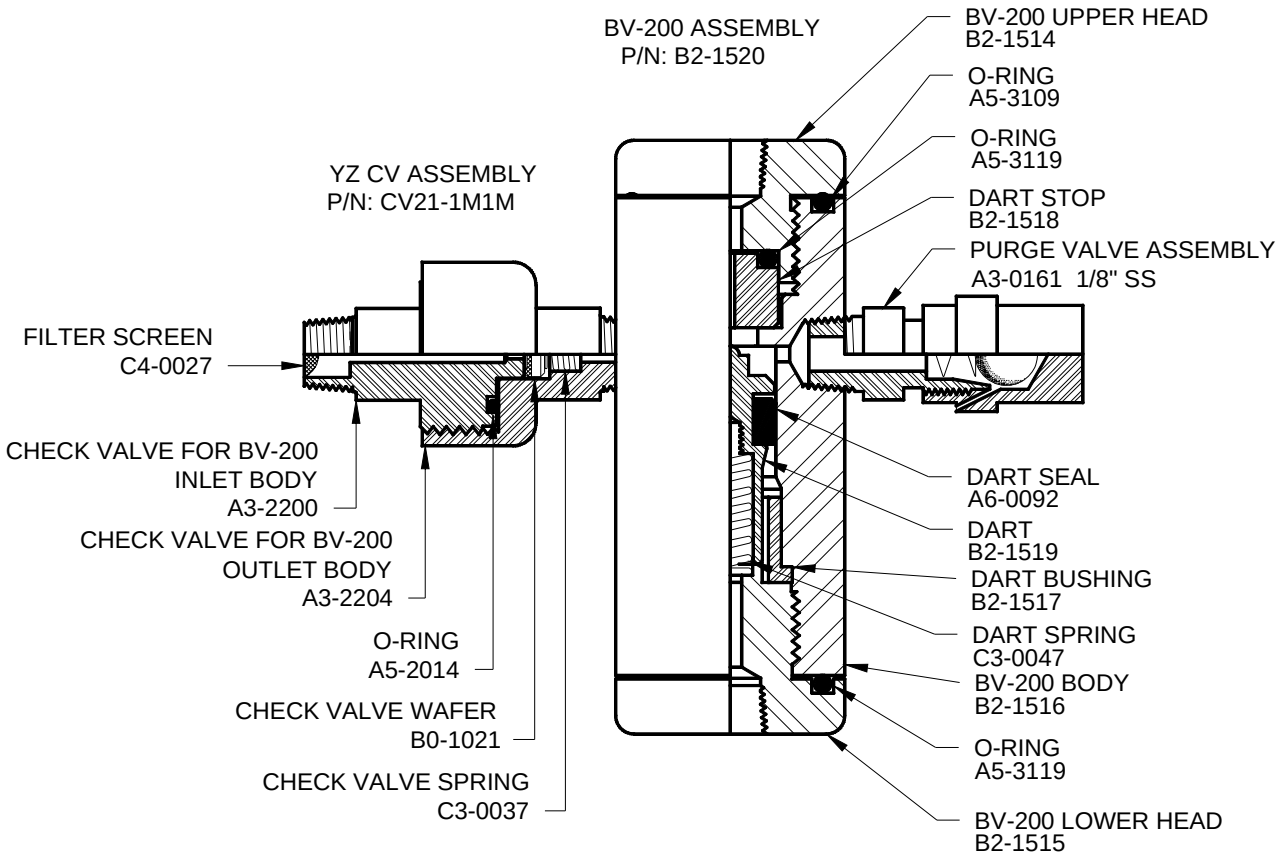
The balance valve automatically senses pipeline pressure and adjusts to ensure that product is not allowed to free flow to the product vessel, refer to page 8. When the pipeline pressure is greater than the precharge pressure on the accumulator vessel, the balance valve dart is pushed up against the seat and the top head of the balance valve. As the pump strokes, the pressure created in the pump chamber forces the balance valve dart off the seat, allowing product to be pumped to the accumulator vessel. Once the pump completes its stroke, the pressure across the balance 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 2: LPR Sample Pump



Section 2: LPR Sample Pump/ Balance Valve Assembly



Section 3: Five-way Cross Assembly

The Five-way cross assembly 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, refer to page 10.

