

**AirSep[®] Corporation
PSA Oxygen Generator
Model AS-Q - AS-Z**

Instruction Manual

MN173-1 Rev. B 03/12



Ownership Data

Please take a moment to note below important information about your AirSep® Corporation PSA Oxygen Generator. Retain this instruction manual, along with your invoice, to serve as a permanent record of your purchase.

PSA Oxygen Generator

Model Number:

Serial Number:

Invoice Date:

Start-up Date:

AirSep Representative

Company:

Contact:

Address:

City/Town:

State:

Zip:

Country:

Fax:

Phone:

Telex:



Before you attempt to install, operate, or repair the oxygen generator, read and thoroughly understand this instruction manual. Improper operation can result in severe bodily injury, damage to the oxygen generator, or poor performance.

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1.0 Introduction

1.1 General

This instruction manual provides descriptions of the AirSep Corporation PSA Oxygen Generator Models AS-Q, AS-R, AS-W and AS-Z, as well as instructions for their installation, operation, and maintenance. The Appendix of this instruction manual also includes pertinent drawings and component literature.

To ensure safe operation and proper maintenance of the oxygen generator, AirSep Corporation recommends that you keep this instruction manual readily available for reference.

1.2 Warnings, Cautions, and Notes

As you read this instruction manual, pay special attention to the WARNING, CAUTION, and NOTE messages. They identify safety guidelines or other important information as follows:



Provides information that can prevent severe bodily injury or death.



Cautions against the risk of electric shock.



Provides information important enough to emphasize or repeat.

1.3 References to Controls and Indicators

This instruction manual uses uppercase characters (e.g., ON/OFF) to refer to the controls and the indicators on the touch screen of the oxygen generator. Numbers inside parentheses (e.g., V-2) identify manually operated flow

controls (e.g., manual valves). Refer to Chapter 4 for description of the oxygen generator components for each model.

2.0 Safety

2.1 General

Oxygen, the most abundant of the elements, makes up approximately 50 percent of the earth's crust. In its free state, oxygen forms approximately one-fifth of our air by volume. Although classified as a non-flammable gas, oxygen supports combustion. As an active element, it combines directly or indirectly with all elements except the rare gases. Oxygen is an invisible gas that is colorless, odorless, and tasteless.

To ensure your safety, thoroughly read and familiarize yourself with the entire section of this instruction manual. In addition, AirSep Corporation strongly recommends that you review this section periodically.

2.2 Potential Hazards



Oxygen vigorously accelerates the burning of combustible materials. In an oxygen-enriched atmosphere, many materials that do not burn in normal air require only a slight spark or moderate heat to set them aflame.

To reduce the risk of fire or explosion, keep gasoline, kerosene, oil, grease, cotton fibers, wood, paint, and other combustible material away from all parts of the oxygen generator.

Do not allow smoking, open flame, or usage of electronic devices that may generate sparks near the oxygen generator.

Post "NO SMOKING OR OPEN FLAMES" signs conspicuously near the location of the oxygen generator.



Take extreme care to keep all oxygen piping and vessels clean. To avoid fire or explosion, oxygen clean all surfaces that can come in contact with the product oxygen. Check all oxygen fittings for leaks with an oxygen-compatible, leak-detecting solution.



To prevent fire or electrical shock, locate the oxygen generator indoors, away from rain or any other type of moisture.



Before you attempt to install, operate, or repair the oxygen generator, read and thoroughly understand this instruction manual and the component manuals located in Appendix D of this instruction manual. Improper installation, operation, or repairs can result in severe bodily injury, damage to the oxygen generator, or poor performance.



The interior of the oxygen generator control cabinet contains electrical parts that can produce an electrical shock hazard if not handled properly. To prevent electrical shock, read and thoroughly understand Section 8 — Troubleshooting in this instruction manual before you service the oxygen generator.



AirSep oxygen generators are sold for use in industrial applications only. Contact AirSep Corporation or an authorized AirSep representative before you use this unit for any medical application.



Disconnect power before servicing oxygen generator.



Do not disconnect protective earth.



2.3 Safety Publications

The safety section of this instruction manual is not a complete summary of required safety precautions. Few of the publications for additional information on the safe handling of oxygen are listed below:

- "Installation of Bulk Oxygen Systems at Consumer Sites;" NFPA No. 50; National Fire Protection Association; 1 Batterymarch Park; P. O. Box 9101; Quincy, Massachusetts 02269-9101 USA.
- "Oxygen;" Pamphlet G-4; Compressed Gas Association; 1725 Jefferson Davis Highway; Arlington, Virginia 22202-4102 USA.
- "Cleaning Equipment For Oxygen Service," Pamphlet G-4.1; Compressed Gas Association; 1725 Jefferson Davis Highway; Arlington, Virginia 22202-4102 USA.

3.0 System Description

3.1 General

Air Contains 21 % oxygen, 78% nitrogen, 0.9% argon, and 0.1% other gases. AirSep PSA Oxygen units separate this small percentage of oxygen from compressed air through a unique Pressure Swing Adsorption (PSA) process. The compressed air flows through a filter assembly before the air enters the adsorber vessels. A particulate filter removes condensed water, oil, dirt, scale, etc. from the feed air, and then a separate coalescing filter (mounted on most of the models) removes additional oil and water vapor.

The oxygen generator uses in its adsorber vessels an inert ceramic material called molecular sieve to separate compressed air into oxygen and other gases. The unique properties of molecular sieve allow it to attract, or adsorb, nitrogen physically from air under pressure. This allows oxygen to exit the adsorbers as a product gas. The process valves on the oxygen generator then direct the oxygen to the oxygen receiver for storage until needed by your application.

While one adsorber produces oxygen, the other depressurizes to exhaust the waste gases it adsorbed (collected) during the oxygen production cycle. The entire oxygen generating process is completely regenerative, which makes it both reliable and virtually maintenance-free. The molecular sieve does not normally require replacement.

This instruction manual serves as the guidelines for all the standard AS-Q through AS-Z series models.

4.0 Components Description

4.1 General

The chapter deals with the description of the various components of the AS-Q - AS-Z series oxygen generators. The components of the oxygen generator are grouped and are described in the following sub-sections of the chapter. Figure below displays the location of the major components of the oxygen generator.

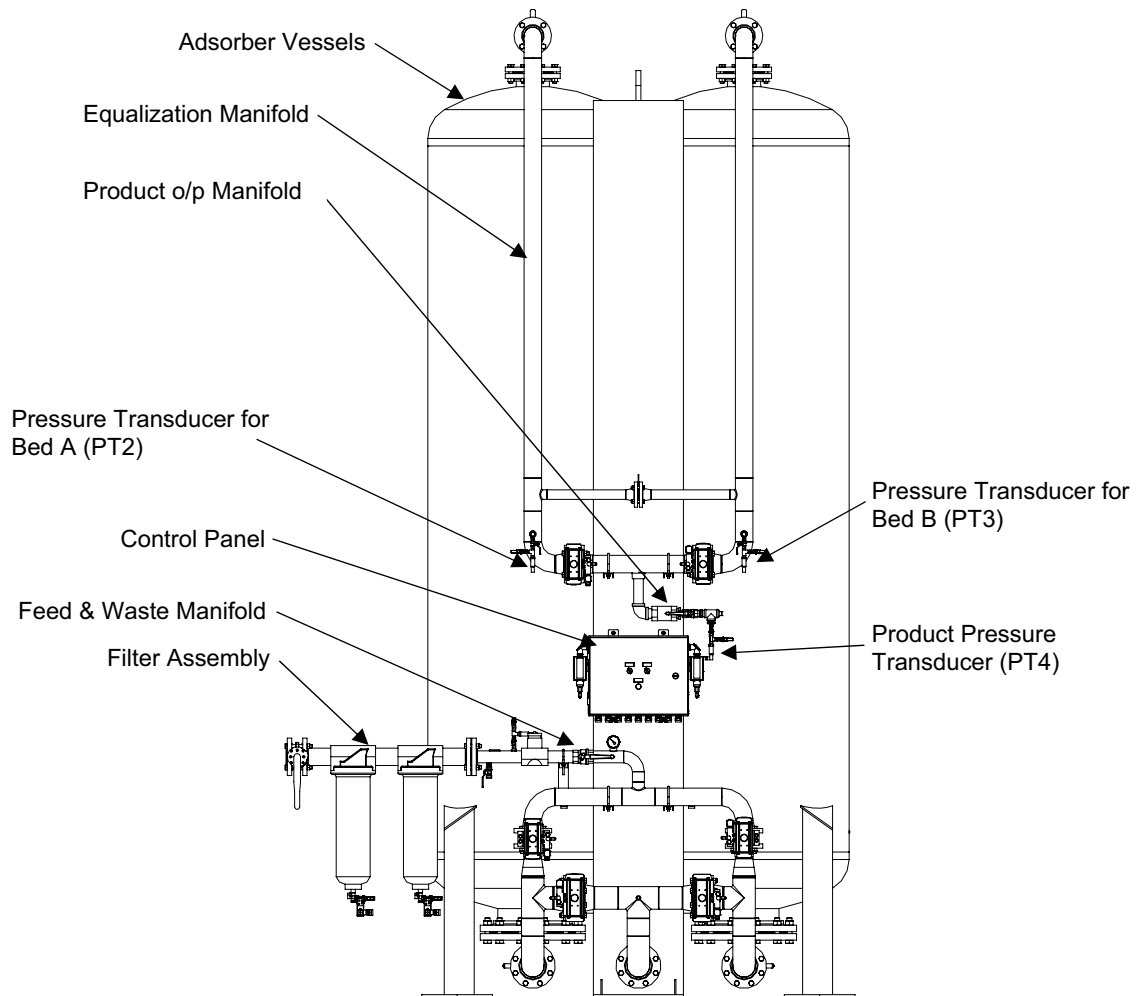


Figure 4.1: General Layout of the Oxygen Generator

4.2 Adsorber Vessels

The adsorbers, or beds, are vessels that contain the molecular sieve used to adsorb (attract) nitrogen from compressed air and allow oxygen to pass through as the product gas.

4.3 Filter Assembly

The filter assembly consists of two filters. The particulate filter, or pre-filter, removes particulates from the feed air before the air enters the coalescing filter and the coalescing filter removes condensed water, oil vapor, and other contaminants from the feed air before the air enters the adsorbers.

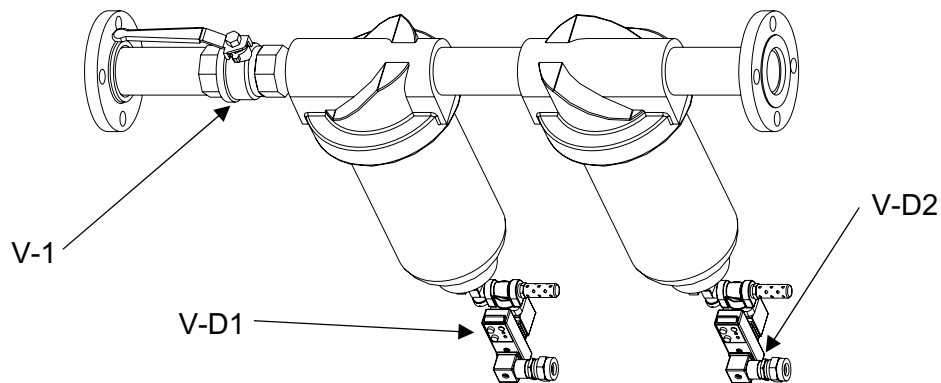


Figure 4.2: Typical Filter Assembly

Particulate Filter Drain (V-D1)

This automatic valve removes moisture from the particulate filter.

Coalescing Filter Drain (V-D2)

This automatic valve removes moisture from the coalescing filter.

Manual Feed #1 Valve (V-1)

This manual valve (if available) controls the flow of feed air from the air compressor to the filter assembly.

4.4 Pressure Switch Sub-assembly

The assembly is located before the inlet ball valve (V-2) of the feed and waste manifold (Section 4.6). It solves the purpose of monitoring the feed air pressure. The assembly also regulates the flow of air through all the automatic valves.

Manual Valve to Pressure Switch

This manual valve controls the flow of air to the pressure switch on the oxygen generator. The valve should not be closed at any circumstance while the unit is running.

4.5 Product Output Sub-assembly

The product output sub-assembly directs the oxygen flow to the oxygen receiver and the pressure transducer (PT4).

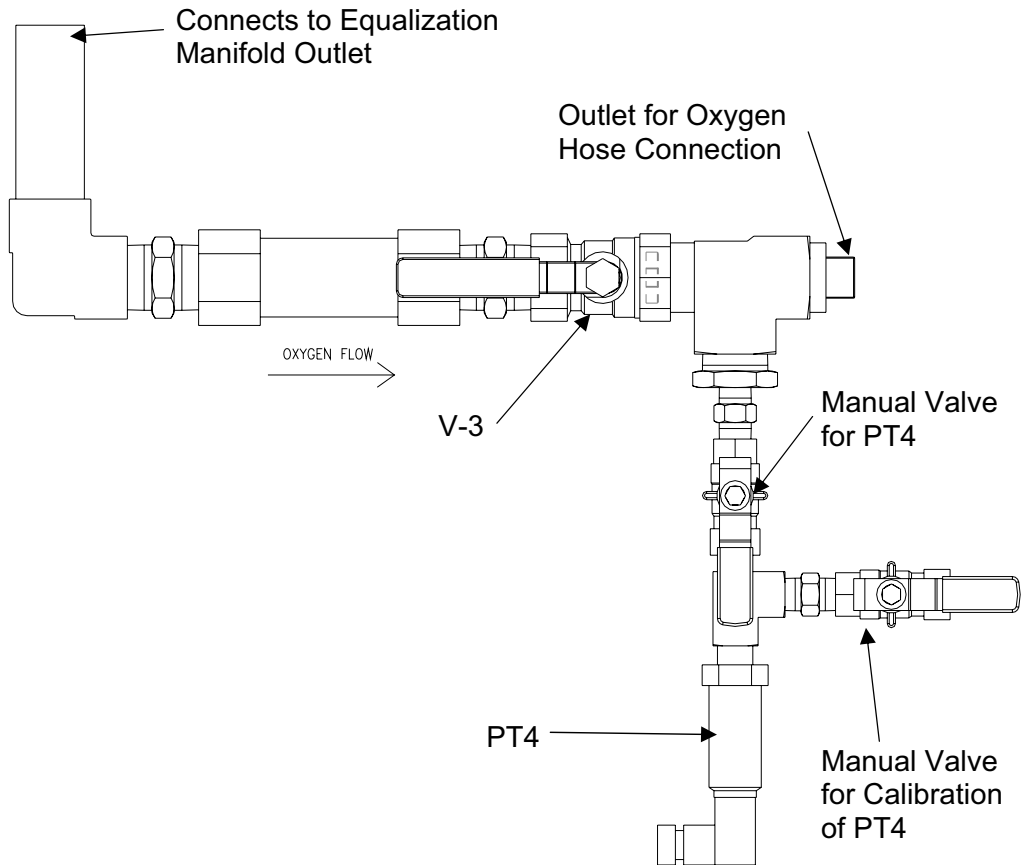


Figure 4.3: Typical Product Output Sub-assembly

Manual Product Valve (V-3)

This manual valve controls the flow of oxygen from the product manifold to the oxygen receiver.

Manual Valve to Pressure Transducer (PT4)

This manual valve controls the flow of oxygen to the pressure transducer (PT4) on the oxygen generator. The valve should not be closed at any circumstance while the unit is running except for the purpose of calibration. In some AS models, the two manual valves for PT4 are replaced by a three way valve.

4.6 Feed and Waste Manifold Assembly

The feed and waste manifold includes all the process valves: feed air through valves V-FA, V-FB, and waste gas from the valves V-WA, V-WB.

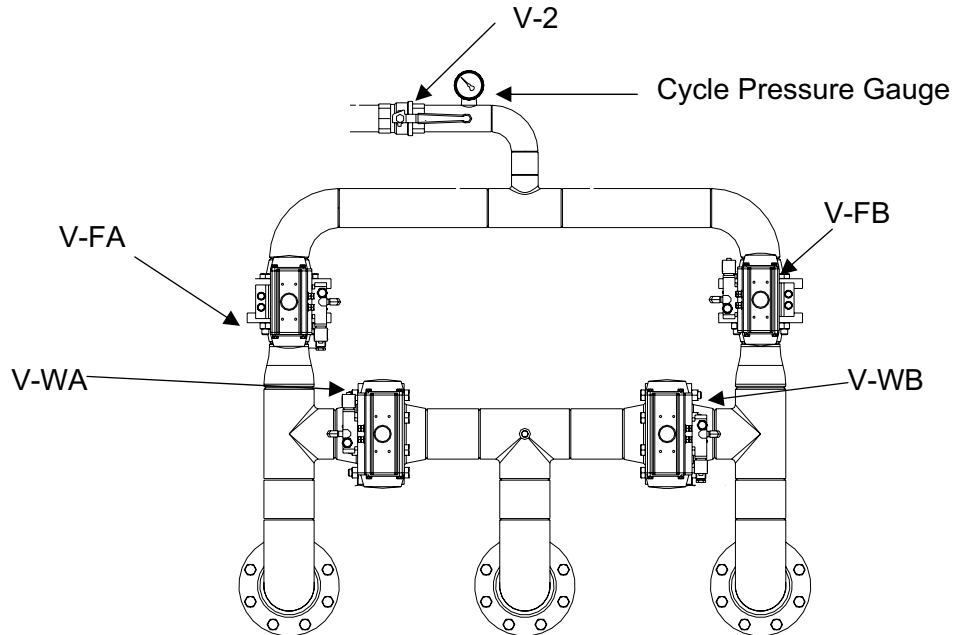


Figure 4.4: Typical Feed & Waste Manifold Assembly

Manual Feed #2 Valve (V-2)

This manual valve controls the flow of feed air from the air compressor, through the filter assembly, to the feed and waste manifold.

Vent Silencers (not shown)

The vent silencers muffle the sound of the waste gas as it exits the adsorbers.

Cycle Pressure Gauge

The cycle pressure gauge indicates the pressure of the feed air before the air enters the adsorbers.

4.7 Equalization and Purge Manifold Assembly

The manifold includes all the process valves (V-EA, V-EB and V-PU) that direct the flow of oxygen from the adsorbers.

4.8 Control Panel: Internal Components

Programmable Logic Controller (PLC)

The oxygen generator uses a programmable logic controller to control and monitor all valves, interfaces and switches on the oxygen generator.

Transformer

The transformer provides the proper voltage for the electrical components of the oxygen generator.

Terminal Block (TB1)

The terminal block provides the connection point for electrical wiring that supplies electrical power to the oxygen generator.

EMI Filter (EMI1)

The EMI filter eliminates electrical line interference from the incoming power source.

Circuit Breakers

The circuit breakers protect the electrical components of the oxygen generator from any damaging electrical current if an overload occurs.

4.9 Control Panel: External Components

Allen-Bradley Touch Screen

The touch screen on the oxygen generator control panel uses a series of screen pages to perform the following functions:

- Provides a normal start-up system
- Monitors and controls the operation of the process valves;
- Monitors signals coming from pressure transducers.
- Provides an alarm system to indicate malfunctions in the PSA Oxygen Generating System.
- Provides a fail-safe shutdown in the event of loss in product purity.

The main Human/Machine Interface (HMI) consists of the Allen Bradley PanelView Plus 600 Touch screen. The PanelView Plus has a 5.5" screen, which is touch-sensitive.

In order to make the software simple to use, the various screens follow a consistent template design. Each screen consists of two components: the title bar and the information display.

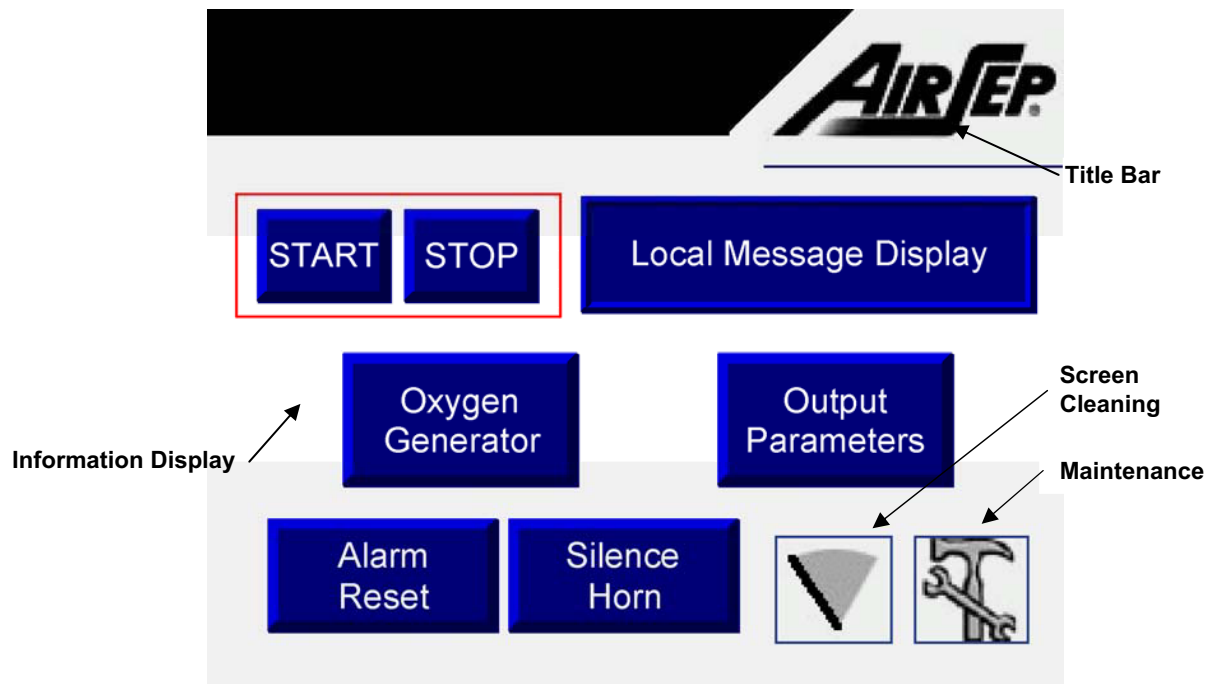


Figure 4.5: Typical Main System Control Screen

The title bar serves two purposes. It identifies the screen that is currently being displayed. It also acts as the main navigational tool.

No matter which screen is being currently displayed, touching the AirSep logo will display the Main System Control screen.

The “Information Display” changes depending on the screen currently displayed. However, they all share three basic components: Monitoring Devices, Message Displays, and Interface Mechanisms. Monitoring Devices are components that are used to relay real-time information about the system, like pressure graphs. Message Displays are used to relay information pertaining to the system in a text format. These displays are also used to present help pages that can be used to better understand the unit. Interface Mechanisms are screen items that can be used to interface directly with the system. These are in the form of buttons, switches, or icons.

The Main System Control Screen is the primary source for information on the whole unit. In the top left corner of the information display are the buttons that will start and stop the oxygen generator.