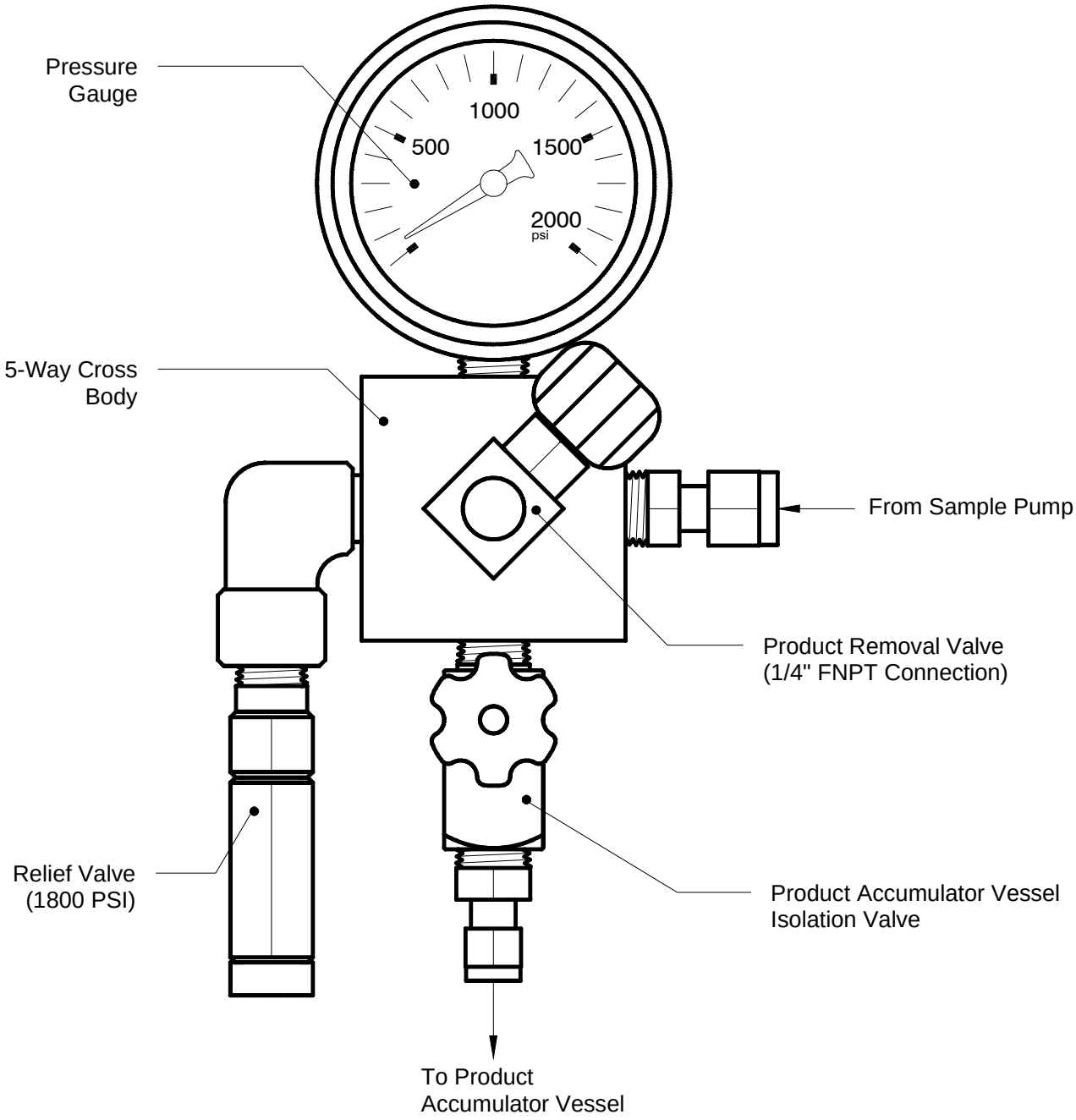
The pressure gauge is used during normal operation to indicate the pressure within the accumulator vessel. During start-up and troubleshooting procedures it is used in conjunction with the accumulator vessel isolation valve to check pump performance.

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 3: Five-way Cross Assembly



Section 4: Product Accumulator Vessel (P)

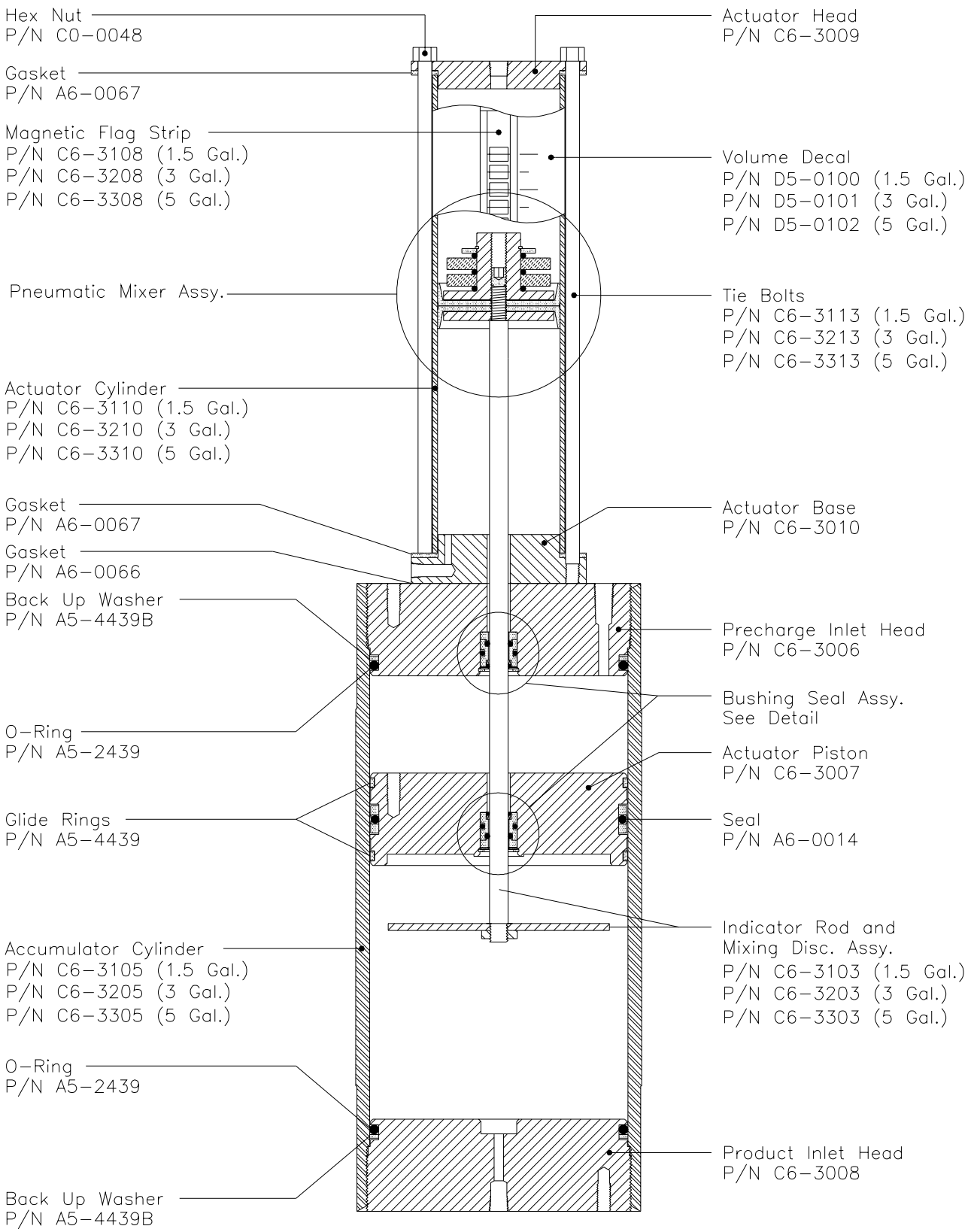
The YZ Product Accumulator Vessel is designed to maintain a composite sample in the liquid phase. This is accomplished by using a free-floating piston design and an inert precharge gas system, refer to page 12. As product is collected in the accumulator vessel, the precharge gas system maintains a constant 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.

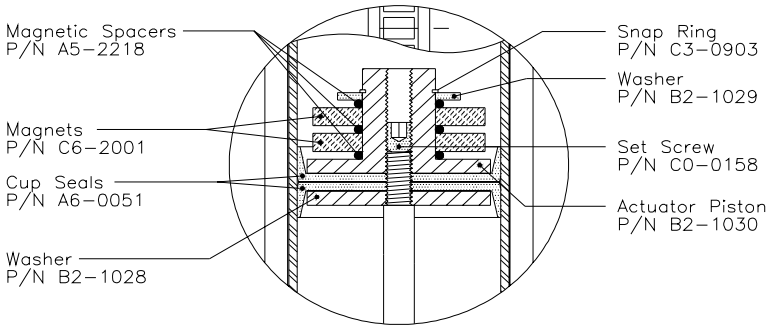
The actuator assembly is located on the top of the accumulator cylinder and serves two functions, refer to page 13.The first is to provide mixing of the sampled product by moving the mixing disc up and down within the product portion of the accumulator cylinder. This is done by introducing pneumatic pressure to one side of the pneumatic mixer piston assembly and then by applying pressure to the opposite side of the pneumatic 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.