Everytime you have an alarm or shutdown condition displayed on the ‘Local Message Display’ (Refer to Figure 4.5), rectify the cause and press the ‘Alarm Reset’ icon to bring the system into normal mode before starting.

The ‘Local Message Display’ icon displays different status of the generator namely Stopped, Running, Standby and Alarm. The icons ‘Oxygen Generator’, and ‘Output Parameters’ take the user to dedicated screens described later in this section. Lastly, by touching ‘Screen Cleaning’ icon at the bottom right corner of the information display will display a blank screen for cleaning purpose and the ‘Maintenance’ icon will display a screen that provides guidelines for the general maintenance of the unit. The ‘Silence Horn’ icon bypasses the horn for 10 minutes during an alarm or shutdown condition.

Figure below shows the layout of all the screens in HMI for easy navigation.

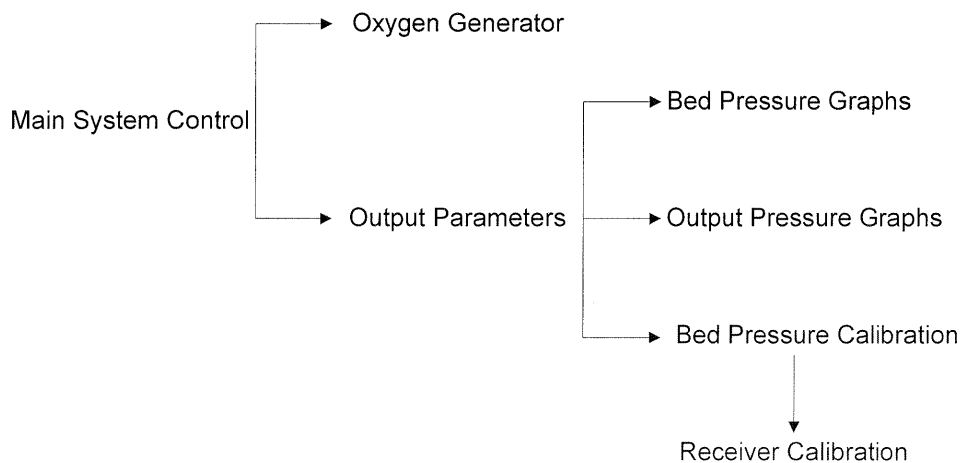


Figure 4.6: HMI Navigation Layout

The ‘Oxygen Generator’ Screen is the primary source of information pertaining to the actual oxygen generation process. The adsorber vessels (also called beds – Bed A is the bed on your left while facing the control panel and Bed B is

on your right while facing the control panel) are shown in the center of the screen and the oxygen receiver vessel is shown on the right hand side of the screen. The receiver has a numeric pressure display. Additionally, the diagram shown will animate to indicate which valves are currently being actuated. The 'AUTO/MAN' icon selects the operating mode for the oxygen generator. In the AUTO position, the oxygen generator cycles on and off to meet oxygen demand.

When the pressure in the product output manifold/oxygen receiver reaches auto standby upper setpoint pressure, the oxygen generator stops oxygen production after a timed delay and enters standby mode. This time delay is approx 3-5 min. The time delay is to prevent short cycling and maintain purity. This time delay to the generator standby functions only in the Auto mode.

When the pressure in the product output manifold/oxygen receiver decreases to approximately the auto standby lower setpoint pressure, the oxygen production begins.

In the *MANUAL* position, the oxygen generator cycles continuously. The symbol 'A' at the right side of the 'AUTO/MAN' switch appears only when the oxygen generator is in AUTO mode.

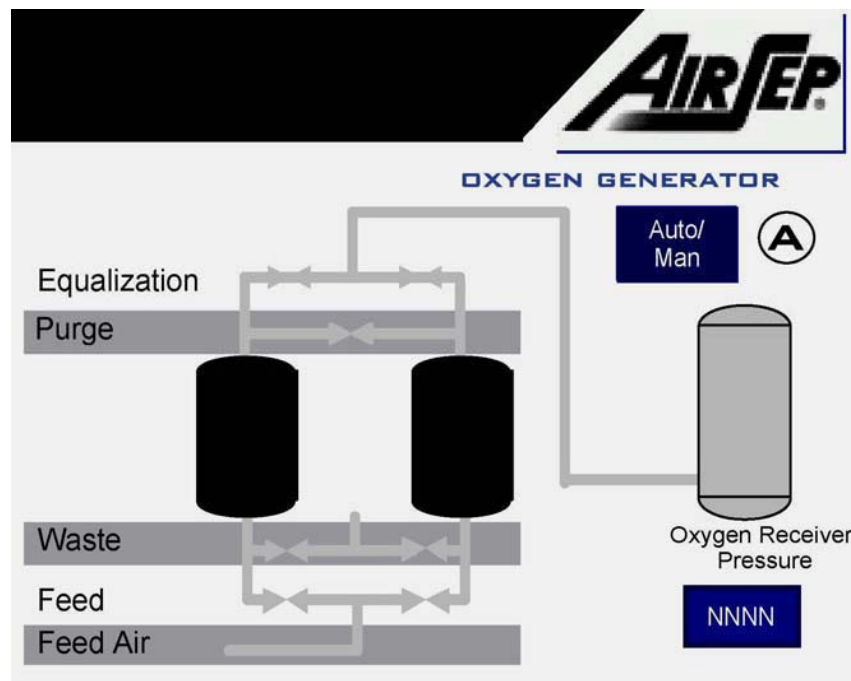


Figure 4.7: Typical Oxygen Generator Screen

The 'Parameters and Output' Screen is the main location to observe the several parameters of the oxygen generator. The bed pressures, oxygen receiver pressure, oxygen purity and the number of working hours, are all displayed here via Message Displays. The 'Yearmeter' counts 8000 hours as

one year so that after 8000 hours, 'Hourmeter' resets to zero and the 'Yearmeter' counter increases by unity.

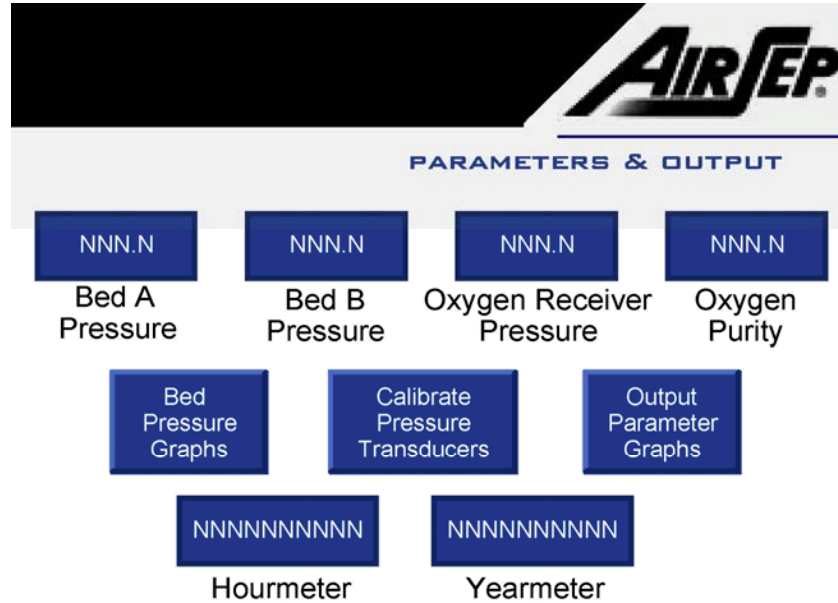


Figure 4.8: Typical Parameters and Output Screen

The 'Bed Pressure Graphs' icon takes to the Bed Pressure Graphs Screen as shown.

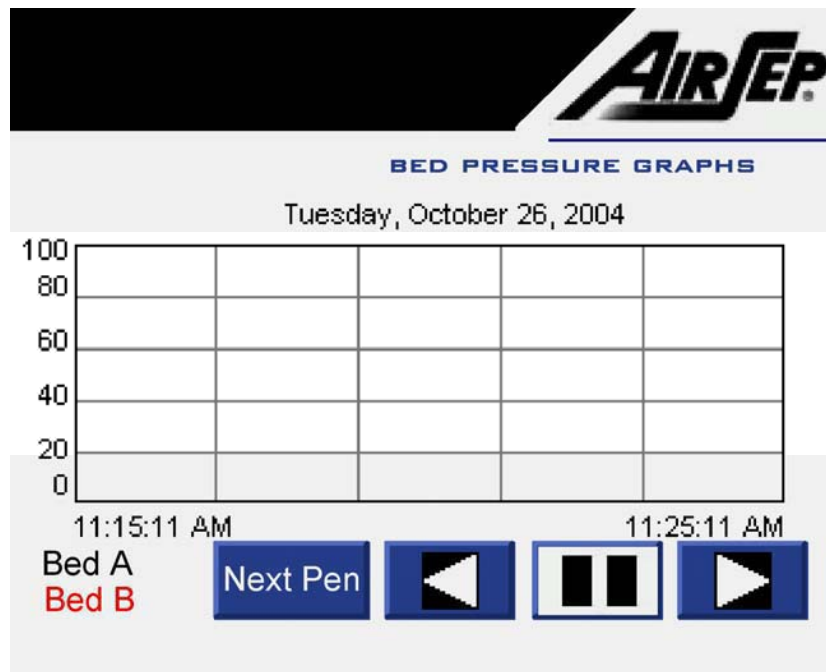


Figure 4.9: Typical Bed Pressure Graphs Screen

The 'Output Parameter Graphs' icon takes to the screen that displays the graphs between oxygen pressure Vs time and the oxygen purity Vs time. The 'Next Pen' icon changes the scale of the ordinate to suit the respective displayed pressure.

The 'Calibrate Pressure Transducers' icon takes to a screen dedicated to the pressure transducers calibration and settings as shown below.

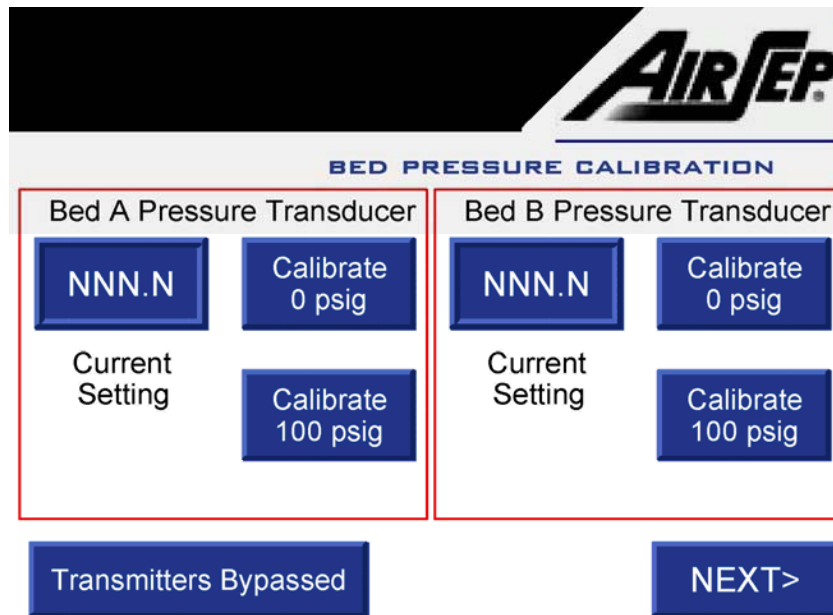


Figure 4.10: Typical Bed Pressure Calibration Screen

The pressure transducers for the beds and the product oxygen pressure are factory calibrated and should not require any calibration for a long period. However, if the need arises, follow the procedure below for calibration.

1. To calibrate pressure transducer, press the 'BYPASS TRANSMITTERS' icon on the screen to bypass the pressure transducer signal to the PLC. The text of the icon will change to 'TRANSMITTERS BYPASSED' as shown in Figure 4.10.
2. The three-way valve (V-A) (Figure 4.9) handle shows the direction of flow path. In Figure 4.11, direction of flow path is from oxygen generator to pressure transducer. Close this manual three-way valve (V-A), so that the flow path is from the atmosphere to the pressure transducer.
3. Take out the plug, if any, from the port A (Figure 4.11) and attach a manual air pump having an accurate pressure gauge.

4. Press the 'Calibrate 0 psig' icon when the gauge on the manual air pump reads 0 psig.
5. Manually pump the air so that the pressure reading on the gauge is 100 psig.
6. At this point, press the 'Calibrate 100 psig' icon on the calibration screen to finish the calibration procedure.

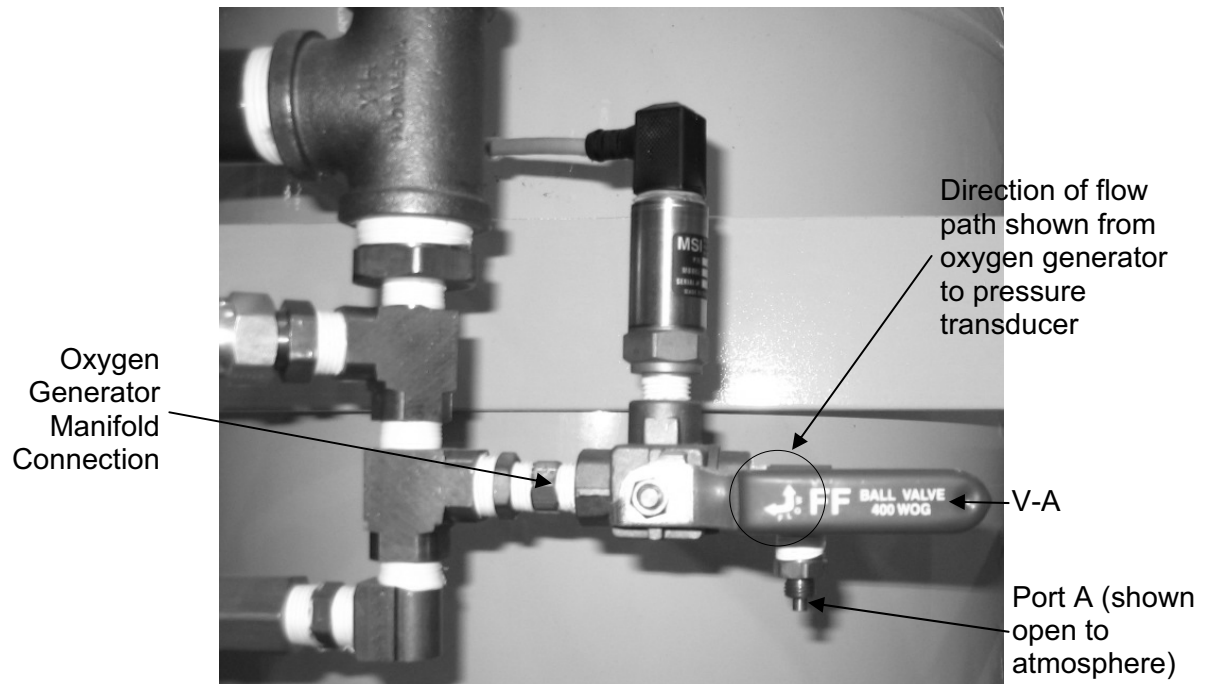


Figure 4.11: Feed Air Pressure Transducer Assembly

7. Disconnect the manual air pump from the port A and put the plug, if any, back to the port A.
8. Open the manual three-way valve (V-A), so that the flow path is from the oxygen generator to the pressure transducer as shown in Figure 4.11.
9. Press the 'TRANSMITTERS BYPASSED' icon to reactivate the signals of pressure transducers.

Press the 'NEXT' icon to navigate the calibration screen for the oxygen receiver pressure transducer.



NOTE

If 'BYPASS TRANSMITTERS' icon is pressed, it will bypass the transmitter for 10 minutes and then it resets itself. However, it also acts as a toggle icon and if pressed again before the expiry of 10 minute time period, the icon resets.

5.0 Installation

5.1 Unpacking

AirSep Corporation ships the oxygen generator on a wooden skid along with the filter assembly. In the AS-Z series models, vent silencer assembly is also shipped apart from the oxygen generator and filter assembly. The oxygen receiver, if supplied, is also shipped on a separate skid.



Follow these unpacking guidelines carefully to protect yourself against loss from any damage that occurred during shipment.

- 1) Thoroughly inspect the exterior of the oxygen generator, filter assembly, vent silencer assembly and oxygen receiver, if supplied, for any damage that occurred during shipment. Pay special attention to the control cabinet on the oxygen generator. Open the control cabinet door, and inspect the interior for damage. If you observe any damage, note it on the freight bill or the express receipt before you sign it.



Failure to note any exterior damage on the freight bill or the express receipt at the time of delivery can result in the refusal of a damage claim by the carrier.

- 2) Carefully cut and remove any banding straps from the oxygen generator, filter assembly, vent silencer assembly and oxygen receiver, if supplied.



Remove all packing material very carefully. Retain the packing material for use if any additional shipping is required.



Use extreme caution when you lift the oxygen generator from the pallet. Lift only by the two lifting lugs at the top of the unit.

- 3) Carefully stand the oxygen generator on its legs.



Use extreme care when you handle any part of the oxygen generator to prevent damage.

- 4) Carefully stand the oxygen receiver, if supplied, on its base.
- 5) Although the oxygen generator, the filter assembly, the vent silencer assembly and the oxygen receiver are carefully inspected, tested, and packed, they can be damaged during shipment due to improper handling. If you find any concealed damage (loss or damage not found until you unpack the oxygen generator, filter assembly, vent silencer assembly and oxygen receiver), immediately call the delivery carrier and file a concealed-damage claim. Retain ALL container materials and interior packing for the carrier's inspection.



You must make a concealed damage claim within 24 hours of delivery. Only the consignee can file this claim.

5.2 Pre-Installation Guidelines

Before you install the oxygen generator, filter assembly, vent silencer assembly and oxygen receiver, if supplied, refer to the Specifications section of this instruction manual to determine applicable floor space, feed air, and power requirements for your particular model.



NOTE

The oxygen generator may use feed air at specifications outside those shown in this instruction manual; however, use of such feed air may require modification of the oxygen generator at the AirSep Corporation factory to ensure the product oxygen meets the specifications. Consult your sales representative to determine whether your oxygen generator requires modifications for your application.



CAUTION

Locate the oxygen generator in an area where the ambient air temperature remains between 4°C (40°F) and 40°C (104°F) to prevent damage not covered under the AirSep Corporation Product Warranty.



WARNING

AirSep oxygen generators are sold for indoor use only. Provide adequate ventilation at the location where you install the oxygen generator to ensure that the ambient air circulates readily. If the oxygen generator malfunctions or is not operated properly, inadequate ventilation may allow the ambient air to become either oxygen deficient or oxygen enriched.

5.3 Installation Instructions

The section illustrates the standard installation arrangement.



CAUTION

Do not connect the filter assembly outlet directly to the feed air inlet on the oxygen generator. The feed air piping on the oxygen generator does not provide adequate support for the weight of the filter assembly.



Feed air at a temperature above 50°C (122°F) can cause damage to the oxygen generator not covered under the AirSep Corporation Product Warranty.



AirSep Corporation recommends installation of a shut-off valve on your air receiver. The shut-off valve enables safe depressurization of the feed air piping and air receiver to perform maintenance or repairs.

- 1) On the AS-Z models, connect the vent silencer assembly to the oxygen generator (Refer to Appendix A of this instruction manual for general layout drawings of the AS-Z models which show the vent silencer):
 - a) Install the bracket provided to the rear of the oxygen generator.
 - b) Connect the oxygen generator exhaust outlet to the flanged pipe provided with the vent silencer assembly.
 - c) Remove the flange covers, if any, from the flange at the base of the vent silencer assembly and the flange at the base of the rear of the oxygen generator.
 - d) Connect the flanges at the base of the vent silencer assembly and rear of the oxygen generator. Take care not to damage the gasket between the flanges during installation.
 - e) Connect the mufflers provided for the silencer assembly.
- 2) Remove the flange cover from the filter assembly inlet and outlet flange.
- 3) Connect the filter assembly to the oxygen generator after providing support to the filter assembly.
- 4) Connect the filter assembly inlet flange to the piping from your source of feed air. Provide clean piping with enough length to provide support for the weight of the filter assembly. Take care not to damage the gasket between the flanges during installation.
- 5) Install your oxygen receiver supplied by AirSep Corporation. If AirSep Corporation supplied the oxygen receiver, install a relief valve and oxygen outlet manifold to complete its assembly. AirSep Corporation recommends, if not supplied, the oxygen outlet manifold contain a manual ball valve, a vent valve with muffler, a pressure gauge, and a pressure regulator. If your application includes an oxygen analyzer or monitor, install an outlet with a manual ball valve on the oxygen outlet manifold to provide an oxygen sample.



Take extreme care to keep all oxygen piping, hoses, and vessels clean. To avoid fire or explosion, oxygen clean all surfaces that can come in contact with the product oxygen.

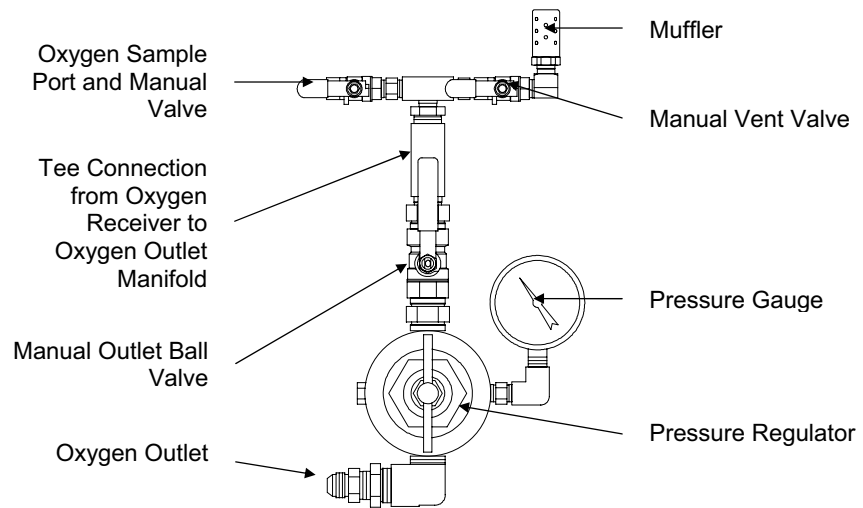


Figure 5.1: Typical Oxygen Outlet Manifold on Oxygen Receiver

- 6) Install the oxygen regulator assembly on the oxygen receiver.
- 7) Connect the respective electrical wires to the automatic drain valves of the filter assembly. Refer to the Appendix A of the instruction manual for the electrical schematics pertinent to the oxygen generator model.
- 8) Remove the plug from the oxygen outlet on the oxygen generator. Take care to prevent contamination from dust, oil, grease, etc. of the oxygen outlet and oxygen hose or piping.
- 9) Connect the oxygen outlet to the oxygen hose or piping to the oxygen receiver. Use Teflon™ tape to seal threaded connections.
- 10) Connect electrical wiring to the appropriate power supply.