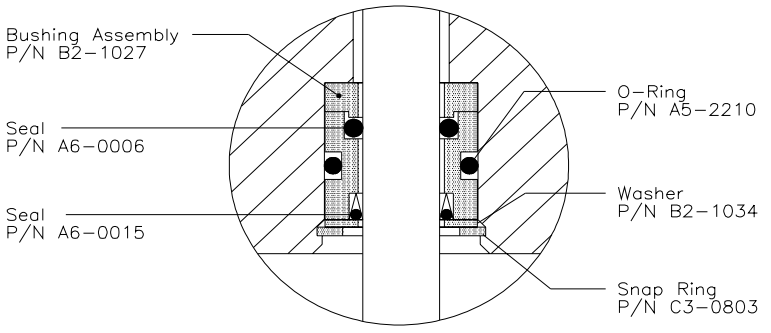
Section 4: Product Accumulator Vessel (P)



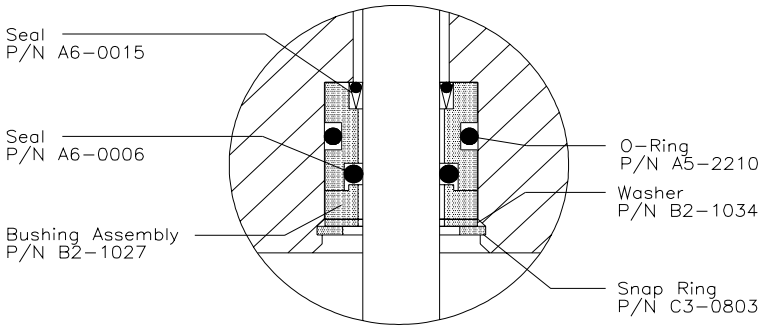
Section 4: Product Accumulator Vessel (P)



Pneumatic Mixer
Piston Assembly



Bushing Seal Assembly for
Precharge Inlet Head



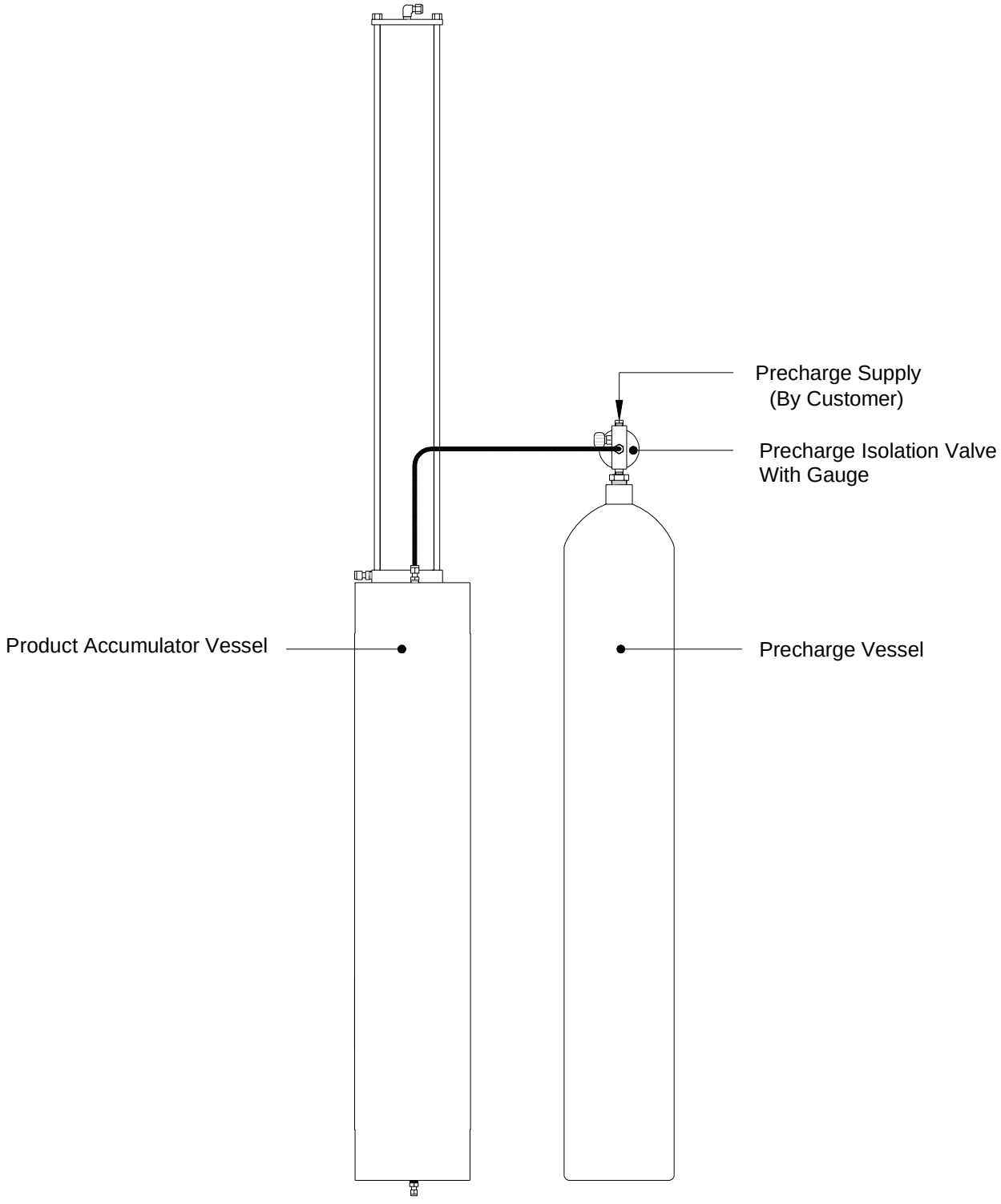
Bushing Seal Assembly for
Actuator Piston

Section 5: Precharge Gas System

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, refer to page 15. 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.

Section 5: Precharge Gas System



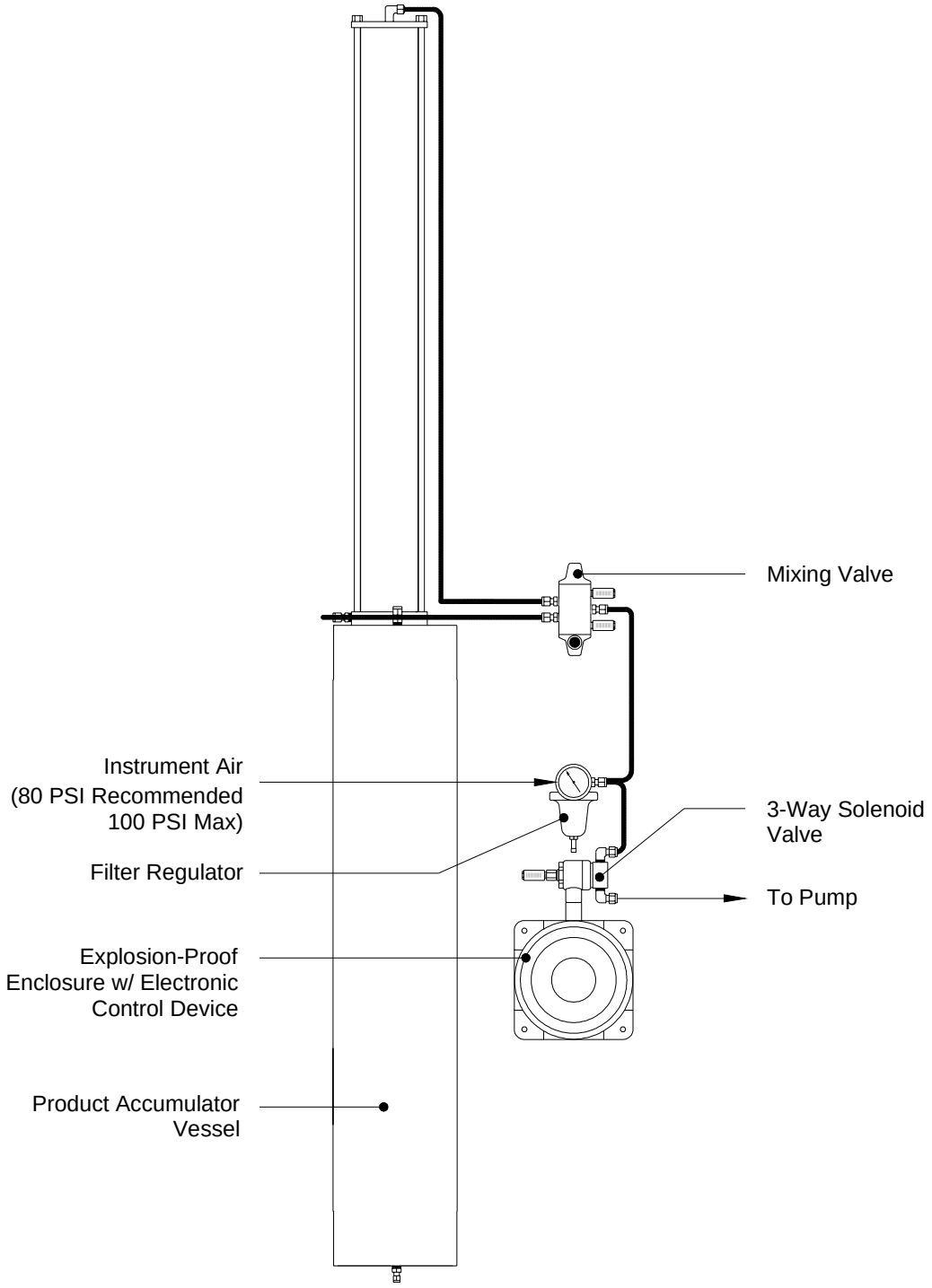
Section 6: Actuation/Mixing Power Source (PNEU)