AirSep Corporation recommends the connection of the oxygen generator's terminal block to a circuit that cannot be accidentally turned off. An accidental shutdown causes the oxygen generator to stop cycling randomly and results in initially lower purity oxygen during the subsequent start-up. If electrical power is off while your application uses oxygen, the oxygen receiver depressurizes.



Provide proper voltage to the oxygen generator. Improper voltage causes damage not covered under the AirSep Corporation Product Warranty.

6.0 System Operation

6.1 General

This section of the instruction manual provides the procedures for start-up and shutdown of the oxygen generator. Review the component literature provided in the Appendix D of this instruction manual before you attempt to start the oxygen generator. Also read and thoroughly understand any literature or instruction manuals for components not provided by the AirSep Corporation.



Oxygen vigorously accelerates the burning of combustible materials. In an oxygen-enriched atmosphere, many materials that do not burn in normal air require only a slight spark or moderate heat to set them aflame.

Do not allow smoking, open flame, or electronic devices that may generate sparks (e.g., cellular telephones) near the oxygen generator.

Post “NO SMOKING OR OPEN FLAMES” signs conspicuously near the location of the oxygen generator.

6.2 Initial Start-Up

To start the oxygen generator for the first time, or after an extended or unexpected shutdown, follow the steps below:

- 1) Supply electrical power to the oxygen generator.
- 2) Refer to Figure 4.1 for the location of the pressure transducers (PT2, PT3 and PT4). Refer to the following chart to set the position of the manual valves on the oxygen generator prior to the initial start-up. Make sure each valve is fully open or fully closed, as indicated in the chart.

Valve Description	Valve No.	Initial Start-Up Position	Normal Operating Position
MANUAL FEED #1 valve (if applicable)	V-1	Open*	Open*
MANUAL FEED #2 valve	V-2	Closed	Open
MANUAL PRODUCT valve	V-3	Open	Open
Manual valve for Pressure Switch	---	Open	Open
Manual valve for PT2**	---	Open	Open
Manual valve for calibration of PT2**	---	Closed	Closed
Manual valve for PT3**	---	Open	Open
Manual valve for calibration of PT3**	---	Closed	Closed
Manual valve for PT4**	---	Open	Open
Manual valve for calibration of PT4**	---	Closed	Closed

Manual inlet valve of receiver	---	Open	Open
Manual valve to gauge on receiver	---	Open	Open
Manual sample valve	---	Closed	Open
Manual vent valve	---	Closed	Closed
Manual outlet valve of receiver	---	Closed	Open
Manual outlet valve to application	---	Closed	Open

* Also open all manual valves prior to MANUAL FEED #1 valve

** If a three way valve is installed for PT2, PT3 and PT4, ensure that the flow path is from oxygen generator to the pressure transmitter and not from atmosphere to the pressure transmitter.

Table 6.1 – Manual Valve Position Chart

- 3) Supply the compressed air.
- 4) Make sure the feed air supplied is within the feed air pressure range specified in this instruction manual.
- 5) Press the 'AUTO/MAN' icon on the Oxygen Generator Control Screen so that the oxygen generator is in *MANUAL* mode.
- 6) Press the 'ALARM RESET' icon on the Oxygen Generator Control Screen. The generator will only start if there is no shutdown condition existing. However, during start-up, a low purity alarm may exist. If a shutdown condition exists, pressing the 'ALARM RESET' will not reset the system.

Please note that during initial start-up or start-up after a long period, the oxygen purity can be lower than the low purity alarm and/or shutdown setpoint and a 'low purity' alarm may exist. However, the oxygen generator ignores the oxygen purity shutdown setpoint for the first 60 minutes after start-up. If the oxygen purity after 60 minutes of operation is still below the low purity shutdown setpoint, the oxygen generator shuts down.



NOTE

The FEED PRESSURE must be above the feed air low pressure shutdown level specified in this instruction manual for the oxygen generator to run.

- 7) Make sure the POWER lights on the automatic drain valves at the base of the filter bowls illuminate. Press the manual override buttons on the PARTICULATE FILTER DRAIN valve and the COALESCING FILTER DRAIN valve, and make sure air discharges from the drain outlets.



NOTE

Make sure the exhaust contains no liquid. If liquid discharges, press the manual override buttons on the drain valves until the exhaust no longer contains liquid.



The automatic drains on the oxygen generator exhaust periodically during operation to remove condensate from the filter bowls.

- 8) Adjust the automatic drain timer so that the exhaust contains no liquid without overdrawing the feed air. The typical timing for the drain valve operation is 5 sec every 10 min.
- 9) Press the 'START' icon on the Oxygen Generator Control Screen. You may press the 'Silence Horn' icon on the main screen to silence the alarm due to low oxygen purity. The 'Silence Horn' icon bypasses the horn for 10 minutes.
- 10) Open the MANUAL FEED #2 valve (V-2) slightly. The valve should be open no more than 20-25%. Allow the unit to run this way until the bed pressures reach a maximum of 55-60 psig each cycle. This will take approximately 5 minutes. Once this pressure is reached, open the valve so that it is no more than 50% open. Allow the unit to run this way until the bed pressures reach a maximum of 60-65 psig each cycle. This will take approximately an additional 5 minutes. Lastly, open the valve so that it is no more than 75% open. Allow the unit to run this way until the bed pressures reach a maximum of 70-75 psig each cycle. This will take approximately an additional 5 minutes.



When initially starting the unit, the adsorber vessels and oxygen receiver will be completely empty. If the feed valve is fully open when the unit begins to run, all of the air from the feed compressor, feed air tank, and feed piping will rush into the empty generator. This will cause the pressure to drop below the low instrument air shutdown setpoint. By slowly throttling the feed valve, it allows the empty generator to be gradually filled to the point at which the feed valve can be fully opened to its normal operating condition.

- 11) To purge oxygen at less than design purity from the oxygen receiver, while the oxygen generator is running, open the manual vent valve on the oxygen receiver to vent gas. (This is the manual valve that vents low purity oxygen to the atmosphere to increase oxygen purity in the oxygen receiver to the level required for your application. Ensure that vent is sized such that the oxygen generator is never overdrawn.)



During initial start-up, while the feed air oxygen generator piping and hoses, oxygen lines, and oxygen receiver pressurize, apply soapy water to all feed air piping and connections, oxygen piping or hoses and connections, and oxygen receiver connections to check for leaks. Repair or replace the leaking item(s).

- 12) Open the product sample valve to the oxygen analyzer assembly (if used) to monitor the purity of the oxygen. If an oxygen analyzer board is provided, ensure that the pressure regulator to the oxygen analyzer board is set at 5 psig.
- 13) When the oxygen analyzer indicates the purity of the oxygen in the oxygen receiver that exceeds the minimum purity specified in this instruction manual, close the manual vent valve.
- 14) Fully open the manual outlet valves that control the flow of oxygen from the oxygen receiver to your application, and set the pressure regulator on the oxygen receiver outlet manifold to the pressure required for your application.
- 15) Press the 'AUTO/MAN' icon on the Oxygen Generator Screen so that the oxygen generator comes in *AUTO* mode.

6.3 Operation

AUTO Mode

When the 'AUTO/MAN' icon on the oxygen generator touch screen is in the *AUTO* mode, the oxygen generator cycles on and off automatically based on oxygen demand. When the product oxygen pressure increases to the approximate maximum pressure specified in this instruction manual, oxygen production stops after one cycle and the generator enters standby mode. When your application uses enough oxygen to decrease the oxygen receiver pressure to approximately the minimum pressure specified in this instruction manual, the oxygen generator resumes oxygen production. The *AUTO* mode enables the most energy-efficient operation of the oxygen generator. Use the *AUTO* mode during normal operation and to shut down the oxygen generator.

MANUAL Mode

With the 'AUTO/MAN' icon on the oxygen generator touch screen in the *MANUAL* mode, the oxygen generator cycles continuously, regardless of the pressure in the oxygen receiver. Use the *MANUAL* mode during initial start-up or start-up after an extended shutdown of the oxygen generator and, depending on the oxygen flow, pressure, and purity requirements of your application, as directed by your AirSep Corporation representative.

6.4 Shutdown

- 1) Stop the flow of oxygen from the oxygen receiver to your application.
- 2) Make sure the 'AUTO/MAN' Icon on the Oxygen Generator Screen' is in the *AUTO* mode. When the product oxygen pressure is higher than the maximum pressure set point, the oxygen generator stops cycling after a timed delay and enters the standby mode.
- 3) Press the 'STOP' icon on the Main System Control Screen.
- 4) If your oxygen receiver includes a manual sample gas valve to enable oxygen to flow to an oxygen analyzer, close it fully.

- 5) Fully close the MANUAL PRODUCT valve (V-3).
- 6) Stop the supply of feed air.

6.5 Normal Start-Up



To perform a normal start-up, the oxygen generator first requires a shutdown as described in Section 6.4 — Shutdown. If the oxygen generator shuts down due to a power loss or inadequate feed air pressure, follow the procedure in Section 6.2 — Initial Start-Up to restart the oxygen generator.

- 1) Start the supply of compressed air.
- 2) Make sure the MANUAL FEED #1 (V-1) and #2 (V-2) valves are fully open.
- 3) Make sure the INSTRUMENT AIR valve is fully open.
- 4) Make sure the 'AUTO/MAN' icon on the oxygen generator control panel is in the *AUTO* mode.
- 5) When the feed air pressure exceeds the minimum feed air pressure specified in this instruction manual, press the 'START' icon on the Main System Control Screen.
- 6) Fully open the MANUAL PRODUCT valve (V-3) and the product sample valve.



The oxygen generator will not produce oxygen during a normal start-up until the product oxygen pressure is less than the minimum pressure specified in this instruction manual.

- 7) Start the flow of oxygen from the oxygen receiver to your application.

6.6 Extended Shutdown

To shut down the oxygen generator for 24 hours or longer, complete all the steps in Section 6.4 — Shutdown. In addition, perform the following steps:

- 1) Stop the supply of feed air.
- 2) Fully close the MANUAL FEED #1 (V-1) and MANUAL FEED #2 (V-2) valves.
- 3) Fully close the INSTRUMENT AIR valve.



In addition, fully close any manual valves on the oxygen receiver. Close all manual valves to isolate the oxygen in the oxygen generator and oxygen receiver to prevent loss of oxygen pressure and enable a normal start-up.

6.7 Start-Up After an Extended Shutdown

After an extended shutdown or an unexpected shutdown, such as a loss of electrical power, you must purge the oxygen receiver of any low purity oxygen before the oxygen generator can supply oxygen within purity specifications. To purge the oxygen receiver, follow all the steps in Section 6.2 — Initial Start-Up.

7.0 Maintenance

7.1 General

The most important maintenance you can perform on the oxygen generator is to make sure the automatic drain valves on the filters function properly. Routinely monitor the operation of these drain valves to ensure the long life of the oxygen generator. Follow the procedures described in this section of the instruction manual for daily, semi-annual, and annual maintenance.

Use the following chart as a guide to perform maintenance on a regular schedule:

Time Period	Action
Daily	Make sure automatic drains function properly.
Six Months	Replace particulate filter element(s)*.
Annually	Replace coalescing filter element(s)*.
	Check performance of automatic valves and actuators. Rebuild, if necessary.

* Filter elements should be replaced if dirty or at least after the period shown above

Table 7.1 – Maintenance Chart

7.2 Daily Maintenance

- 1) Observe the operation of the automatic drain valves at the bottom of both filters. Make sure the condensate outlets for the drain valves are not obstructed.
- 2) The automatic drain valves can be set to operate at the desired intervals. Generally, it is set at the intervals such that the condensate could be removed completely without over draining the feed air supply.
- 3) If condensate does not discharge from an outlet, fully close the manual inlet isolation valve on the automatic drain valve at the outlet, remove the screw-on type plug from the base of the inlet, remove the strainer inside the inlet, clean the strainer, replace the strainer and plug, and fully open the manual inlet isolation valve.
- 4) Press the manual override buttons on the automatic drain valves on both filters to test the operation of the drain valves. Air or condensate should discharge from the outlets on the drain valves.
- 5) Observe the discharge from the automatic drain valves during normal operation. The discharge from the drain valves should not contain condensate at the end of each drain cycle. If condensate remains in the discharge at the end of the drain cycle, adjust the timers on the drain valves to either increase the length of time for the drain cycle or decrease

the interval between drain cycles until the discharge at the end of the drain cycle is free of condensate.

To adjust the time for the drain cycle, use the lower knob on the timer on the drain valve. Rotate the knob counterclockwise to decrease the time or clockwise to increase the time.

To adjust the interval between drain cycles, use the upper knob on the timer. Rotate the knob counterclockwise to decrease the interval or clockwise to increase the interval.



Excess operation of the automatic drain valves may decrease the quantity of feed air enough to impair the performance of the oxygen generator. Set the timers to allow the drain valves to operate long enough to drain all the condensate from the discharge but not long enough to allow air-only discharge for more than a few seconds.

7.3 Semi-Annual Maintenance

Perform the semi-annual maintenance procedure only with the oxygen generator shut down.



Do not attempt to remove the filter bowls until the filter assembly fully depressurizes.

7.3.1 Particulate Filter Replacement

The particulate filter removes rust, pipe scale, and other foreign particles from the feed air. It also separates most of the condensed water and oil from the air. Use the following procedure to replace the particulate filter element(s) at least every six months or as required:



The expected life of the particulate filter is approximately six months. Its purpose is to protect and extend the life of the coalescing filter. The life of the particulate filter depends on air and piping quality. The particulate filter has a rating of 5 microns.

- 1) Follow all steps in Section 6.6 — Extended Shutdown.
- 2) Make sure that manual valves on either side of the filter assembly are closed.

- 3) Press the manual override button on the automatic drains of the filters to depressurize the filter assembly.
- 4) Disconnect, tag, and lockout electrical power to the drain valve.
- 5) Remove the timer and conduit from the drain valve on the bottom of the filter bowl. The timer attaches to the valve body with one screw.
- 6) Slowly loosen, but do not remove, all eight-socket head cap screws that hold the bowl to the filter body to make sure the bowl fully depressurizes before removal.
- 7) Remove the eight-socket head cap screws that hold the bowl to the filter body to disconnect the bowl. An empty filter bowl indicates proper drain system operation.



The old particulate filter element(s) cannot be cleaned. You must replace it (them) with (a) new element(s).

- 8) To remove the particulate filter element(s), disconnect the retainer nut from under the element(s).
- 9) Place the new element(s) where the old one(s) was (were) located, and reconnect the retainer nut.
- 10) Wash the bowl in warm, soapy water, and rinse.
- 11) Reconnect the filter bowl.
- 12) Reconnect the timer and conduit assembly to the drain valve body.
- 13) Remove the lockout and tag, and provide electrical power to the oxygen generator.
- 14) Make sure the MANUAL FEED #2 valve (V-2) remains fully closed.
- 15) Fully open the MANUAL FEED #1 valve (V-1) to pressurize the particulate filter.
- 16) Apply soapy water to check for leaks on all fittings loosened during the replacement procedure.
- 17) Press the manual override button on the automatic drain valve on the particulate filter and make sure the exhaust contains no liquid.
- 18) Follow all steps in Section 6.2 — Initial Start-Up.

7.4 Annual Maintenance

Perform the annual maintenance procedure only with the oxygen generator shut down.



Do not attempt to remove the filter bowls until the filter assembly fully depressurizes.

7.4.1 Maintenance of Automatic Valves

If possible, the functioning of the valves should be checked daily.

- 1) Check all moving parts on the oxygen generator (automatic valves and pneumatic actuators) for any indication of wear. Replace all worn parts.
- 2) Make sure all automatic valves operate properly. Make sure all connections remain tight and that each valve opens and closes properly.
- 3) If a valve operates slowly (two seconds or more), repair or rebuild the solenoid valve or valve actuator. Refer to the valve manufacturer's literature in Appendix D of this instruction manual for more information.
- 4) Check all automatic valves and pneumatic actuators for leaks. Use soapy water to check leaks at the valve stems. If the valves or actuators leak, tighten or replace the packing.



Do not over-tighten packing bolts on air operated valves.

7.4.2 Coalescing Filter Replacement

The coalescing filter causes oil “fog” particles and water vapor that pass through the particulate filter to collide (coalesce) and form larger droplets, which fall to the bottom of the filter bowl. Replace the coalescing filter element(s) annually.



The expected life of the coalescing filter is approximately one year with proper maintenance of the particulate filter. The coalescing filter has a rating of 0.01 microns.

- 1) Follow all steps in Section 6.6 — Extended Shutdown.
- 2) Make sure that manual valves on either side of the filter assembly are closed.
- 3) Press the manual override button on the automatic drains of the filters to depressurize the filter assembly.
- 4) Disconnect, tag, and lockout electrical power to the drain valve.
- 5) Remove the timer and conduit from the drain valve on the bottom of the filter bowl. The timer attaches to the valve body with one screw.
- 6) Slowly loosen, but do not remove, all eight socket head cap screws that hold the bowl to the filter body to make sure the bowl fully depressurizes before removal.
- 7) Remove the eight socket head cap screws that hold the bowl to the filter body to disconnect the bowl.

An empty filter bowl indicates proper drain system operation.



The old coalescing filter element(s) cannot be cleaned. You must replace it (them) with (a) new element(s).

- 8) To remove the coalescing filter element(s), disconnect the retainer nut from under the element(s).
- 9) Place the new element(s) where the old one(s) was (were) located, and reconnect the retainer nut.
- 10) Wash the bowl in warm, soapy water, and rinse.
- 11) Reconnect the filter bowl.
- 12) Reconnect the timer and conduit assembly to the drain valve body.
- 13) Remove the lockout and tag, and provide electrical power to the oxygen generator.
- 14) Make sure the MANUAL FEED #2 valve (V-2) remains fully closed.
- 15) Fully open the MANUAL FEED #1 valve (V-1) to pressurize the particulate filter.
- 16) Apply soapy water to check for leaks on all fittings loosened during the replacement procedure.

- 17) Press the manual override button on the automatic drain valve on the coalescing filter and make sure the exhaust contains no liquid.
- 18) Follow all steps in Section 6.2 — Initial Start-Up.

8.0 Troubleshooting

8.1 General



The oxygen generator contains electrical parts that can produce an electrical shock hazard if not handled properly. To prevent electrical shock, use extreme care when you service the oxygen generator. Only trained personnel may open the oxygen generator.

The AirSep PSA Oxygen Generator is pressurized during normal operation. You must depressurize the oxygen generator before you attempt any repairs.

To depressurize the oxygen generator safely, use the following procedure:

- 1) Fully close the MANUAL FEED #2 valve (V-2).
- 2) Fully close the manual valve at the inlet and the outlet of the oxygen receiver and the valve on the sample oxygen flow connection to the oxygen analyzer panel.
- 3) Press the 'Start' icon on the Oxygen Generator Touch Screen.
- 4) Set the 'AUTO/MAN' icon on the Oxygen Generator Screen to *MANUAL* mode.
- 5) Allow the oxygen generator to run until the CYCLE PRESSURE, BED A, and BED B gauges register 0 psig, then press the 'Stop' icon on the Main System Control Screen.
- 6) If the gauges do not decrease to 0 psig, press the 'Stop' icon on the Main System Control Screen, and contact your distributor.
- 7) If instructed by your distributor to contact AirSep Corporation, contact the AirSep Commercial Products Service Department by telephone Monday through Friday between 7:30 a.m. and 4:30 p.m. Eastern Time. In the USA or Canada, call 1-800-320-0303. Outside the USA or Canada, call (716) 691-0202. Send fax inquiries anytime to (716) 691-1255. Address written inquiries to AirSep Corporation, 260 Creekside Drive, Buffalo, NY 14228-2075 USA, Attention: Commercial Products Service Department.
- 8) Fully close the MANUAL FEED #1 valve (V-1).
- 9) Depressurize the filter assembly by pressing the manual override button on the automatic drains for the filters.

8.2 Troubleshooting Chart

Use the following chart as a guide to troubleshoot the oxygen generator.

Problem	Probable Cause	Solution
Oxygen generator does not cycle.	No electrical power to control cabinet.	Provide electrical power to control cabinet.
	Low Feed air pressure	Ensure feed air pressure is more than the minimum feed air pressure specified in the Appendix A and then press the 'ALARM RESET' icon before starting the generator.
Oxygen generator does not cycle even after pressing the 'START' icon. Feed air pressure exceeds minimum feed air pressure specified in Appendix A of this instruction manual.	Oxygen generator controls not reset after unexpected shutdown.	Press the 'ALARM RESET' icon.
	Blown fuse(s) or tripped circuit breaker for PLC.	Replace fuse(s) or reset the circuit breaker.
Oxygen generator does not cycle. 'AUTO/MAN' icon is in <i>AUTO</i> mode.	'START' icon is not pressed.	Refer to Section 6.2 — Initial Start-Up or Section 6.5 — Normal Start-Up, as appropriate, to start oxygen generator.
	Oxygen generator in standby.	Oxygen generator restarts automatically when oxygen receiver depressurizes.
Oxygen generator does not cycle when OXYGEN RECEIVER PRESSURE gauge registers less than the minimum pressure specified in this instruction manual. 'AUTO/MAN' icon is in <i>AUTO</i> position.	PT-4 defective or not calibrated.	Calibrate the pressure transducer PT-4. Replace PT-4 if defective.
	'START' icon is not pressed	Press the 'START' icon.
	Loose wire in the control panel.	Repair loose connections.
	PLC defective.	Replace PLC.
Oxygen generator cycles continuously. OXYGEN RECEIVER PRESSURE gauge registers pressure greater than the	PT-4 defective or not calibrated.	Calibrate the pressure transducer PT-4. Replace PT-4 if defective.

maximum oxygen receiver pressure specified in this instruction manual. 'AUTO/MAN' icon in AUTO position.		
	PRODUCT SAMPLE valve not fully closed.	Fully close PRODUCT SAMPLE valve.
	Leak on hoses or piping, or on fittings that connect oxygen generator to oxygen receiver.	Use soapy water, to check hoses, piping, and fittings between oxygen generator and oxygen receiver. Check all tube and pipe fittings inside control cabinet with soapy water. You can hear most leaks when area is quiet. Repair leaks as necessary.
When oxygen generator cycles, feed air pressure is less than maximum cycle pressure specified in the Appendix of this instruction manual.	Restriction in feed air piping.	Remove restriction from feed air piping.
	Partially open valve between air compressor and oxygen generator.	Make sure manual valves between air compressor and oxygen generator, if any, are either fully closed or fully open, depending on purpose of valves.
	Feed air piping or connection smaller in diameter than required.	Use larger diameter piping or connection to decrease pressure drop.
	Air compressor malfunction.	Check air compressor. Service as necessary.
Low purity oxygen.	Waste gas in oxygen receiver during initial start-up, start-up after servicing, or start-up after an extended shutdown.	Vent oxygen receiver as described in Section 6.2 — Initial Start-up.
	Oxygen generator output overdrawn.	Fully close PRODUCT SAMPLE valve on product manifold and oxygen vent valve, if any, on oxygen receiver and check the purity.
	Automatic valves make unusual noises, or do not fully open or close,	Make sure valve actuators receive adequate instrument

	or do not open or close at approximately the same speed (1–2 secs)	air pressure for proper operation.
		Use soapy water to check for leaks at valve stems, hoses, actuators, or solenoid valves. Repair leaks as necessary.
		Make sure solenoid coils energize properly.
		Make sure actuator to valve couplings are tight and positioned properly on valve stems, and that valve stems actually turn.
		Replace or Rebuild actuators or valves as necessary.