The function of the 80-100 psi instrument air supply is to provide an actuation power source for the sample pump and the accumulator vessel mixing system, refer to page 17. Constructed as an integral component of the entire sampling system, the actuation system is pressure tested at the factory prior to shipment.

The instrument air source is connected to a tee welded onto the sample skid. It is this tee that splits the pneumatic source between sample pump actuation and accumulator vessel mixing. The " actuation" leg of the tee is piped to a pressure regulator (factory set at 38 psi) and on to a three-way explosion proof solenoid valve. This solenoid valve is normally closed and is mounted on the explosion proof enclosure provided with the sample skid. 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 pump is factory installed.

The "mixing" leg of the welded tee 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 five passes through the sample should provide sufficient mixing.

Section 6: Actuation/Mixing Power Source (PNEU)



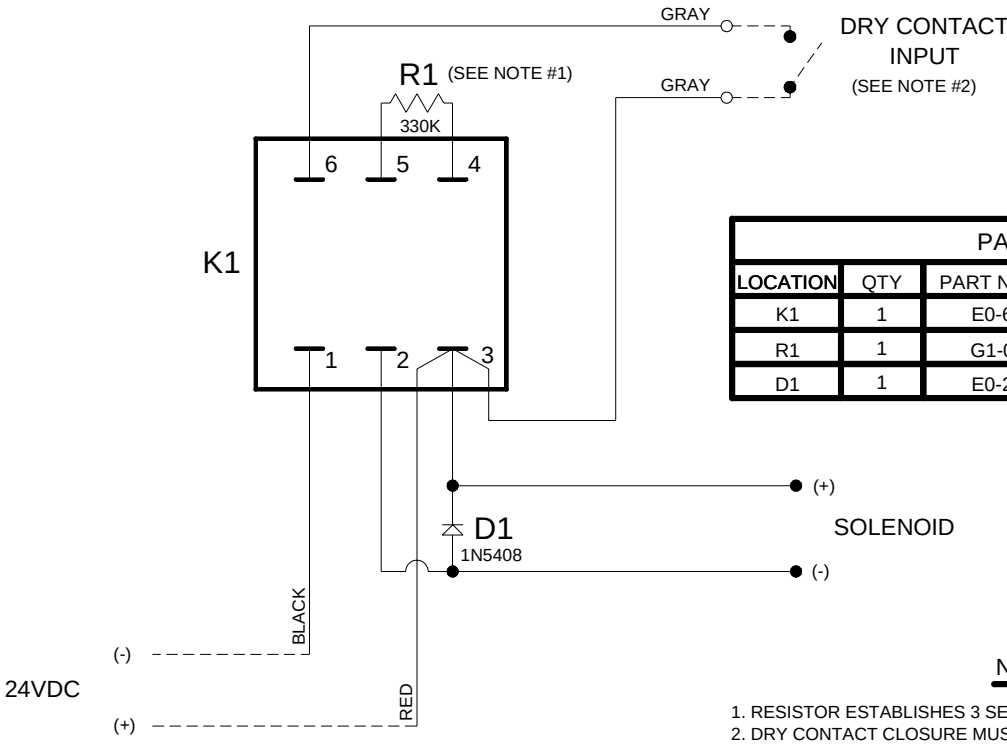
Section 7: Electronic Control for Pneumatic Systems (-1B)

The electronic control package provided with your sampling system consists of a solid state Time Delay Relay (TDR). The TDR converts a continuous voltage signal into a 3 second voltage output everytime a contact closure occurs. This 3 second duration allows sufficient time to stroke the sample pump and retrieve a single sample.

The control package requires you to provide 24 VDC at terminals 1 and 3. You are also required to provide dry contacts at terminals 3 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, refer to page 19.

Refer to the figures on the following pages for information on system wiring layout and replacement parts.