A Appendix:

Technical Data

Specifications

Data in this section refers to the standard AS-Q through AS-Z model oxygen generators. The oxygen generators may use feed air at specifications outside those shown; however, use of such feed air may require modification of the oxygen generators at the AirSep Corporation factory to ensure the product oxygen meets the design specifications. Consult your sales representative to determine whether your oxygen generator requires modifications for your application.



Provide proper voltage from a grounded outlet to the oxygen generator. Main power supply voltage fluctuation must not exceed 10% of the nominal supply voltage.

AS-Q

Oxygen output:	2500 - 2800 SCF/hr at 45 psig* (max.)**
Oxygen purity:	93% Nominal
Oxygen dew point:	-73°C -100°F
Approximate weight:	8620 lbs 3910 kg
Dimensions	61 x 112 x 140 in. (L x W x H) 154 x 286 x 355 cm (L x W x H)

Feed Air Requirements

Pressure:	90 psig (min.) 620 kPa (min.)
Temperature:	50°C (max.) 122°F (max.)
Power requirements:	120 V~±10%, 50/60 Hz, Single Phase, 3A 240 V~±10%, 50/60 Hz, Single Phase, 1A

Other Specifications:	Pollution degree: 2 Installation category: II Altitude: 2000 m
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*SCF (standard cubic foot) gas measured at 1 atmosphere and 70°F.

** Pressures up to 65 psig available.

AS-R

Oxygen output:	3000 - 3700 SCF/hr at 45 psig* (max.)**
Oxygen purity:	93% Nominal
Oxygen dew point:	-73°C -100°F
Approximate weight:	12405 lbs 5627 kg
Dimensions	74 x 114 x 157 in. (L x W x H) 187 x 290 x 398 cm (L x W x H)

Feed Air Requirements

Pressure:	90 psig (min.) 620 kPa (min.)
Temperature:	50°C (max.) 122°F (max.)
Power requirements:	120 V~±10%, 50/60 Hz, Single Phase, 3A 240 V~±10%, 50/60 Hz, Single Phase, 1A

Other Specifications:	Pollution degree: 2 Installation category: II Altitude: 2000 m
-----------------------	--

*SCF (standard cubic foot) gas measured at 1 atmosphere and 70°F.

** Pressures up to 65 psig available.

AS-W

Oxygen output:	4000 - 4600 SCF/hr at 45 psig* (max.)**
Oxygen purity:	93% Nominal
Oxygen dew point:	-73°C -100°F
Approximate weight:	15990 lbs 7253 kg
Dimensions	88 x 114 x 197 in. (L x W x H) 223 x 289 x 501 cm (L x W x H)

Feed Air Requirements

Pressure:	90 psig (min.) 620 kPa (min.)
Temperature:	50°C (max.) 122°F (max.)
Power requirements:	120 V~±10%, 50/60 Hz, Single Phase, 3A 240 V~±10%, 50/60 Hz, Single Phase, 1A

Other Specifications:	Pollution degree: 2 Installation category: II Altitude: 2000 m
-----------------------	--

*SCF (standard cubic foot) gas measured at 1 atmosphere and 70°F.

** Pressures up to 65 psig available.

AS-Z

Oxygen output:	5000 - 5500 SCF/hr at 45 psig* (max.)**
Oxygen purity:	93% Nominal
Oxygen dew point:	-73°C -100°F
Approximate weight:	19460 lbs 8827 kg
Dimensions	90 x 116 x 220 in. (L x W x H) 229 x 294 x 560 cm (L x W x H)

Feed Air Requirements

Pressure:	90 psig (min.) 620 kPa (min.)
Temperature:	50°C (max.) 122°F (max.)
Power requirements:	120 V~±10%, 50/60 Hz, Single Phase, 3A 240 V~±10%, 50/60 Hz, Single Phase, 1A

Other Specifications:	Pollution degree: 2 Installation category: II Altitude: 2000 m
-----------------------	--

*SCF (standard cubic foot) gas measured at 1 atmosphere and 70°F.

** Pressures up to 65 psig available.

Typical Operating Data*

Description	Operating Pressure (psig)	Operating Pressure (kPa)
Feed air low pressure shutdown level	35	241
Minimum feed air pressure	90	620
Maximum feed air pressure	125	862
Typical Adsorber A or B max. operating pressure	75-80	517-552
Table A.1 – Operating Pressures		

Description	Length of Interval
Interval during which drain valve operates	5 seconds
Interval between periods of drain valve operation	10 minutes
Table A.2 - Drain Valve Operating Intervals	

Typical Feed Air Regulator Setting (If supplied)	75-77 psig	517 – 531 kPa
Auto-standby feature: Standby activates at:	75 psig (Product Oxygen Pressure)	517 kPa
Standby resets at:	68 psig (Product Oxygen Pressure)	469 kPa
Oxygen Analyzer Board pressure regulator setting	1 psig	7 kPa
Low oxygen purity alarm	89%	
Low Oxygen Purity Shutdown or Low Purity Cut-off valve (If supplied) set point	87%	
High bed pressure alarm	83 psig	572 kPa
High bed pressure shutdown	85 psig	586 kPa
Table A.3 - Set points		

*Data may vary as per the customer's requirements.

Drawings

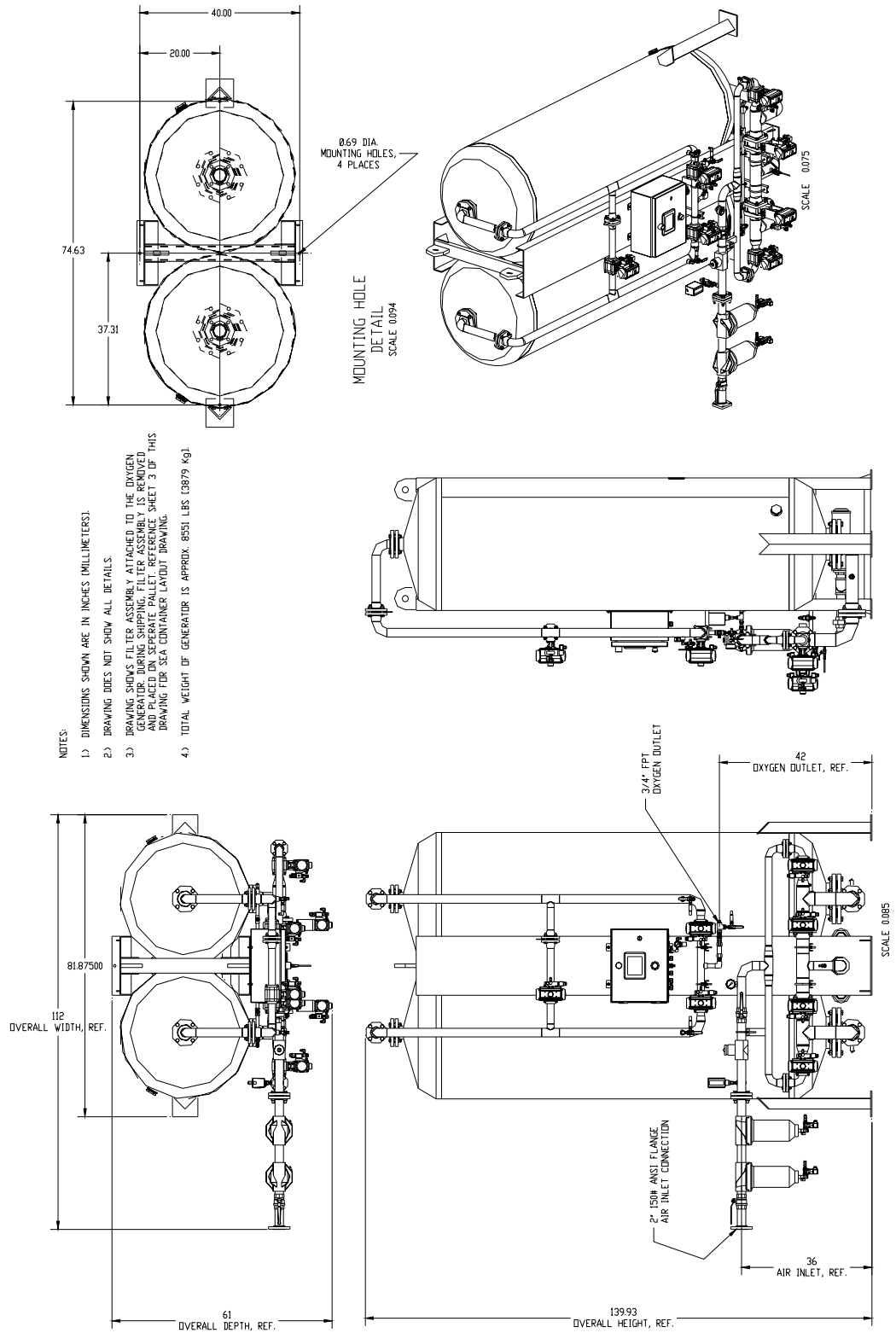


Figure A.1: General Arrangement Drawing – AS-Q

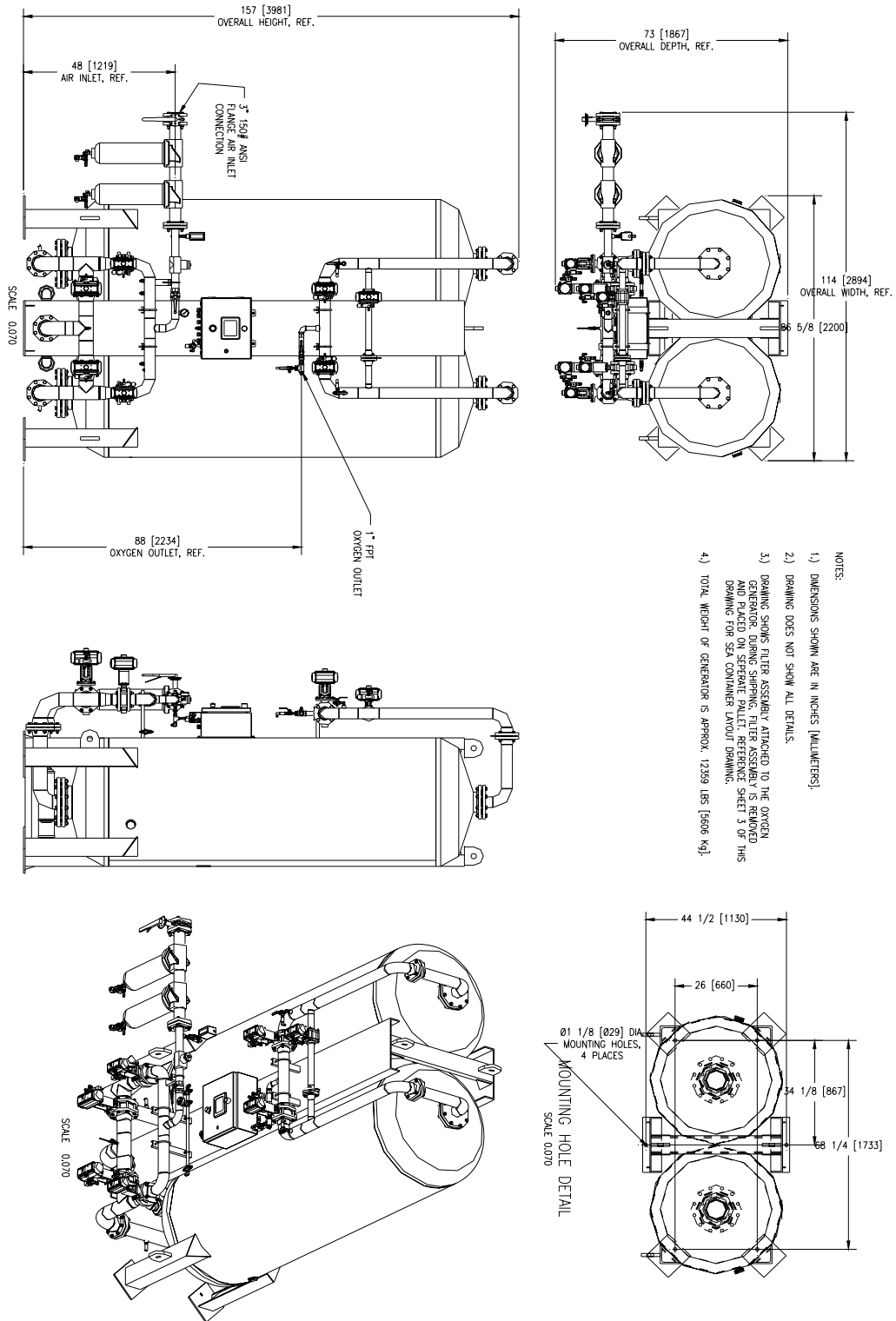


Figure A.2: General Arrangement Drawing – AS-R

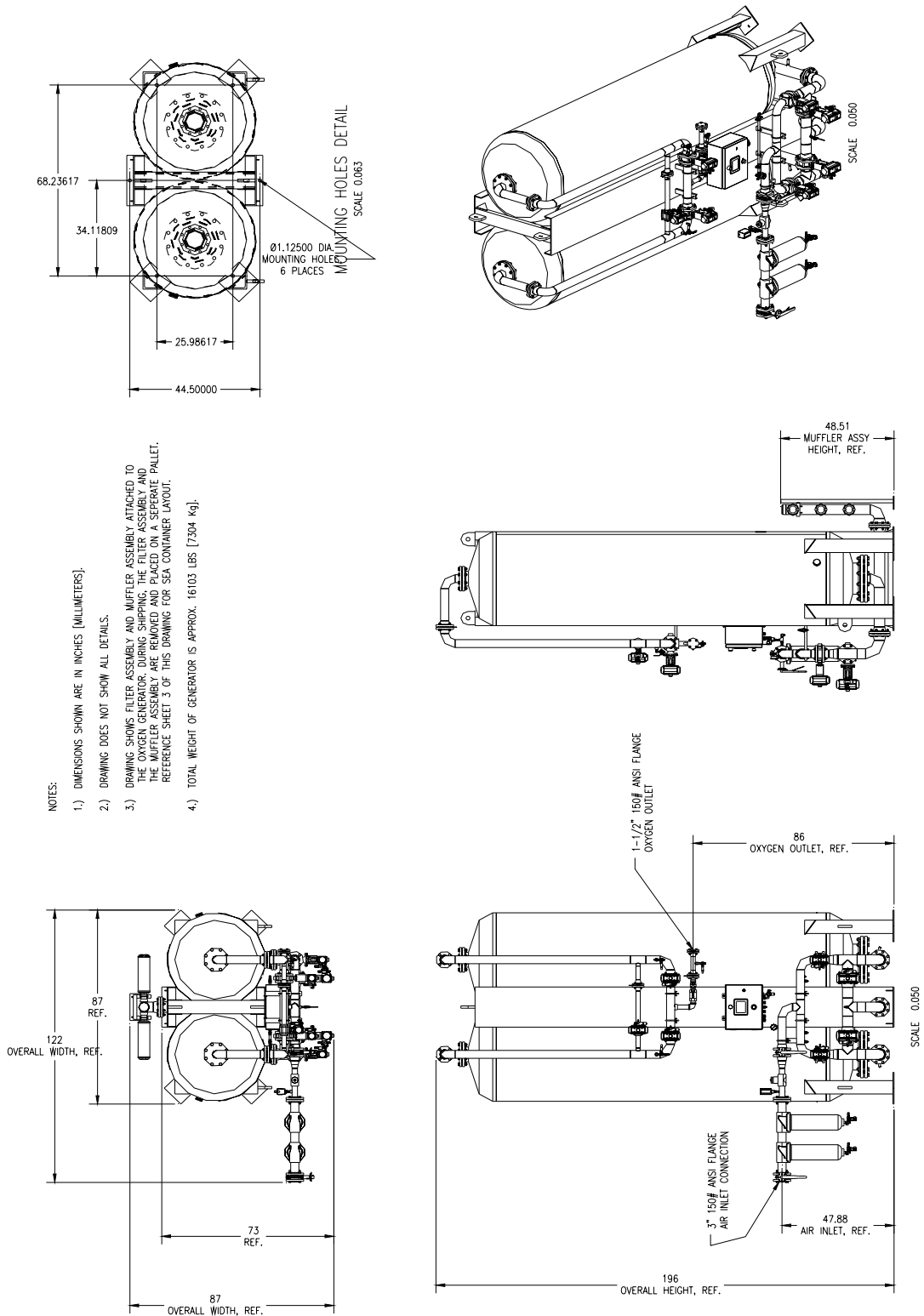
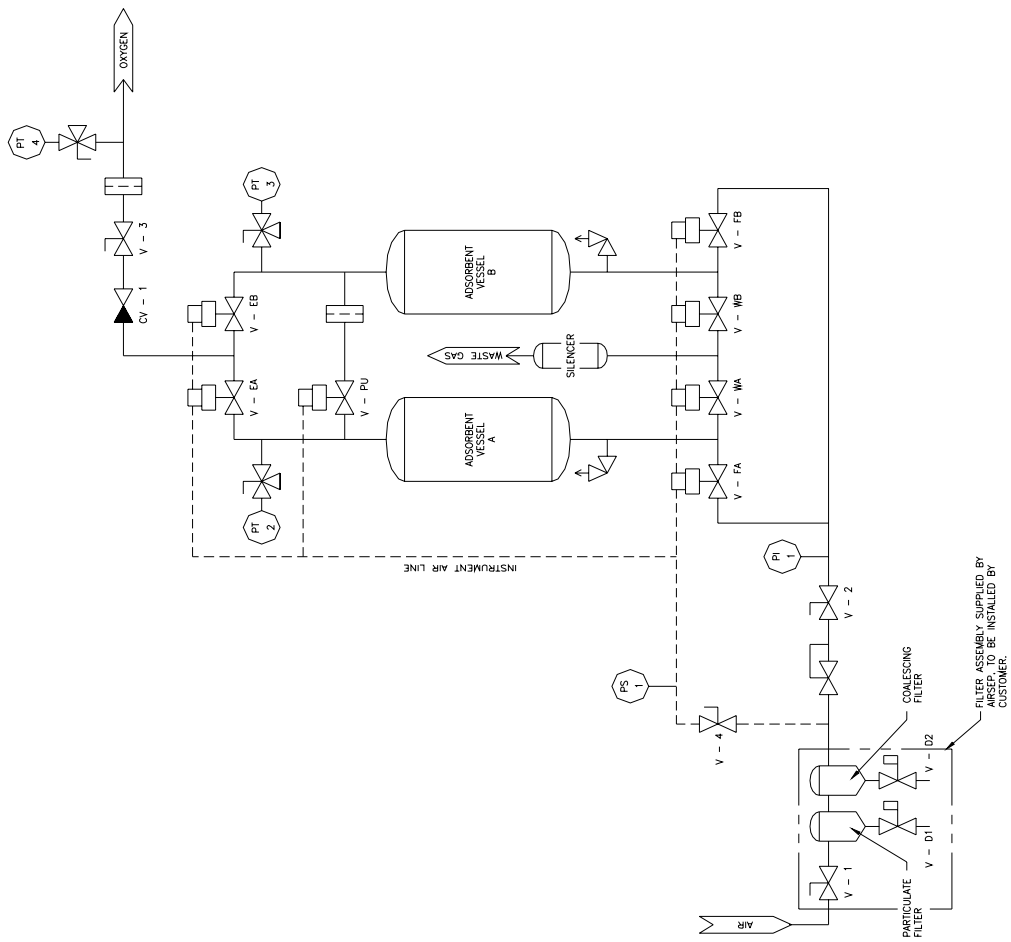


Figure A.3: General Arrangement Drawing – AS-W



VALVE IDENTIFICATIONS:

- V - FA/FB = FEED AIR VALVES
- V - WA/WB = WASTE VALVES
- V - PU = PURGE VALVES
- V - D1 = PARTICULATE FILTER DRAIN VALVE
- V - D2 = COALESCING FILTER DRAIN VALVE
- V - 1 = MANUAL FEED #1 VALVE
- V - 2 = MANUAL FEED #2 VALVE
- V - 3 = INSTRUMENT AIR VALVE
- V - 4 = PRODUCT CHECK VALVE
- CV - 1 = INSTRUMENT AIR VALVE
- CV - 2 = PRODUCT CHECK VALVE

PRESSURE GAUGE IDENTIFICATIONS:

- PI 1 = FEED AIR PRESSURE

PRESSURE SWITCH IDENTIFICATIONS:

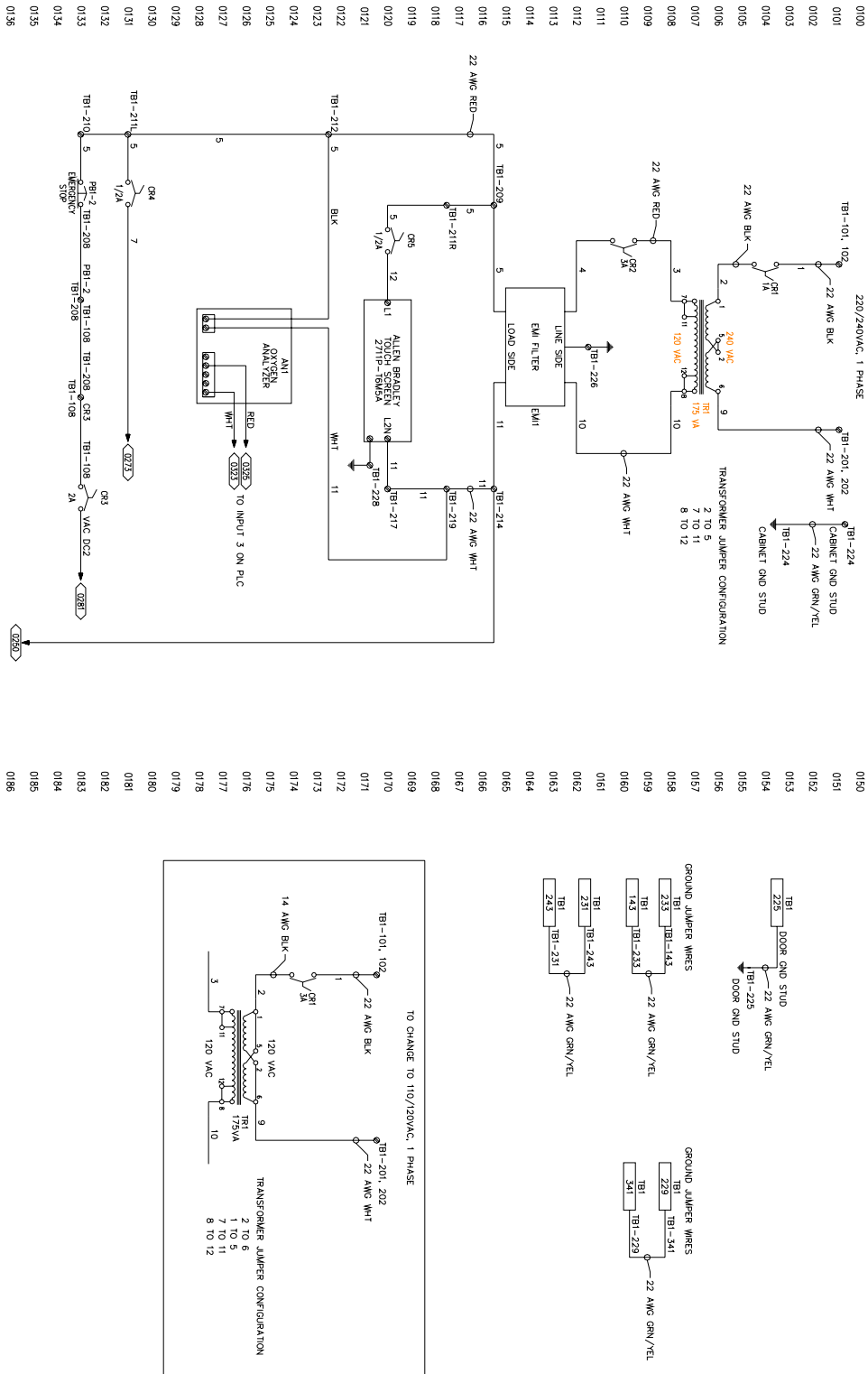
- PS 1 = FEED AIR PRESSURE

PRESSURE TRANSDUCER IDENTIFICATIONS:

- PT 2 = BED A PRESSURE
- PT 3 = BED B PRESSURE
- PT 4 = OXYGEN RECEIVER PRESSURE

LEGEND			
ITEM	DESCRIPTION	ITEM	DESCRIPTION
	MANUAL VALVE		PNEUMATIC VALVE
	SOLENOID OPERATED VALVE		RELIEF VALVE
	CHECK VALVE		LOCAL MOUNTED PRESSURE GAUGE
			LOCAL MOUNTED PRESSURE TRANSDUCERS
			PRESSURE REGULATOR
			FLOW CONTROL ORIFICE

Figure A.5: Process & Instrumentation Drawing – AS-Q, AS-R, AS-W and AS-Z



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Figure A.6: Electrical Schematic - I

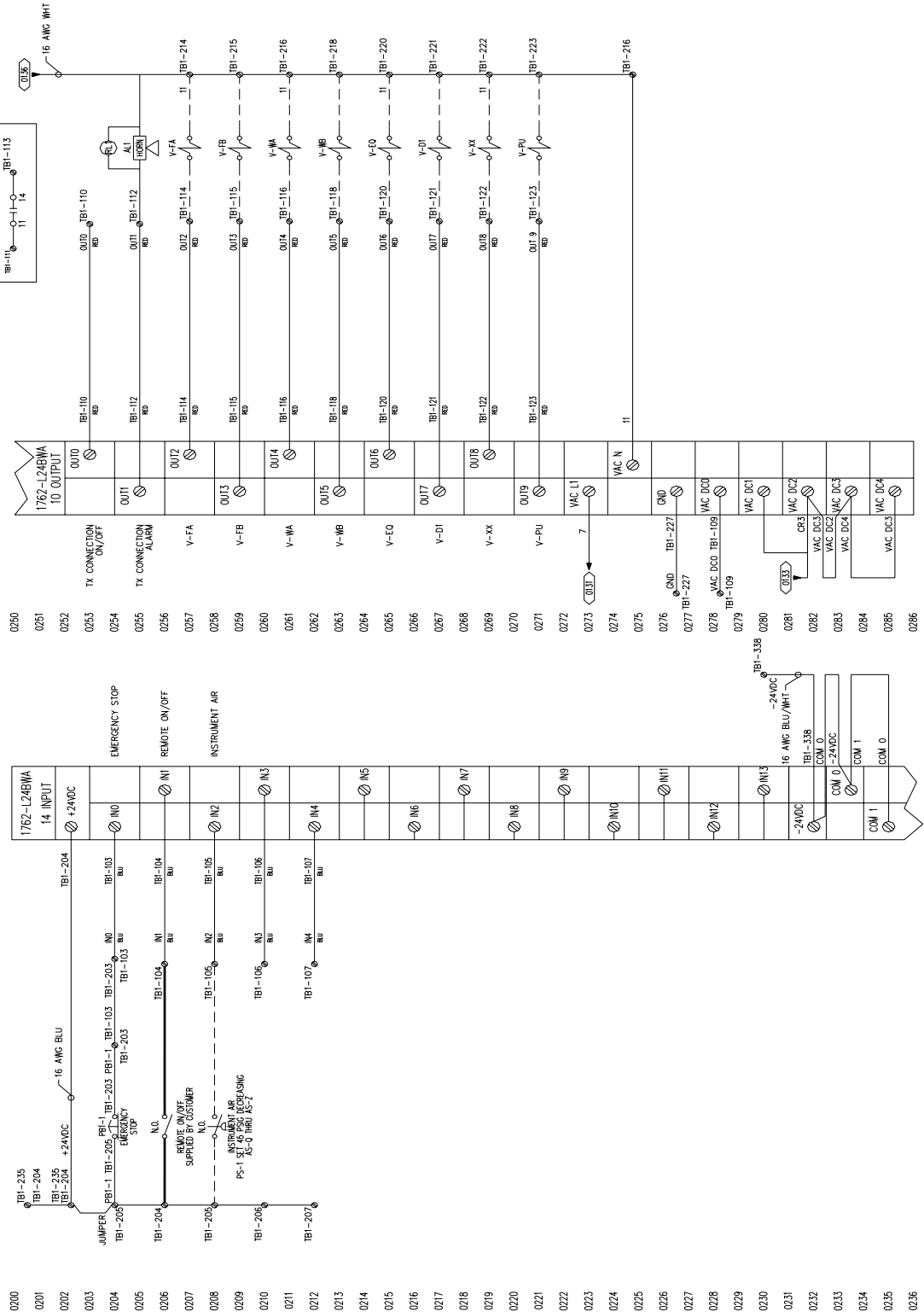


Figure A.7: Electrical Schematic - II

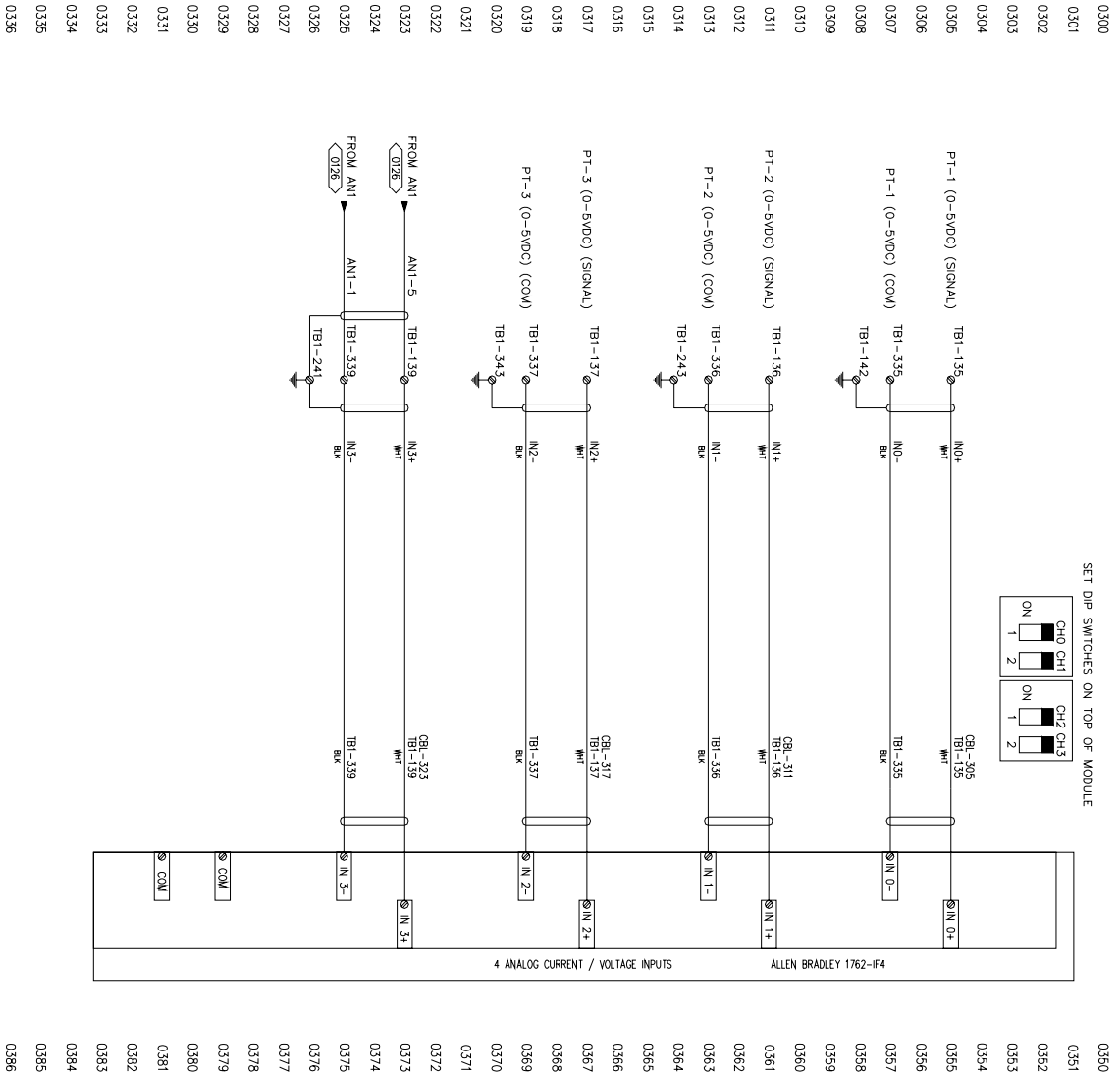


Figure A.8: Electrical Schematic - III

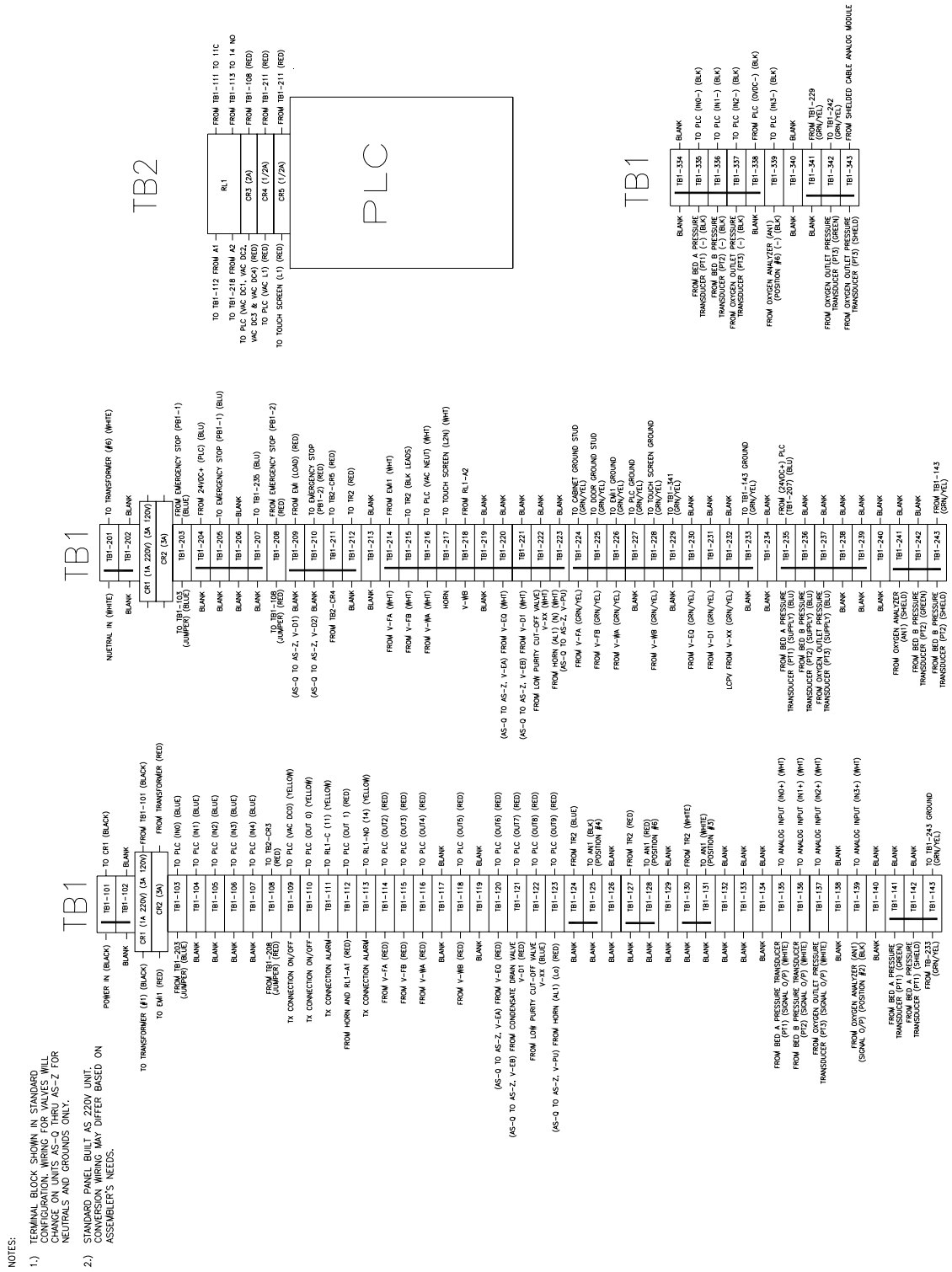


Figure A.9: Electrical Schematic - IV

B Appendix: Warranty>Returns

Product Warranty

AirSep Corporation (“AirSep”) warrants to the party purchasing from AirSep (the “original purchaser”) the PSA oxygen generator to be free from defect in parts and workmanship for one year from the date of start-up, not to exceed eighteen (18) months from the date of shipment to the original purchaser, under normal use, maintenance and operation*. TO THE EXTENT PERMITTED UNDER APPLICABLE LAW, ALL WARRANTIES WITH RESPECT TO SUCH UNIT SHALL ONLY EXTEND TO AND BE FOR THE BENEFIT OF THE ORIGINAL PURCHASER AND SHALL NOT BE ASSIGNABLE TO, EXTEND TO OR BE FOR THE BENEFIT OF ANY OTHER PARTY. AirSep’s obligations under this warranty are limited, at AirSep’s option, to the repair, replacement or refunding the purchase price of any such unit of equipment (or part thereof) found by AirSep to be defective in parts or workmanship; provided, however, that AirSep shall have no obligation hereunder with respect to a defective part unless it receives written notice of such defect prior to the expiration of the applicable warranty period as referenced above.

Each unit of equipment for which a warranty claim is asserted shall, at the request of AirSep, be returned on a prepaid basis with proof of purchase date to the AirSep factory specified by AirSep at the expense of the original purchaser. Replacement parts shall be warranted as stated above for the unexpired portion of the original warranty. This warranty does not extend to any unit or part subjected to misuse (at AirSep’s sole determination), accident, improper maintenance or application, or which has been repaired or altered outside of the AirSep factory without the express prior written authorization of AirSep.

Notwithstanding anything to the contrary contained herein, during the applicable warranty period, as specified above, AirSep will pay the cost of return freight charges to the original purchaser, provided an authorized AirSep representative approved return of the unit or parts, for any equipment found by AirSep to be defective. For warranty repairs performed during the first 90 days from the date of invoice, AirSep will pay freight both ways. After the applicable parts warranty period has expired, the original purchaser is responsible for freight both ways.

* Please refer to the appropriate product documentation for applicable installation and operating requirements.

Limits of Liability

THE FOREGOING WARRANTY IS THE ONLY WARRANTY MADE BY AIRSEP WITH RESPECT TO THE EQUIPMENT (OR ANY PART THEREOF) AND IS IN LIEU OF ANY OTHER WARRANTY, EXPRESSED OR IMPLIED, IN FACT OR IN LAW, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. IT IS EXPRESSLY UNDERSTOOD THAT THE SOLE AND EXCLUSIVE REMEDY FOR ANY DEFECT IN PARTS OR WORKMANSHIP IS LIMITED TO ENFORCEMENT OF AIRSEP'S OBLIGATIONS AS SET FORTH ABOVE, AND AIRSEP SHALL NOT BE LIABLE TO ORIGINAL PURCHASER OR ANY OTHER PARTY FOR LOSS OF USE OF THE EQUIPMENT, LOST PROFITS OR FOR ANY OTHER SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES (EVEN IF AIRSEP HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES).



AirSep oxygen generators are sold for use in industrial applications only. Contact AirSep Corporation or an authorized AirSep Corporation representative before you use this unit for any medical application.

Returning the Oxygen Generator or a Component for Service

If the oxygen generator or a defective part requires service, contact your distributor. If instructed by your distributor to contact AirSep Corporation, follow the procedure below to return the oxygen generator or a component for service or credit.

- 1) Obtain a Return Goods Authorization (RGA) number from the AirSep Commercial Products Service Department. (Refer to Section 8.0 — Troubleshooting for information about contacting AirSep Corporation.) Before you call for service assistance, have the following information readily available:
 - Oxygen Generator Model
 - Serial Number
 - Hours of Use
 - Invoice Date



AirSep Corporation issues no credit for any warranted item until you present the model number, serial number, and invoice date of the oxygen generator, and defective part is returned to AirSep Corporation.

- 2) Write the RGA number clearly on the outside of the shipping container.



AirSep Corporation accepts no item(s) for service or credit unless prior written authorization was issued by AirSep Corporation.

- 3) Return item(s) in their original packaging material. Pack merchandise for a safe return. AirSep Corporation assumes no responsibility for damage that occurs in transit. Any damage to the oxygen generator or a component because of failure to follow this procedure is the sole responsibility of the customer.



Return item(s) on a freight prepaid basis only.

C Appendix: Parts List

Use the following lists to order parts or rebuild kits for the oxygen generator. To order, please contact your distributor. If instructed by your distributor to contact AirSep Corporation, contact the AirSep Commercial Products Service Department as described in Section 8.0 — Troubleshooting. If the list does not contain the part you require, please provide a precise description of the part when you call.

Item	Qty	Part #
8,000 Hour Kit/1 Year		
Prefilter Element, FRP-95-508, 1/4000 hours	2	FI065-1
Microalescer Element, MTP-95-562, 1/8000 hours	1	FI022-1
16,000 Hour Kit/2 Year		
Prefilter Element, FRP-95-508, 1/4000 hours	4	FI065-1
Microalescer Element, MTP-95-562, 1/8000 hours	2	FI022-1
Feed:		
<i>Valve Assy, Butterfly, 3", w/VPVL200DAB act</i>		VA402-3
Asco Valve SC8551A1MS	2	VA311-2
Jamesbury Actuator Rebuild Kit, RKP155	2	VA412-2
Jamesbury Butterfly Kit, RKW352XZ	2	VA414-3
Waste:		
<i>Valve Assy, Butterfly, 4", w/VPVL250DAB act</i>		VA403-4
Asco Valve SC8551A1MS	2	VA311-2
Jamesbury Actuator Rebuild Kit, RKP156	2	VA412-3
Jamesbury Butterfly Kit, RKW353XZ	2	VA414-4
Equalization		
<i>Valve Assy, Butterfly, 3", w/VPVL200DAB act</i>		VA402-3
Asco Valve SC8551A1MS	2	VA311-2
Jamesbury Actuator Rebuild Kit, RKP155	2	VA412-2
Jamesbury Butterfly Kit, RKW352XZ	2	VA414-3
Purge:		
<i>Valve Assy, Ball valve 1 1/2" VPVL200DAB act</i>		VA401-3
Asco valve SC8551AIMS	1	VA311-2
Jamesbury Actuator rebuild kit RKP155	1	VA412-2
Jamesbury Ball kit RKN359XT	1	VA414-2
Emergency spares		
PLC Timer Allem Bradley 1200 Micrologic 1762-L24BWA		CM102-2
PLC Timer Allem Bradley Analog input 1762-1F4		CM103-1
PLC Timer Allem Bradley Panel view plus 600		CM104-2
Actuator Jamesbury VPVL200DAB		VA411-2
Actuator Jamesbury VPVL250DAB		VA411-3
Drain Valve, 115/60Hz		DA003-1
Muffler Elements 2"		MU057-1

Check Valve 1"
Transducer
MagnaLube

VA161-1
MI224-1
PS211-1

D Appendix: Component Literature

Programmable Logic Controller

- Allen Bradley
MicroLogix™ 1200
Programmable Logic Controller (PLC)
[Installation Instructions](#)
- Allen Bradley
MicroLogix™
Analog Input Module
[Installation Instructions](#)
- Allen Bradley
PanelView Plus 400 and 600 Terminals
[Installation Instructions](#)

Filters

- Wilkerson
Filter Models F35, F36, and F37
[Installation and Maintenance Sheet](#)
- Wilkerson
Filter Models M35, M36, and M37
[Installation and Maintenance Sheet](#)
- Wilkerson
Filter Model F43
[Installation and Maintenance Sheet](#)
- Wilkerson
Filter Models M43 & M45
[Installation and Maintenance Sheet](#)

Pressure Transducer

- Measurement Specialties, Inc. – MSI
MSP-300 Stainless Steel Isolated Pressure
Transducer
- Measurement Specialties, Inc. – MSI
MSP-300-150-P-4-N-X-XXX Pressure
[Transducer Drawing](#)

Valves and Actuators

- Neles-Jamesbury
IMO 308
Model C Wafer-Sphere® Butterfly Valves
[Installation, Maintenance and Operating Instructions](#)
- Motivair
Automatic Condensate Removal Valve
EDM 20-1 Electronic Timer-Solenoid
[Technical Data](#)
- ASCO
4-Way 2 Position Single Solenoid Valves —
¼ NPT Pressure
Series 8551
[Installation and Maintenance Instructions](#)
- Jamesbury
Double-opposed Piston Actuators
IMO-528
[Installation, Maintenance and Operating Instructions](#)

Pressure Switch

- Allen-Bradley
Bulletin 836
Style C
[Instruction Sheet](#)

Miscellaneous

- Gasket Material for Oxygen Service
Durabla Manufacturing Company
Durabla Black Compressed Gasket Material
[Material Safety Data Sheets](#)



Installation Instructions

English Section

MicroLogix™ 1200 Programmable Controllers

(Cat. No. 1762-L24AWA, 1762-L24BWA, 1762-L24BXB, 1762-L40AWA,
1762-L40BWA, 1762-L40BXB, 1762-L24AWAR, 1762-L24BWAR,
1762-L24BXBR, 1762-L40AWAR, 1762-L40BWAR, 1762-L40BXBR)