Section 7: Electronic Control for Pneumatic Systems (-1A)



PARTS LIST			
LOCATION	QTY	PART NUMBER	DESCRIPTION
K1	1	E0-6007	TIME DELAY RELAY
R1	1	G1-0024	RESISTOR ASSEMBLY
D1	1	E0-2003	DIODE

NOTES

1. RESISTOR ESTABLISHES 3 SECOND DWELL.
2. DRY CONTACT CLOSURE MUST BE A MINIMUM 20 MSEC DURATION.
3. CUSTOMER SUPPLIED – – – – – – – – – –

Section 8: Installation/Start-up/Operation
(LPR-2S-(1.5,3,5)P-1A)

Skid Installation
The skid should be located as close as possible to the pipeline. Four 5/8” diameter holes are provided to mount the skid to a concrete slab, metal skid, etc.

Product Loop
1/4" stainless steel tubing should be field routed from the pipeline sample probe to the pump port tagged “product in”. Likewise, 1/4" stainless steel tubing should be field routed from the pump port tagged “product loop” back to a downstream port in the pipeline. Care should be taken in routing this tubing to prevent traps, long runs, etc. A pressure drop of 2-3 psi (min) should be present between the pipeline connections.

Electrical Connections
24 VDC, electrical power should be connected to the left side opening of the skid electrical enclosure. The power wiring should be connected to the wires tagged “24VDC”. The hot wire should be connected to the black system wire. The neutral wire should be connected to the white system wire, refer to page 19.

The meter contacts to control the system should be connected to the right side opening of the skid electrical enclosure. The wiring for the meter contacts should be connected to the grey wires which are tagged “meter contacts”. All electrical connections are designed for ½” NPT conduit.

Precharge Gas Installation
Connect the precharge gas source (normally nitrogen) to the isolation valve 1/4" NPT connection located on top of the precharge vessel. Open the isolation valve. 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. Once the vessel is filled, close the isolation valve and remove the precharge gas source. Leak test all connections between the precharge vessel and the product accumulator vessel.

Section 8: Installation/Start-up/Operation
(LPR-2S-(1.5,3,5)P-1A)

Pneumatic Supply
A 1/4" connection is provided for a continuous pneumatic supply (80-100 psi). The necessary regulator, solenoid valve, etc. is provided with the sampling skid.

Sampler Control Set-up
Calculate the pump setting using the following formula:

$$\text{Pump Setting} = \frac{D \times E}{B \times C}$$

Where, B = Average Flow rate (Gal/day or BBL/day)
C = Sample period (days)
D = Metered volume per pulse (Gal/pulse or BBL/pulse)
E = 80% sample accumulator volume (cc)

For 1.5 gallon accumulators, E = 4,750 cc
For 3 gallon accumulators, E = 8,750 cc
For 5 gallon accumulators, E = 16,750 cc

The pump setting must be within range of 0.25 to 1.8 cc / stroke.

Pump Sample Size
The sample size of the Sample Pump is adjustable from 0.25 to 1.8 cc/stroke. 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.

Section 8: Installation/Start-up/Operation
(LPR-2S-(1.5,3,5)P-1A)

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 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 Balance Valve. 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 page 10. 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 Removal Procedure

After mixing the sample, attach a DuraSite, refer to page 23, constant pressure portable sample vessel to the rob valve located on the Five-way Cross Assembly. The portable sample vessel must also be precharged to 100-150 psi above the vapor pressure of the product. Open the rob valve to remove the product from the cylinder. Close the rob valve and remove the DuraSite from the rob valve. Open the rob valve to flare any remaining product from the Product Accumulator Vessel. Close the rob valve. Raise the mode switch to the “sample” position. Rotate the diverter switch to the “sample” position.

Section 9 - DuraSite Portable Sample Vessel Instructions

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.
Proceed to *EITHER* Step 2, or Step 3 as required for your application.

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

2a: Connect the product end of the pre-charged sample vessel to the product supply. (Sampler product removal valve, or Pipeline sample probe)
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: FOR DIRECT CONNECTION TO SAMPLER.

3a: Connect the sampler discharge port to the product inlet port to the DuraSite using 1/8" stainless steel tubing.

3b: (Gas sampling) Connect the pre-charge port to the DuraSite to the pipeline for pre-charge pressure (Proceed to step 3d), or configured like the liquid sample application below. (Step 3c)

3c: (Light sampling) Pre-charge the DuraSite as indicated in Step 1, then install a pressure relief valve to the pre-charge port and open the pre-charge valve on the DuraSite. (The pressure relief valve should have a relief pressure setting of approximately 100 psi above line pressure.)