For More Information

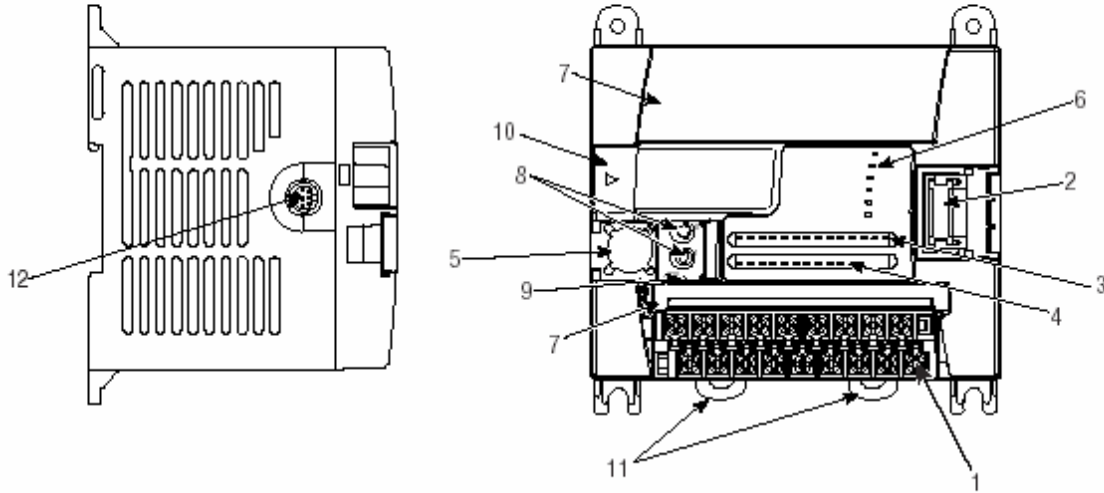
Related Publications

For	Refer to this Document	Pub. No.
A more detailed description of how to install and use your MicroLogix 1200 programmable controller and expansion I/O system.	MicroLogix™ 1200 Programmable Controllers User Manual	1762-UM001
A reference manual that contains data and function files, instruction set, and troubleshooting information for MicroLogix 1200 and MicroLogix 1500.	MicroLogix™ 1200 and MicroLogix™ 1500 Instruction Set Reference Manual	1762-RM001
Information on installing and using 1762 expansion I/O modules.	Installation Instructions are included with each module. Also available via www.theautomationbookstore.com .	1762-INxxx
More information on proper wiring and grounding techniques.	Industrial Automation Wiring and Grounding Guidelines	1770-4.1

If you would like a manual, you can:

- download a free electronic version from the internet: www.theautomationbookstore.com
- purchase a printed manual by:
 - contacting your local distributor or Rockwell Automation representative
 - visiting www.theautomationbookstore.com and placing your order
 - calling **1.800.963.9548** (USA/Canada) or **001.330.725.1574** (Outside USA/Canada)

Controller Description



Item	Description	Item	Description
1	Terminal Blocks (Removable Terminal Blocks on 40-point controllers only)	7	Terminal Doors and Label
2	Bus Connector Interface to Expansion I/O	8	Trim Pots
3	Input LEDs	9	Default Communications Push Button
4	Output LEDs	10	Memory Module Port Cover ⁽¹⁾ -or- Memory Module and/or Real Time Clock ⁽²⁾
5	Communication Port (Channel 0)	11	DIN Rail Latches
6	Status LEDs	12	Programmer/HMI Port (Equipped with 1762-LxxxxR controllers only)

⁽¹⁾ Shipped with controller

⁽²⁾ Optional equipment.

Specifications

General Specifications

Description	1762-						
	L24AWA, L24AWAR	L24BWA, L24BWAR	L24BXB, L24BXBR	40AWA, 40AWAR	L40BWA, L40BWAR	L40BXB, L40BXBR	
Dimensions	Height: 90 mm, 104 mm (with DIN latch open) Width: 110 mm, Depth: 87 mm			Height: 90 mm 104 mm (with DIN latch open) Width: 160 mm, Depth: 87 mm			
Shipping Weight	0.9 kg (2.0 lbs)			1.1 kg (2.4 lbs)			
Number of I/O	14 inputs and 10 outputs			24 inputs, 16 outputs			
Power Supply	100 to 240V ac (-15%, +10%) at 47 to 63 Hz		24V dc (-15%, +10%) Class 2 SELV	100 to 240V ac (-15%, +10%) at 47 to 63 Hz		24V dc (-15%, +10%) Class 2 SELV	
Heat Dissipation	Refer to the MicroLogix 1200 Programmable Controllers User Manual.						
Power Supply Inrush	120V ac: 25A for 8 ms 240V ac: 40A for 4 ms		24V dc: 15A for 20 ms	120V ac: 25A for 8 ms 240V ac: 40A for 4 ms		24V dc: 15A for 30 ms	
Power Supply Usage	68 VA	70 VA	27W	80 VA	82 VA	40W	
Power Supply Output	5V dc	400 mA	400 mA ⁽¹⁾	400 mA	600 mA	600 mA ⁽²⁾	600 mA
	24V dc	350 mA	350 mA ⁽¹⁾	350 mA	500 mA	500 mA ⁽²⁾	500 mA
Sensor Power Output	none	24V dc at 250 mA 400 µF max. ⁽¹⁾	none	none	24V dc at 400 mA 400 µF max. ⁽²⁾	none	
Input Circuit Type	120V ac	24V dc sink/source	24V dc sink/source	120V ac	24V dc sink/source	24V dc sink/source	
Output Circuit Type	Relay	Relay	Relay/FET	Relay	Relay	Relay/FET	
Operating Temp.	+0°C to +55°C (+32°F to +131°F) ambient						
Storage Temp.	-40°C to +85°C (-40°F to +185°F) ambient						
Operating Humidity	5% to 95% relative humidity (non-condensing)						
Vibration	Operating: 10 to 500 Hz, 5G, 0.030 in. max. peak-to-peak, 2 hours each axis Relay Operation: 1.5G						

Description	1762-					
	L24AWA, L24AWAR	L24BWA, L24BWAR	L24BXB, L24BXBR	40AWA, 40AWAR	L40BWA, L40BWAR	L40BXB, L40BXBR
Shock	Operating: 30G; 3 pulses each direction, each axis Relay Operation: 7G Non-Operating: 50G panel mounted (40G DIN Rail mounted); 3 pulses each direction, each axis					
Agency Certification	<ul style="list-style-type: none"> • UL 508 • C-UL under CSA C22.2 no. 142 • Class I, Div. 2, Groups A, B, C, D (UL 1604, C-UL under CSA C22.2 no. 213) • CE/C-Tick compliant for all applicable directives 					
Electrical/EMC	The controller has passed testing at the following levels: <ul style="list-style-type: none"> • IEC1000-4-2: 4 kV contact, 8 kV air, 4 kV indirect • IEC1000-4-3: 10V/m, 80 to 1000 MHz, 80% amplitude modulation, +900 MHz keyed carrier • IEC1000-4-4: 2 kV, 5 kHz; communications cable: 1 kV, 5 kHz • IEC1000-4-5: communications cable 1 kV galvanic gun I/O: 2 kV CM (common mode), 1 kV DM (differential mode) AC Power Supply: 4 kV CM (common mode), 2 kV DM (differential mode) DC Power Supply: 500V CM (common mode), 500V DM (differential mode) • IEC1000-4-6: 10V, communications cable 3V 					
Terminal Screw Torque	0.791 Nm (7 in-lb) rated					

^[1] Do not allow the total load power consumed by the 5V dc, 24V dc, and sensor power outputs to exceed 12W.

^[2] Do not allow the total load power consumed by the 5V dc, 24V dc, and sensor power outputs to exceed 16W.

Refer to the MicroLogix 1200 User Manual for system validation worksheets.

Input Specifications

Description	1762-L24AWA, -L40AWA 1762-L24AWAR, -L40AWAR	1762-L24BWA, -L24BXB, -L40BWA, -L40BXB 1762-L24BWAR, -L24BXHR, -L40BWAR, -L40BXHR	
		Inputs 0 through 3	Inputs 4 and higher
On-State Voltage Range	79 to 132V ac	14 to 24V dc (+10% at 55°C/131°F) (+25% at 30°C/86°F)	10 to 24V dc (+10% at 55°C/131°F) (+25% at 30°C/86°F)
Off-State Voltage Range	0 to 20V ac	0 to 5V dc	
Operating Frequency	47 Hz to 63 Hz	0 Hz to 20 kHz	0 Hz to 1 kHz (scan time dependent)
On-State Current:			
<ul style="list-style-type: none"> • minimum • nominal • maximum 	<ul style="list-style-type: none"> • 5.0 mA at 79V ac • 12 mA at 120V ac • 16.0 mA at 132V ac 	<ul style="list-style-type: none"> • 2.5 mA at 14V dc • 7.3 mA at 24V dc • 12.0 mA at 30V dc 	<ul style="list-style-type: none"> • 2.0 mA at 10V dc • 8.9 mA at 24V dc • 12.0 mA at 30V dc
Off-State Leakage Current	2.5 mA max.	1.5 mA min.	
Nominal Impedance	12K Ω at 50 Hz 10K Ω at 60 Hz	3.3K Ω	2.7K Ω
Inrush Current (max.) at 120V ac	250 mA	Not Applicable	

Output Specifications

General

Description		1762			
		-L24AWA -L24BWA -L24AWAR -L24BWAR	-L24BXB -L24BXBR	-L40AWA -L40BWA -L40AWAR -L40BWAR	-L40BXB -L40BXBR
Relay and FET Outputs					
Maximum Controlled Load		1440 VA			
Maximum Continuous Current:					
Current per Group Common		8A	7.5A	8A	8A
Current per Controller	at 150V max	30A or total of per-point loads, whichever is less			
	at 240V max	20A or total of per-point loads, whichever is less			
Relay Outputs					
Turn On Time/Turn Off Time		10 msec (minimum) ⁽¹⁾			
Load Current		10 mA (minimum)			

⁽¹⁾ scan time dependent

Relay Contact Ratings

Maximum Volts	Amperes		Amperes Continuous	Volt-Amperes	
	Make	Break		Make	Break
240V ac	7.5A	0.75A	2.5A ⁽²⁾	1800 VA	180 VA
120V ac	15A	1.5A	2.5A ⁽²⁾	1800 VA	180 VA
125V dc	0.22A ⁽¹⁾		1.0A	28 VA	
24V dc	1.2A ⁽¹⁾		2.0A		

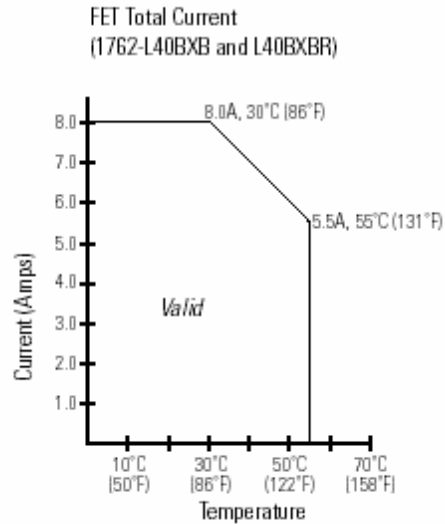
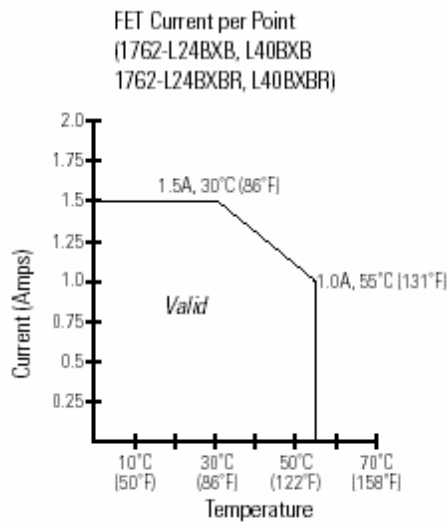
⁽¹⁾ For dc voltage applications, the make/break ampere rating for relay contacts can be determined by dividing 28 VA by the applied dc voltage. For example, 28 VA/48V dc = 0.58A. For dc voltage applications less than 14V, the make/break ratings for relay contacts cannot exceed 2A.

⁽²⁾ 1.5A above 40°C.

BXB FET Output Specifications

Description	General Operation	High Speed Operation ⁽¹⁾ (Output 2 Only)
Power Supply Voltage	24V dc (-15%, +10%)	
On-State Voltage Drop:		
<ul style="list-style-type: none"> at maximum load current at maximum surge current 	<ul style="list-style-type: none"> 1V dc 2.5V dc 	<ul style="list-style-type: none"> Not Applicable Not Applicable
Current Rating per Point		
<ul style="list-style-type: none"> maximum load minimum load maximum leakage 	<ul style="list-style-type: none"> See graphs below. 1.0 mA 1.0 mA 	<ul style="list-style-type: none"> 100 mA 10 mA 1.0 mA

Maximum Output Current (temperature dependent):



Surge Current per Point:		
<ul style="list-style-type: none"> peak current maximum surge duration maximum rate of repetition at 30°C (86°F) maximum rate of repetition at 55°C (131°F) 	<ul style="list-style-type: none"> 4.0A 10 msec once every second once every 2 seconds 	<ul style="list-style-type: none"> Not Applicable Not Applicable Not Applicable Not Applicable

Description	General Operation	High Speed Operation ⁽¹⁾
		(Output 2 Only)
Turn-On Time (maximum)	0.1 msec	6 µsec
Turn-Off Time (maximum)	1.0 msec	18 µsec
Repeatability (maximum)	n/a	2 µsec
Drift (maximum)	n/a	1 µsec per 5°C (9°F)

⁽¹⁾ Output 2 is designed to provide increased functionality over the other FET outputs. Output 2 may be used like the other FET transistor outputs, but in addition, within a limited current range, it may be operated at a higher speed. Output 2 also provides a pulse train output (PTO) or pulse width modulation output (PWM) function.

Working Voltage

Description	1762-L24AWA, 1762-L40AWA, 1762-L24AWAR, 1762-L40AWAR
Power Supply Input to Backplane Isolation	Verified by one of the following dielectric tests: 1836V ac for 1 second or 2596V dc for 1 second
	265V ac Working Voltage (IEC Class 2 reinforced insulation)
Input Group to Backplane Isolation	Verified by one of the following dielectric tests: 1517V ac for 1 second or 2145V dc for 1 second
	132V ac Working Voltage (IEC Class 2 reinforced insulation)
Input Group to Input Group Isolation	Verified by one of the following dielectric tests: 1517V ac for 1 second or 2145V dc for 1 second
	132V ac Working Voltage (basic insulation)
Output Group to Backplane Isolation	Verified by one of the following dielectric tests: 1836V ac for 1 second or 2596V dc for 1 second
	265V ac Working Voltage (IEC Class 2 reinforced insulation)
Output Group to Output Group Isolation	Verified by one of the following dielectric tests: 1836V ac for 1 second or 2596V dc for 1 second
	265V ac Working Voltage (basic insulation) 150V ac Working Voltage (IEC Class 2 reinforced insulation).

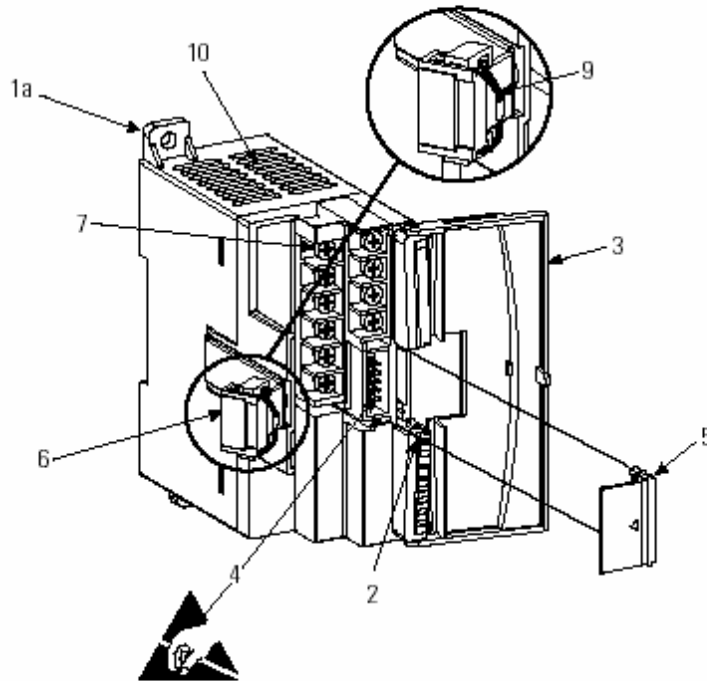


Installation Instructions

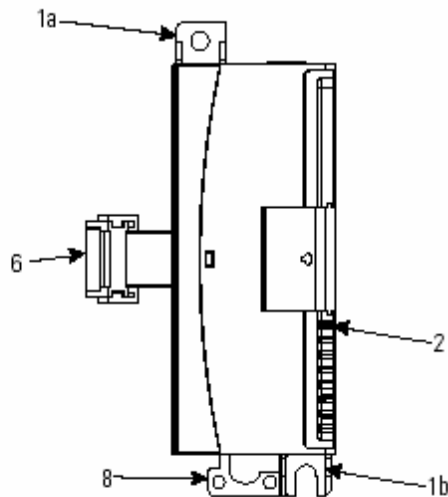
MicroLogix™ Analog Input Module

(Catalog Number 1762-IF4)

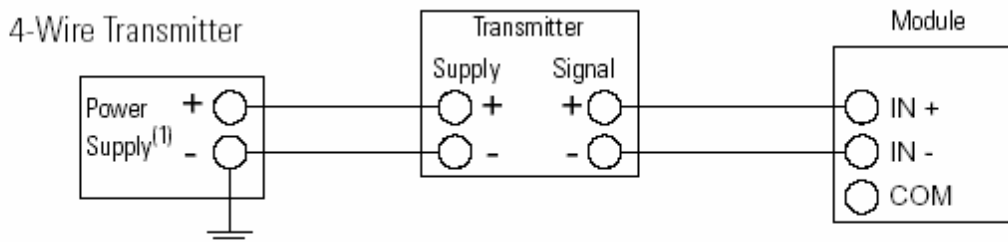
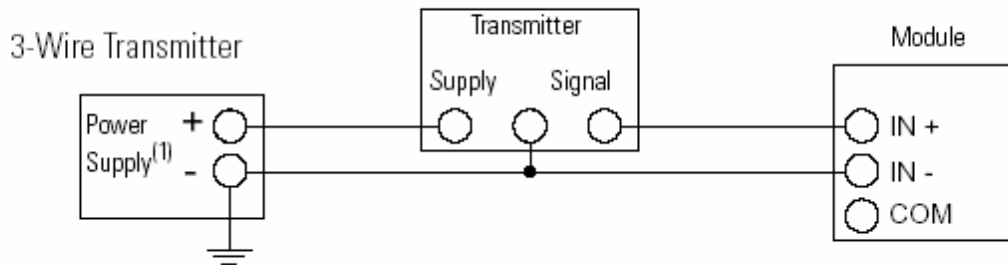
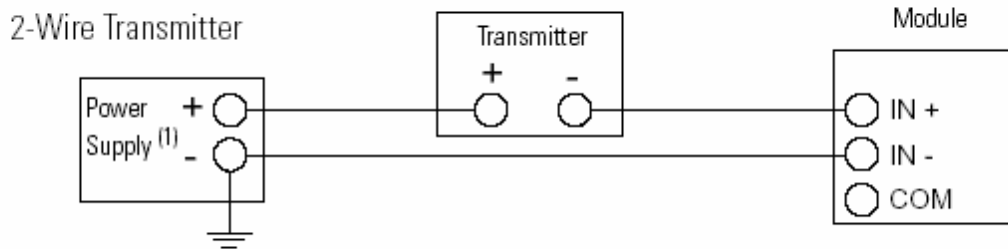
Description



Item	Description
1a	upper panel mounting tab
1b	lower panel mounting tab
2	power diagnostic LED
3	module door with terminal identification label
4	bus connector with male pins
5	bus connector cover
6	flat ribbon cable with bus connector (female)
7	terminal block
8	DIN rail latch
9	pull loop
10	input type selector switch



Sensor/Transmitter Types



(1) All power supplies rated N.E.C. Class 2.

Labeling the Terminals

A write-on label is provided with the module. Mark the identification of each terminal with permanent ink, and slide the label back into the door.

Specifications

General Specifications

Specification	Value
Dimensions	90 mm (height) x 87 mm (depth) x 40 mm (width) height including mounting tabs is 110 mm 3.54 in. (height) x 3.43 in. (depth) x 1.58 in. (width) height including mounting tabs is 4.33 in.
Approximate Shipping Weight (with carton)	235g (0.521 lbs.)
Storage Temperature	-40°C to +85°C (-40°F to +185°F)
Operating Temperature	0°C to +55°C (+32°F to +131°F)
Operating Humidity	5% to 95% non-condensing
Operating Altitude	2000 meters (6561 feet)
Vibration	Operating: 10 to 500 Hz, 5G, 0.030 in. max. peak-to-peak
Shock	Operating: 30G
Bus Current Draw (max.)	40 mA at 5V dc 50 mA at 24V dc
Analog Normal Operating Range	Voltage: -10 to +10V dc Current: 4 to 20 mA
Full Scale ⁽¹⁾ Analog Ranges	Voltage: -10.5 to +10.5V dc Current: -21 to +21 mA
Resolution	15 bits (bipolar)
Repeatability ⁽²⁾	±0.1%
Input Group to System Isolation	30V ac/30V dc rated working voltage ⁽³⁾ (N.E.C. Class 2 required) (IEC Class 2 reinforced insulation) type test: 500V ac or 707V dc for 1 minute
Module Power LED	On: indicates power is applied.
Recommended Cable	Belden™ 8761 (shielded)

(1) The over- or under-range flag comes on when the normal operating range (over/under) is exceeded. The module continues to convert the analog input up to the maximum full scale range.

(2) Repeatability is the ability of the input module to register the same reading in successive measurements for the same input signal.

(3) Rated working voltage is the maximum continuous voltage that can be applied at the terminals with respect to earth ground.

Specification	Value
Vendor I.D. Code	1
Product Type Code	10
Product Code	67
Agency Certification	C-UL certified (under CSA C22.2 No. 142) UL 508 listed CE compliant for all applicable directives
Hazardous Environment Class	Class I, Division 2, Hazardous Location, Groups A, B, C, D (UL 1604, C-UL under CSA C22.2 No. 213)
Radiated and Conducted Emissions	EN50081-2 Class A
<i>Electrical /EMC:</i>	<i>The module has passed testing at the following levels:</i>
ESD Immunity (IEC1000-4-2)	4 kV contact, 8 kV air, 4 kV indirect
Radiated Immunity (IEC1000-4-3)	10 V/m, 80 to 1000 MHz, 80% amplitude modulation, +900 MHz keyed carrier
Fast Transient Burst (IEC1000-4-4)	2 kV, 5 kHz
Surge Immunity (IEC1000-4-5)	1 kV galvanic gun
Conducted Immunity (IEC1000-4-6)	10V, 0.15 to 80 MHz ⁽¹⁾

(1) Conducted Immunity frequency range may be 150 kHz to 30 MHz if the Radiated Immunity frequency range is 30 MHz to 1000 MHz.

Input Specifications

Specification	Value
Number of Inputs	4 differential (bipolar)
A/D Converter Type	Successive approximation
Common Mode Voltage Range ⁽¹⁾	±27 V
Common Mode Rejection ⁽²⁾	> 55 dB at 50 and 60 Hz
Non-linearity (in percent full scale)	±0.1%
Typical Overall Accuracy ⁽³⁾	±0.3% full scale at 0 to 55°C ±0.24% full scale at 25°C
Input Impedance	Voltage Terminal: 200KΩ Current Terminal: 275Ω
Current Input Protection	±32 mA
Voltage Input Protection	±30 V
Channel Diagnostics	Over or under range or open circuit condition by bit reporting for analog inputs.

(1) For proper operation, both the plus and minus input terminals must be within ±27V of analog common.

(2) $V_{cm} = 1 V_{pk-pk} AC$

(3) $V_{cm} = 0$ (includes offset, gain, non-linearity and repeatability error terms)



Installation Instructions

PanelView Plus 400 and 600 Terminals

Catalog Numbers 2711P-x4xxxx, 2711P-x6xxxx

English



For More Information

To obtain an electronic version of this document or the PanelView Plus User Manual, visit the following web sites:

- www.theautomationbookstore.com
- www.rockwellautomation.com

Overview

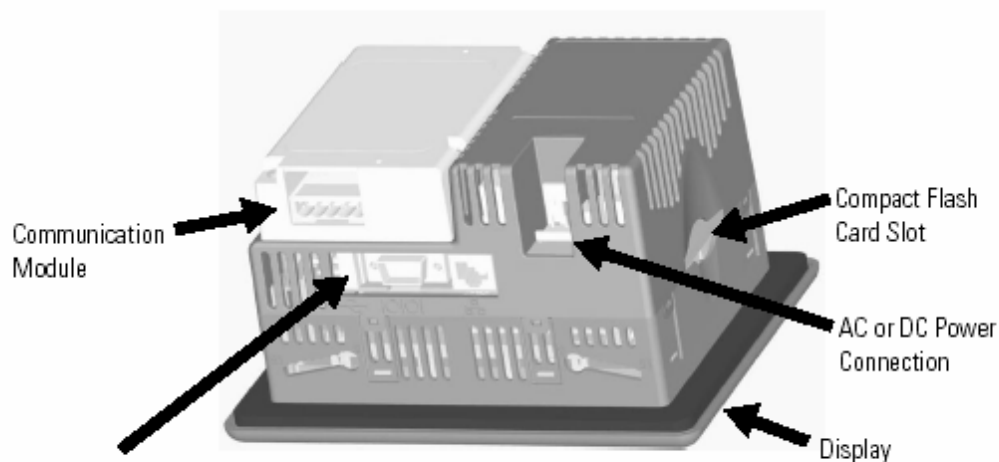
This document provides instructions on how to install the following devices in a panel or enclosure.

- PanelView Plus 400 Keypad Terminal
- PanelView Plus 600 Keypad, Touch or Keypad & Touch Terminal

The base configured unit of these terminals includes:

- AC or DC Power supply
- display
- processor and memory
- RS-232 and USB ports only **or**
- RS-232, USB and Ethernet ports with interface for Communication module

Communication modules for specific protocols can be ordered as separate components for field installation or factory assembled to base unit (with communication interface) per your configuration.

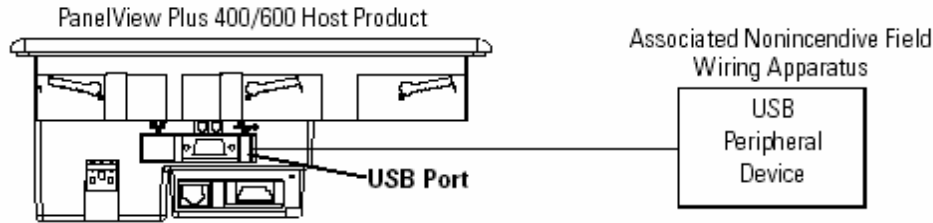


Base Configured Unit with:

- USB & RS-232 Ports Only **or**
- USB, RS-232 & Ethernet Ports with interface for Comm. Module

USB Port Control Drawing

The PanelView Plus 400/600 Terminals contain a single USB (Universal Serial Bus) port which complies with hazardous location environments. This section details the field wiring compliance requirements and is provided in accordance with the National Electrical Code, article 500.



The USB peripheral device must be rated for use in the hazardous location environment in which it is used and also comply with the circuit parameters in Table 2.

The circuit parameters in Table 1 define the maximum voltage and current of the PanelView Plus 400/600 USB port.

Table 1 PanelView Plus 400/600 USB Port Circuit Parameters

Parameter	Value	Parameter Definition
V_{oc}	5.25V dc	Open circuit voltage of the host USB port.
I_{sc}	1.68 A	Maximum output current of the host USB port.

The circuit parameters in Table 2 define the maximum voltage, current, capacitance, and inductance values for any peripheral device connected to the PanelView Plus 400/600 USB port in a hazardous location environment.

Table 2 Required Circuit Parameters for the USB Peripheral Device

Parameter	Value	Parameter Definition and Application Requirement
V_{max}	5.25V dc	Maximum applied voltage rating of the USB peripheral device. V_{max} shall be greater than or equal to V_{oc} in Table 1. ($V_{max} \geq V_{oc}$)
I_{max}	1.68 A	Maximum current to which the USB peripheral device can be subjected. I_{max} shall be greater than or equal to I_{sc} in Table 1. ($I_{max} \geq I_{sc}$)
C_a	10 μ F	Maximum allowed capacitance of the USB peripheral device and its associated cable. The sum of C_{int} of the USB peripheral device and C_{cable} of the associated cable shall be less than or equal to C_a . ($C_a \leq C_{int} + C_{cable}$)
L_a	15 μ H	Maximum allowed inductance of the USB peripheral device and its associated cable. The sum of L_{int} of the USB peripheral device and L_{cable} of the associated cable shall be less than or equal to L_a . ($L_a \leq L_{int} + L_{cable}$)

Installing Terminal in Panel

The PanelView Plus 400 and 600 terminals are installed in the same manner using mounting levers. The number of levers used (4 or 6) varies by terminal type. The mounting levers are shipped with each terminal.

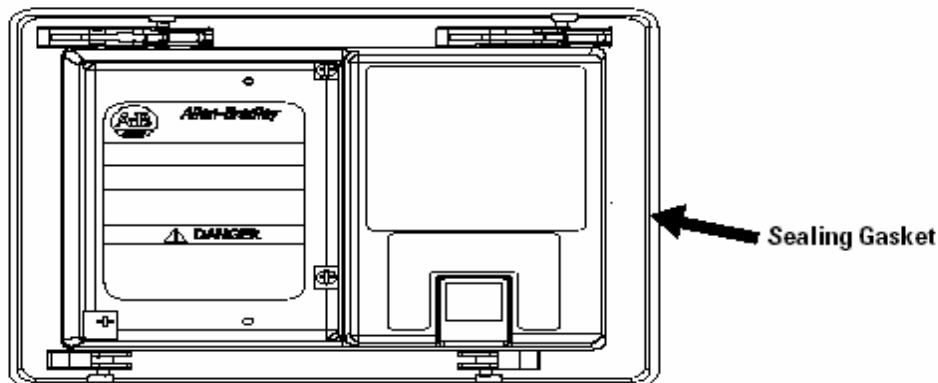
ATTENTION



- Disconnect all electrical power from the panel before making the panel cutout.
- Make sure the area around the panel cutout is clear.
- Do not allow metal cuttings to enter any components already installed in the panel.
- Failure to follow these instructions may result in personal injury or damage to panel components.

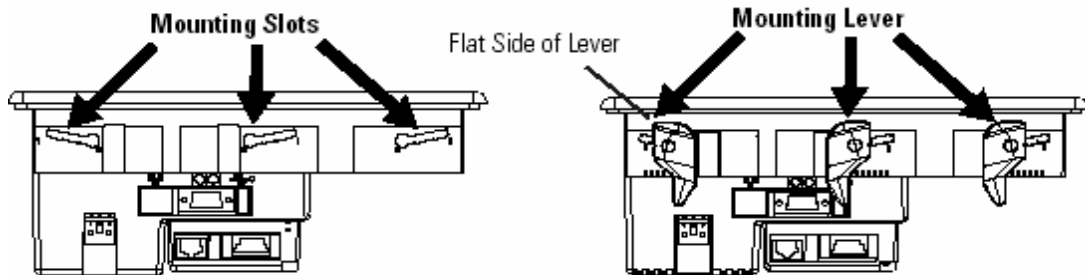
To install terminal in a panel:

1. Cut an opening in the panel using the panel cutout provided with the terminal. Remove any sharp edges or burrs.
2. If Communication Module is ordered separately, attach module to the base unit before panel installation. Refer to the instructions shipped with module.
3. Make sure the terminal sealing gasket is properly positioned on the terminal as shown. This gasket forms a compression type seal. Do not use sealing compounds.

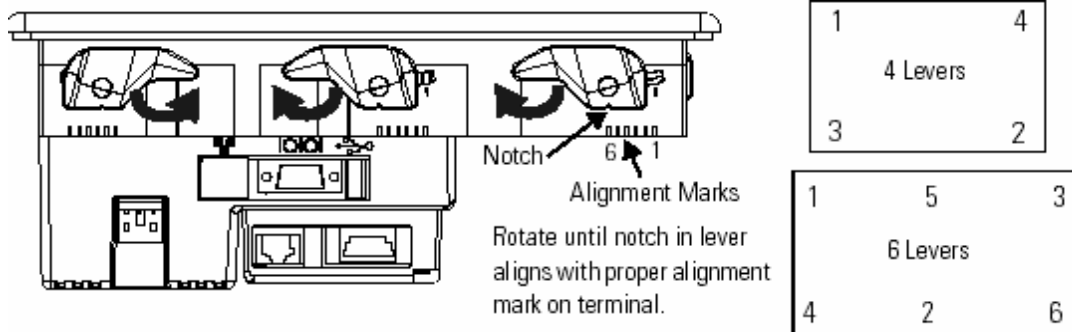


4. If using keypad legend strips on the 600 keypad terminals, we recommend that you install the strips before installing the terminal. Be careful not to pinch legend strip during installation.
5. Place the terminal in the panel cutout.
If installing terminal in existing 550 panel cutout, align terminal with center of cutout for best gasket sealing.

- Insert all mounting levers (4 or 6) into the mounting slots on the terminal (as shown below). Slide each lever until flat side of lever touches the surface of the panel.



- When all levers are in place, slide each lever an additional notch or two until you hear a click.
- Rotate each lever in direction indicated until lever is in final latch position. Follow the latching sequence below to obtain optimum terminal fit.



Use the table below as a guide to insure an adequate gasket seal between terminal and panel.

	Lever Position	Panel Thickness Range	Typical Gauge
<p>Terminal Markings for Alignment</p>	1	0.15 - 2.01 mm (0.060 - 0.079 in)	16
	2	2.03 - 2.64 mm (0.08 - 0.104 in)	14
	3	2.67 - 3.15 mm (0.105 - 0.124 in)	12
	4	3.17 - 3.66 mm (0.125 - 0.144 in)	10
	5	3.68 - 4.16 mm (0.145 - 0.164 in)	8/9
	6	4.19 - 4.75 mm (0.165 - 0.187 in)	7

ATTENTION



Follow instructions above to provide a proper seal and to prevent potential damage to the terminal. Allen-Bradley assumes no responsibility for water or chemical damage to the terminal or other equipment within the enclosure because of improper installation.

Installing and Removing Power Terminal Block

You can remove and re-install the DC or AC power terminal block for ease of installation, wiring, and maintenance. The terminal block is pre-installed when shipped.

ATTENTION



Disconnect all power before installing or replacing components. Failure to disconnect power may result in electrical shock and/or damage to the terminal.

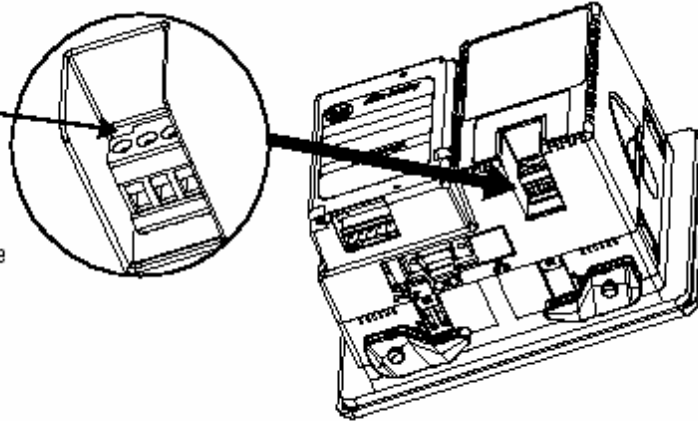
ATTENTION



AC and DC terminal blocks are keyed and marked differently so be sure to follow markings. Do not force terminal blocks into connectors to prevent potential damage to terminal.

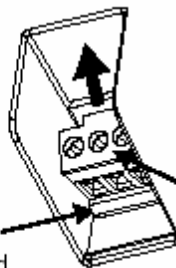
To remove terminal block:

1. Insert tip of small, flat-blade, screw driver into terminal block access slot.
2. Gently pry terminal block away from terminal to release locking mechanism



To install terminal block:

1. Press terminal block base in first with block leaning outward.
2. Gently push top of terminal block back to vertical position to snap in locking tab.



Connecting DC Power


PanelView Plus 400/600 terminals ordered with an integrated DC power supply have the following electrical input rating.


Power Supply	Electrical Input Rating
DC	24V dc nominal (18...30V dc), 25 Watts maximum (1.0 A at 24V dc)

The DC power supply is internally protected against reverse polarity. The input power terminal block on the power supply is removable and supports the following wire sizes:

Wire Type	Wire Size	Terminal Block Screw Torque
Stranded or Solid	#18 to #12 AWG	.23 - .45 N•m (2 - 4 in-lbs)

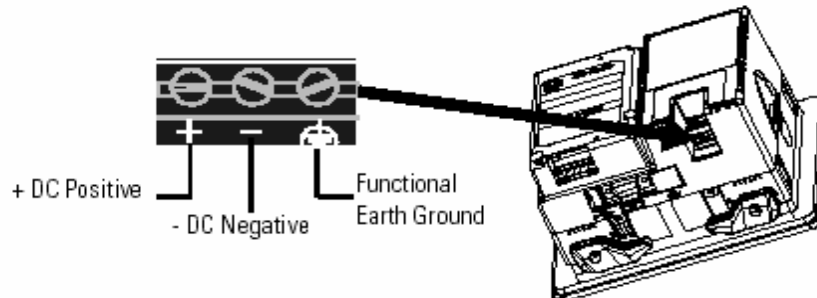
Terminals using 24V dc power are EN 61131-2 Equipment Class II devices.

ATTENTION	
	For DC powered units, use a Class 2/SELV (Safety Extra-Low Voltage), isolated and ungrounded power supply as input power to the terminals. This power source provides protection so that under nominal and single fault conditions, the voltage between conductors and between conductors and Functional Earth/Protective Earth does not exceed a safe value.

ATTENTION	
	Explosion Hazard - Do not connect or disconnect equipment while circuit is live unless area is known to be non-hazardous. Disconnect all power before installing or replacing components. Failure to disconnect power may result in electrical shock and/or damage to the terminal.

To connect DC power:

1. Secure the DC power wires to the terminal block screws.
2. Secure the Earth Ground wire to the appropriate terminal block screw.



3. Apply 24V dc power to the terminal.

Connecting AC Power

PanelView Plus 400/600 terminals ordered with an integrated AC power supply have the following electrical input rating.

Power Supply	Electrical Input Rating
AC	85...264V ac, 60 VA maximum

The input power, terminal block on the power supply is removable and supports the following wire sizes:

Wire Type	Wire Size	Terminal Block Screw Torque
Stranded or Solid	#18 to #12 AWG	.23 - .45 N•m (2 - 4 in-lbs)

ATTENTION



Explosion Hazard - Do not connect or disconnect equipment while circuit is live unless area is known to be non-hazardous.

Disconnect all power before installing or replacing components. Failure to disconnect power may result in electrical shock and/or damage to the terminal.

ATTENTION

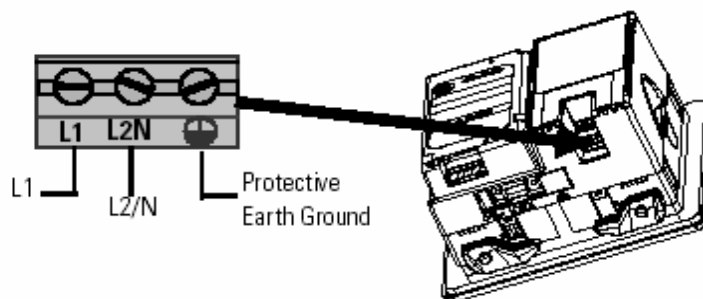


Improper wiring of power terminals may result in voltage at the communication connector shells. Refer to the following figure when wiring.

Do not apply power to the terminal until all wiring connections have been made. Failure to do so may result in electrical shock.

To connect AC power:

1. Secure the AC power wires to the terminal block screws.
2. Secure the Earth Ground wire to the appropriate terminal block screw.



3. Apply power to the terminal.

Specifications

Electrical	
DC Power	
Input Voltage DC	24V dc nominal (18...30V dc)
Power Consumption DC	25 Watts maximum (1.0 A @24V dc)
AC Power	
Input Voltage AC	85...264V ac, 47...63 Hz
Power Consumption AC	60 VA maximum
Display	
Display Type	
600 & 400 Monochrome Display	Monochrome Passive Matrix, Film Compensated Super-Twist Nematic (FSTN) LCD Technology
600 Color Display	Color Active Matrix, Thin Film Transistor (TFT) LCD Technology
Display Size, Diagonal	
400 Monochrome Display	95 mm (3.7 in)
600 Monochrome and Color Display	139 mm (5.5 in)
Display Area (W x H)	
400 Monochrome Display	78 x 59 mm (3.07 x 2.32 in)
600 Monochrome and Color Display	111 x 84 mm (4.37 x 3.30 in)
Display Resolution	
400 Monochrome Display	320 x 240
600 Monochrome and Color Display	320 x 240
Backlight	
400 Monochrome Display	LED
600 Monochrome and Color Display	CCFL 50,000 hours life, minimum
Touch Screen (600 only)	
Touch Screen	Analog resistive
Actuating Rating	1 million presses
Operating Force	10...110 g
Keypad	
Function Keys	8 or 10 function, numeric and navigation keys,
Actuation Rating	1 million presses
Operating Force	340 g

Environmental	
Operating Temperature	0...55 °C (32...131 °F)
Storage Temperature	-25...70 °C (-13...158 °F)
Heat Dissipation	80 BTU/h
Altitude Operating	2000 m (6561 ft)
Vibration	10...57 Hz, 0.012 pk-pk displacement 57...500 Hz 2.0 g pk acceleration
Shock Operating	15 g at 11 ms
Shock Non-Operating	30 g at 11 ms
Relative Humidity	5...95% without condensation
Enclosure Ratings	NEMA Type 12, 13, 4X (indoor use only), IP54, IP65

General	
Battery	5 years at 25 °C minimum
Clock	Battery-backed, +/- 2 minutes per month
LED Indicators	COMM (Green), Fault (Red)
Application Flash Memory	5 MB
External Compact Flash Storage	512 MB maximum

Mechanical	
Dimensions H x W x D	
400 Keypad	152 x 185 x 90 mm (6.0 x 7.28 x 3.54 in)
600 Keypad or Keypad & Touch	167 x 266 x 98 mm (6.58 x 10.47 x 3.86 in)
600 Touch	152 x 185 x 98 mm (6.0 x 7.28 x 3.86 in)
Weight	
400 Keypad ⁽¹⁾	562 g (1.24 lb)
600 Keypad or Keypad & Touch ⁽¹⁾	930 g (2.05 lb)
600 Touch ⁽¹⁾	789 g (1.74 lb)

⁽¹⁾ Add approximately 95 g (.21 lb) for communication module.

WILKERSON
OPERATIONS

4-2

**INSTALLATION AND
MAINTENANCE SHEET**
Filter Models F35, F36 and F37
with Variations and Accessories

WARNING

EXCEPT as otherwise specified by the manufacturer, this product is specifically designed for compressed air service, and use with any other fluid (liquid or gas) is a misapplication. For example, use with or injection of certain hazardous liquids or gases in the system (such as alcohol or liquid petroleum gas) could be harmful to the unit or result in a combustible condition or hazardous external leakage. Manufacturer's warranties are void in the event of misapplication, and manufacturer assumes no responsibility for any resulting loss. Before using with fluids other than compressed air, or for nonindustrial applications, or for life support systems consult manufacturer for written approval.

ATTENTION: Make sure bowl is fully inserted into body, and then fully turned to lock bowl in place before applying air pressure to unit. When bowl is properly installed, the alignment markings on the bowl/bowl guard assembly and the marks on the body will line up, indicating proper assembly. Failure to do so may cause air pressure to blow bowl off of unit, resulting in serious personal injury or death.

INSTALLATION

1. Purge downstream air line of oil.
2. Install the unit with the air flowing in the direction indicated by the arrow on the body and/or the DP2 Differential Pressure Indicator.
3. The drain line connection is dependent on the type of drain that is selected.
4. Maximum inlet pressure and operating temperature ratings are: units with DP2 150 psig (10.3 bar) 150°F (66°C); units without DP2: 300 psig (20 bar) 150°F (66°C).

NOTE: CONTAMINATES REMOVED FROM THE COMPRESSED AIR SYSTEM MUST BE DISPOSED OF IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL STANDARDS.