3d: Open the product inlet valve of the DuraSite and the purge valve on the sampler. Next open the purge valve on the product end of the DuraSite and allow product to purge all lines and connections out.

3e: Close purge valves and begin sample cycle.

3f: At the end of sample cycle, close product inlet valve on the DuraSite and remove the DuraSite. 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 4: (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 5: 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.

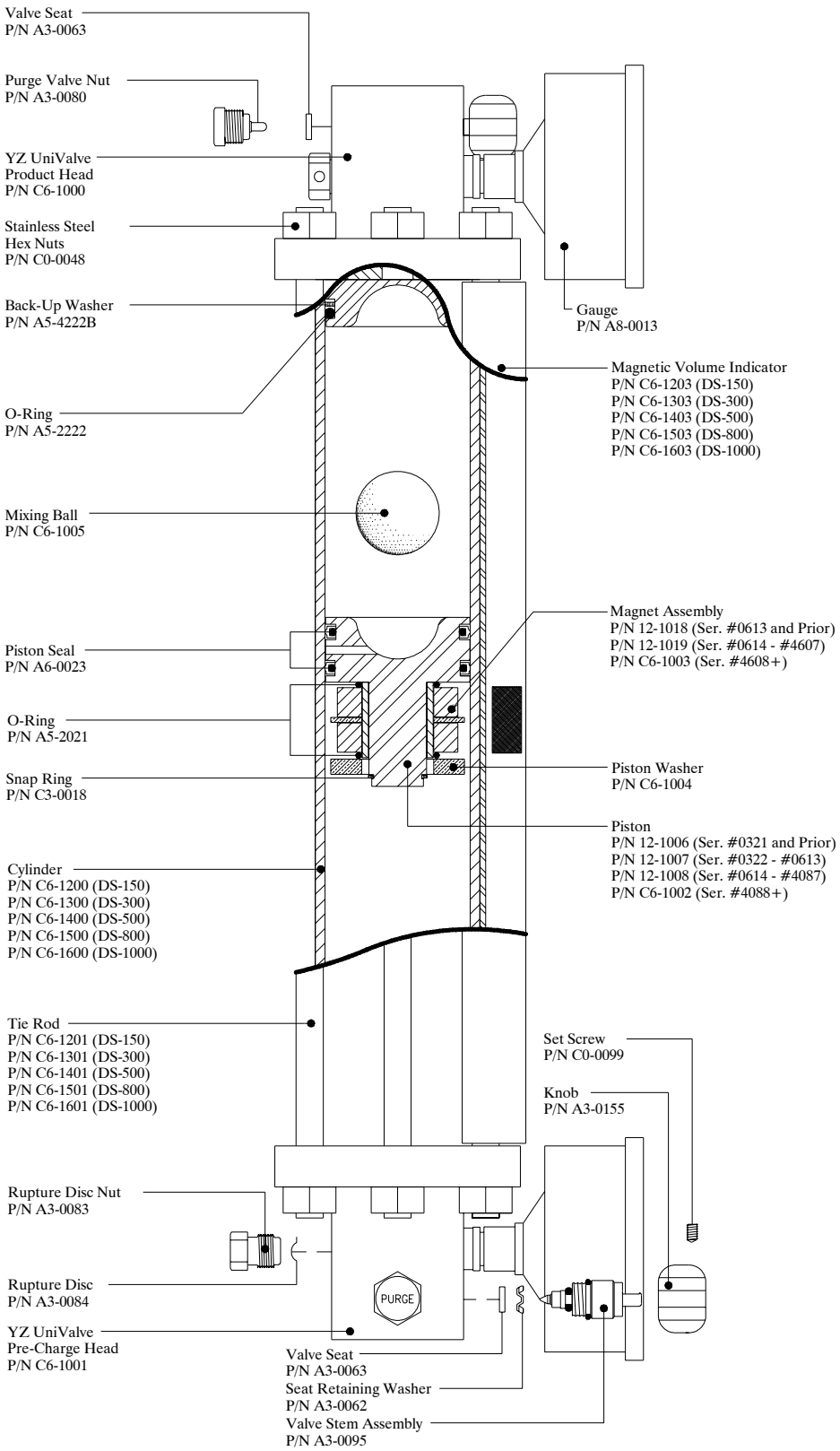
Step 6: Purging a small amount of product from the vessel removes unmixed product from the tee, relief device, gauge, etc. The unit can now be connected to a chromatograph and the product analyzed.

Step 7: 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 9 - DuraSite (STD. illustrated)



Notes

Notes

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