MAINTENANCE

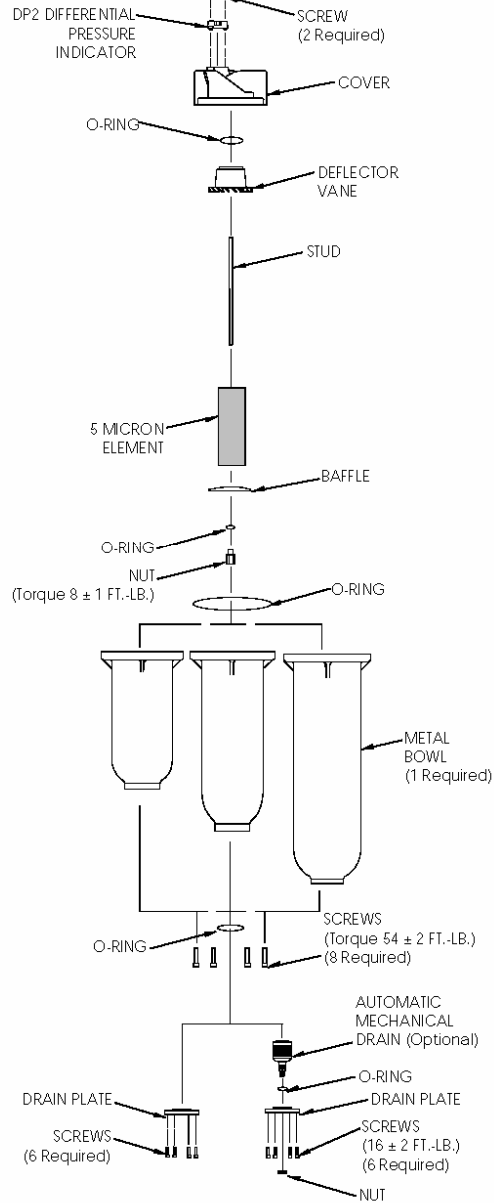
1. TO CLEAN OR REPLACE FILTER ELEMENT: Shut off air supply and reduce pressure in the unit to zero, remove the 8 screws from the filter housing, unscrew the filter support and remove filter element.
 - a. IF THE UNIT HAS A RIGID FILTER ELEMENT: remove and clean periodically by tapping on a hard surface, and blowing off with air gun. Torque element support to 8 ± 1 ft. lb. when replacing element. Element should be cleaned/replaced when the DP2 differential pressure indicator is completely red.
2. IF THE UNIT HAS A MANUAL DRAIN, DRAIN THE UNIT ONCE EVERY 8 HOURS MINIMUM. To do so, rotate the drain knob to the left one or two turns.* If the unit is equipped with an automatic drain, clean the screen around the drain. Clean screen by blowing off with air gun.
3. When the bowl becomes dirty, clean with a dry clean cloth.
4. Before placing the unit in service, make sure that the bowl is properly reinstalled, and securely bolted in place.

*NOTE: In the event the drain knob is over-rotated, it may become disengaged from the drain stem. In such a case, pull down on both the knob and the stem while rotating to the right to re-engage.

REPAIR KITS AND REPLACEMENT PARTS

Filter Element Kit (F35) (includes filter element and o-rings)	FRP-95-505
Filter Element Kit Type (F36) (includes filter element and o-rings)	FRP-95-506
Filter Element Kit Type (F37) (includes filter element, o-ring)	FRP-95-507
Drain Plate Kits	
Drain Plate (For use with internal Automatic Mechanical float drain No. GRP-95-981 or GRP-96-300)	GRP-95-391
Drain Plate (1/4 NPT)	GRP-95-392
Drain Plate Rc 1/4	GRP-95-394
Drain Plate (1/2 NPT)	GRP-95-393
Drain Plate Rc 1/2	GRP-95-395
Differential Pressure Indicator (Standard)	DP2-01-001
Differential Pressure Removal Cap Kit	GRP-95-022
Bowl O-ring Kit	GRP-95-291
Drains:	
Internal Drains:	
Automatic Mechanical Drain (Fluorocarbon seals w/1/4 NPT stem)	GRP-95-981
Automatic Mechanical Drain (Fluorocarbon seals w/R 1/4 stem)	GRP-96-300
Manual Override for Auto Drain (GRP-95-981 1/4 NPT)	GRP-96-000
Manual Override for Auto Drain (GRP-96-300 R 1/4)	GRP-96-100
External Drains:	
External Automatic Mechanical Drain	X01-04-000
External Automatic Mechanical Drain	X02-04-F00
External Automatic Mechanical Drain	X03-04-000

(See reverse side for Repair and Replacement Parts cont.)



83-719-000 REV B 11/96
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REPAIR KITS AND REPLACEMENT PARTS Cont.

Automatic Electric Drain Valve

MODEL NUMBER KIT	PORT SIZE	ORIFICE SIZE	ELECTRICAL	OPERATING PRESS	
				MIN.	MAX.
X20-02-ED00	1/4" NPT	1/16"	115 VAC/1Ph/50-60Hz	2 psig	300 psig
X20-02-EE00	1/4" NPT	1/16"	230 VAC/1PH/50-60Hz	2 psig	300 psig
X20-02-EC00	1/4" NPT	1/16"	24 VDC	5 psig	300 psig
X20-04-ED00	1/2" NPT	1/16"	115 VAC/1Ph/50-60Hz	2 psig	300 psig
X20-04-EE00	1/2" NPT	1/16"	230 VAC/1PH/50-60Hz	2 psig	300 psig
X20-04-EC00	1/2" NPT	1/16"	24 VDC	5 psig	300 psig

WILKERSON
OPERATIONS

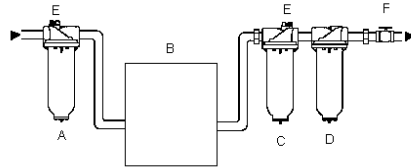
**INSTALLATION AND
MAINTENANCE SHEET**
Filter Models M35, M36 and M37
with Variations and Accessories

WARNING
EXCEPT as otherwise specified by manufacturer, this product is specifically designed for compressed air service only, and use with any other fluids (liquid or gas) is a misapplication. For example, use with or injection of certain hazardous liquids or gases in the system (such as alcohol or liquid petroleum gas) could be harmful to the unit or result in a combustible condition or hazardous external leakage. Manufacturer's warranties are void in the event of misapplication, and manufacturer assumes no responsibility for any resulting loss. Before using with fluids other than air, or for non-industrial applications, consult manufacturer for written approval.

INSTALLATION

1. Purge downstream air line of oil.
2. Install the unit with the air flowing in the direction indicated by the arrow on the body and/or the DP2 Differential Pressure Indicator.
3. The drain line connection is dependent on the type of drain that is selected.
4. Maximum inlet pressure and operating temperature ratings: units with DP2, 150 psig (10,3 bar) and 150°F (66°C); units without DP2: 300 psig (20,7 bar) 150°F (66°C).

TYPICAL INSTALLATION (not to scale)

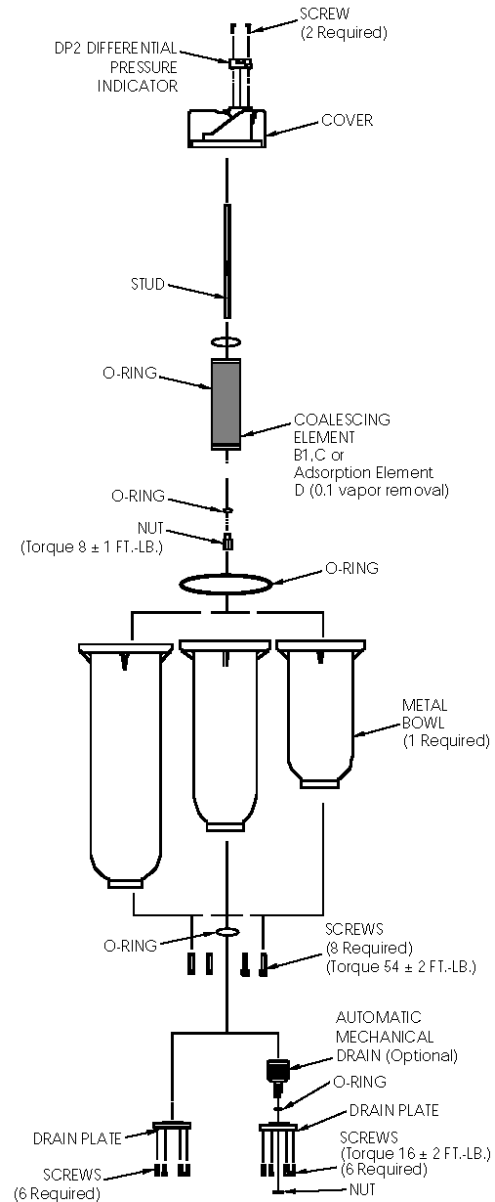


- A. PREFILTER** - It is recommended that a Wilkerson "B1" Element coalescing prefilter (particle removal down to 1.0 micron; maximum downstream remaining oil content is 0.5 ppm/wt) is installed to protect the dryer from contaminants and extend the element life in the high efficiency coalescing filter (filter "C").
- B. AIR DRYER** - (Refrigerated or Desiccant). An air dryer is recommended if water vapor condensation is a problem.
- C. HIGH EFFICIENCY COALESCER FILTER** - It is recommended that a Wilkerson "C" element coalescer (particle removal down to 0.01 micron; maximum downstream remaining oil content 0.01 ppm/wt) be installed to protect the compressed air system from oil and particulate contamination.
- D. OIL VAPOR FILTER** - The Type D element filter (maximum downstream remaining oil content 0.003 ppm/wt) is an adsorption type for removing oil vapors, oil-associated odors, whether petroleum base or synthetic base and nearly 100% of any remaining solid contaminants.
- E. DIFFERENTIAL PRESSURE INDICATOR/GAUGE** - Maximum recommended pressure drop across coalescer filters is 7 psi (0,5 bar). This can be monitored by installing a Wilkerson DP2 differential pressure indicator.
- F. VALVE** - Do not use a valve or shutoff device in conjunction with a coalescer filter that will allow a momentary or surge pressure drop greater than 50 psid (3,4 bar). To avoid high surges which can either ruin the element or momentarily allow downstream contamination, use a slow-opening type valve.

MAINTENANCE

1. The element operates effectively when it is saturated. The element's useful life will end only when the DP2 differential pressure indicator is completely red. The element cannot be cleaned or reused and must be replaced at the end of its useful life.
2. IF THE UNIT HAS A MANUAL DRAIN, DRAIN THE UNIT ONCE EVERY 8 HOURS MINIMUM. If the unit is equipped with an automatic drain clean the screen around the drain. Clean screen by blowing off with air gun.
3. When bowl becomes dirty, clean with a dry clean cloth.
4. Before placing the unit in service, make sure that the bowl is properly reinstalled, and securely bolted in place per noted torque specification.

(See reverse side for Repair and Replacement Kits)



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REPAIR KITS AND REPLACEMENT PARTS

Filter Element Kit (kit includes filter element, element o-ring and retainer o-ring)

Model	Element Types		
	Type B1 (1 micron)	Type C (0.01 micron)	Type D (oil vapor, adsorption)
M35	MSP-95-502	MTP-95-502	MPX-95-502
M36	MSP-95-503	MTP-95-503	MPX-95-503
M37	MSP-95-504	MTP-95-504	MPX-95-504

Drain Plate Kit

- Drain Plate (Use with internal automatic mechanical float drain no. GRP-95-981 or GRP-96-300).....**GRP-95-391**
- Drain Plate (1/4" NPT).....**GRP-95-392**
- Drain Plate (Rc 1/4").....**GRP-95-394**
- Drain Plate (1/2" NPT).....**GRP-95-393**
- Drain Plate (Rc 1/2").....**GRP-95-395**
- Bowl O-ring Kit.....**GRP-95-291**
- Differential Pressure Indicator (Standard).....**DP2-01-001**
- DP2 Removal Cap Kit (for 300 psig appl.).....**GRP-95-022**
- Internal Drains:**
 - Automatic Mechanical Drain (Fluorocarbon seals w/1/8" NPT stem).....**GRP-95-981**
 - Automatic Mechanical Drain (Fluorocarbon seals w/R 1/8" stem).....**GRP-96-300**
 - Manual Override for Auto Drain (GRP-95-981 1/8" NPT).....**GRP-96-000**
 - (GRP-96-300 R 1/8").....**GRP-96-100**
- External Drains**
 - External Automatic Mechanical Drain.....**X01-04-000**
 - External Automatic Mechanical Drain.....**X02-04-F00**
 - External Automatic Mechanical Drain.....**XB3-04-000**

Automatic Electric Drain Valve

MODEL NUMBER KIT	PORT SIZE	ORIFICE SIZE	ELECTRICAL	OPERATING PRESS	
				MIN.	MAX.
X20-02-EE00	1/2" NPT	1/16"	115 VAC/1Ph/50-60Hz	2 psig	300 psig
X20-02-ED00	1/2" NPT	1/16"	230 VAC/1Ph/50-60Hz	2 psig	300 psig
X20-02-EC00	1/2" NPT	1/16"	24 VDC	5 psig	300 psig
X20-04-EE00	1/2" NPT	1/16"	115 VAC/1Ph/50-60Hz	2 psig	300 psig
X20-04-ED00	1/2" NPT	1/16"	230 VAC/1Ph/50-60Hz	2 psig	300 psig
X20-04-EC00	1/2" NPT	1/16"	24 VDC	5 psig	300 psig

WILKERSON
OPERATIONS

WARNING
EXCEPT as otherwise specified by manufacturer, this product is specifically designed for compressed air service only, and use with any other fluids (liquid or gas) is a misapplication. For example, use with or injection of certain hazardous liquids or gases in the system (such as alcohol or liquid petroleum gas) could be harmful to the unit or result in a combustible condition or hazardous external leakage. Manufacturer's warranties are void in the event of misapplication, and manufacturer assumes no responsibility for any resulting loss. Before using with fluids other than air, or for non-industrial applications, consult manufacturer for written approval.

INSTALLATION

1. Purge downstream air line of oil.
2. Install the unit with the air flowing in the direction indicated by the arrow on the body and/or the DP2 indicator.
3. The drain line connection is dependent on the type of drain that is selected. The internal auto float drain has a 1/8" NPT or (BSP) male connection. The external drains require the 1/2" NPT or (BSP) drain plate and a 1/2" NPT or (BSP) pipe nipple to connect the drain to the filter. The X01, X02 and XB3 series of drains have a 1/8" NPT (BSP) female port to connect a drain line to pipe away contaminants.
4. Maximum inlet pressure and operating temperature ratings are: units with DP2 150 psig (10,3 bar) 150°F (66°C); units without DP2: 300 psig (20 bar) 150°F (66°C).

MAINTENANCE

1. TO CLEAN OR REPLACE FILTER ELEMENT: Shut off air supply and reduce pressure in the unit to zero, remove the 8 screws from the filter housing, unscrew the filter support and remove filter element.
 - a. IF THE UNIT HAS A RIGID FILTER ELEMENT: remove and clean periodically by tapping on a hard surface, and blowing off with air blow gun. Torque element support to 8 ± 1 FT.-LB. when replacing element. Element should be cleaned/replaced when the DP2 pressure indicator is completely red or when the DP3 reads 7 psi (0,5 bar).
2. IF THE UNIT HAS A MANUAL DRAIN, DRAIN THE UNIT ONCE EVERY 8 HOURS MINIMUM. If the unit is equipped with an external automatic drain clean the screen on top of the drain. Clean screen by blowing it off with an air blow gun.
3. When the bowl becomes dirty, clean by wiping with dry, clean cloth.
4. Before placing the unit in service, make sure that the bowl is properly reinstalled, and securely bolted in place using the noted torque specifications.

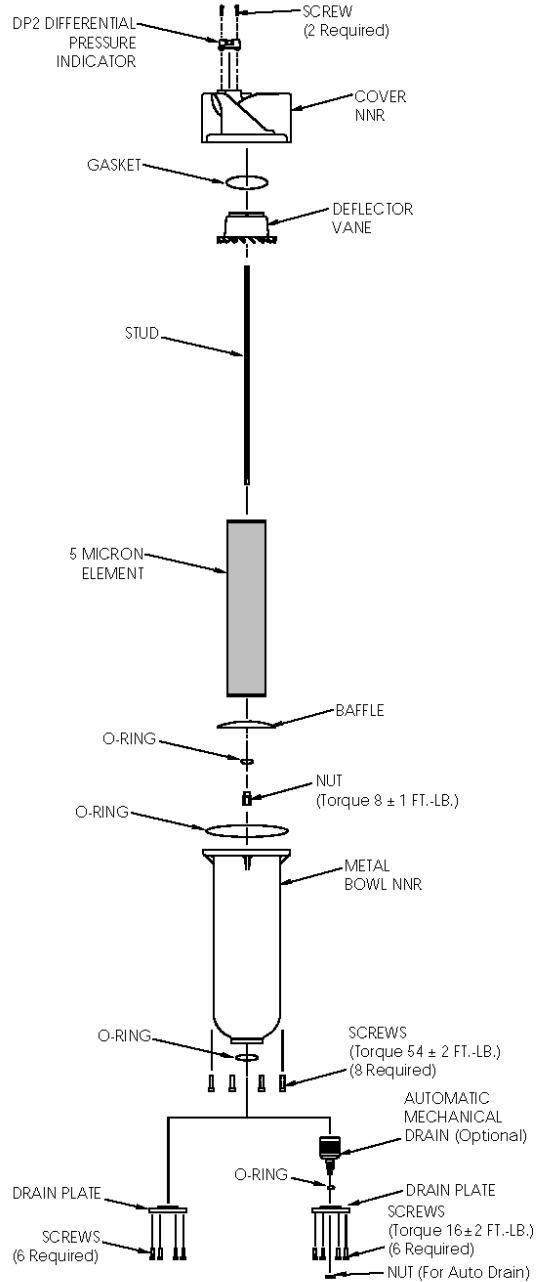
REPAIR KITS AND REPLACEMENT PARTS

Filter Element Kit (F43) (includes filter element, o-ring/gasket).....	FRP-95-508
Drain Plate Kits	
Drain Plate 1/8" diameter (use with internal automatic (mechanical float drain no. GRP-95-981 or GRP-96-300) ...	GRP-95-391
Drain Plate (1/8" NPT)	GRP-95-392
Drain Plate (1/8" BSP)	GRP-95-394
Drain Plate (1/8" NPT)	GRP-95-393
Drain Plate (1/8" BSP)	GRP-95-395
Bowl O-ring Kit	GRP-95-290
Differential Pressure Indicator (Standard)	DP2-01-001
Differential Pressure Removal Cap Kit	GRP-95-022
Internal Drains:	
Automatic Mechanical Drain (Fluorocarbon seals w/NPT stem)	GRP-95-981
Automatic Mechanical Drain (Fluorocarbon seals w/BSP stem)	GRP-96-300
Manual Override for Auto Drain (GRP-95-981)	GRP-96-000
Manual Override for Auto Drain (GRP-96-300)	GRP-96-100
External Drain	
External Automatic Mechanical Drain	X01-04-000
External Automatic Mechanical Drain	X02-04-F00
External Automatic Mechanical Drain	XB3-04-000

(See reverse side for Repair and Replacement cont.)

83-716-000
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**INSTALLATION AND
MAINTENANCE SHEET**
Filter Models F43
with Variations and Accessories



NNR=NOT NORMALLY REPLACED

REPAIR KITS AND REPLACEMENT PARTS Cont.

Automatic Electric Drain Valve

MODEL NUMBER KIT	PORT SIZE	ORIFICE SIZE	ELECTRICAL	OPERATING PRESS	
				MIN.	MAX.
X20-02-EE00	1/4" NPT	7/16"	115 VAC/1PH/50-60Hz	2 psig	300 psig
X20-02-ED00	1/4" NPT	7/16"	230 VAC/1PH/50-60Hz	2 psig	300 psig
X20-02-EC00	1/4" NPT	7/16"	24 VDC	5 psig	300 psig
X20-04-EE00	1/2" NPT	7/16"	115 VAC/1PH/50-60Hz	2 psig	300 psig
X20-04-ED00	1/2" NPT	7/16"	230 VAC/1PH/50-60Hz	2 psig	300 psig
X20-04-EC00	1/2" NPT	7/16"	24 VDC	5 psig	300 psig

WILKERSON.

INSTALLATION AND MAINTENANCE SHEET Filter Models M43 and M45 with Variations and Accessories

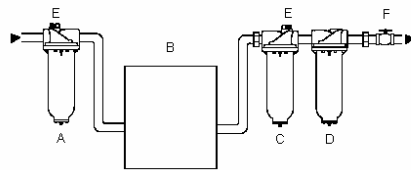
WARNING

EXCEPT as otherwise specified by manufacturer, this product is specifically designed for compressed air service only, and use with any other fluids (liquid or gas) is a misapplication. For example, use with or injection of certain hazardous liquids or gases in the system (such as alcohol or liquid petroleum gas) could be harmful to the unit or result in a combustible condition or hazardous external leakage. Manufacturer's warranties are void in the event of misapplication, and manufacturer assumes no responsibility for any resulting loss. Before using with fluids other than air, or for non-industrial applications, consult manufacturer for written approval.

INSTALLATION

1. Purge downstream air line of oil.
2. Install the unit with the air flowing in the direction indicated by the arrow on the body and/or the Differential Pressure Indicator.
3. The drain line connection is dependent on the type of drain that is selected.
4. Maximum inlet pressure and operating temperature ratings are: units with Differential Pressure Indicator, 150 psig (10.3 bar) and 150°F (66°C); units without DP2 Differential Pressure Indicator: 300 psig (20.7 bar) 150°F (66°C).

TYPICAL INSTALLATION (not to scale)

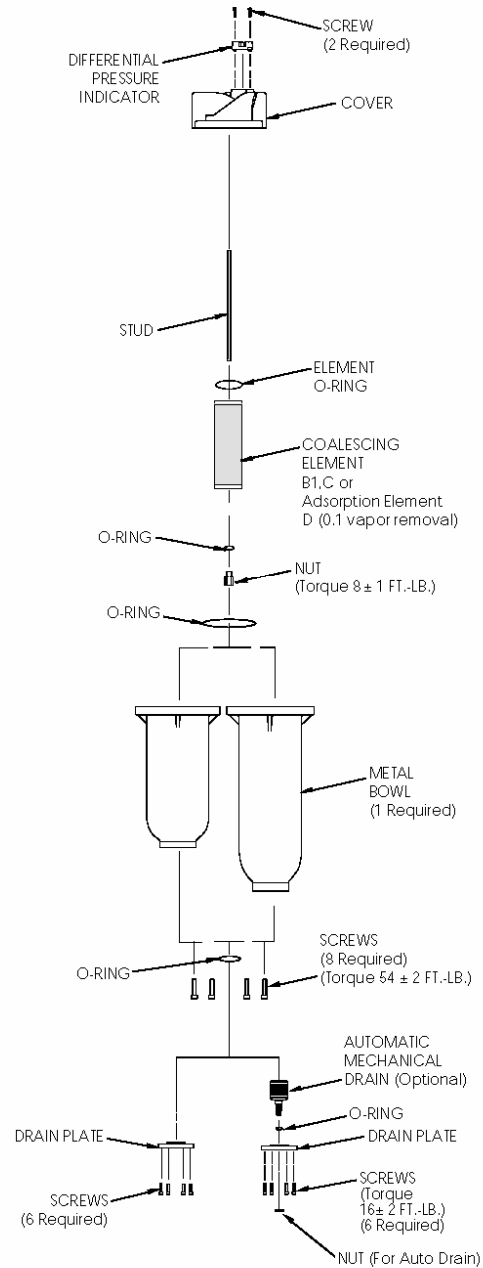


- A. PREFILTER** - It is recommended that a "B1" Element coalescing prefilter (particle removal down to 1.0 micron; maximum downstream remaining oil content is 0.5 ppm/wt.) is installed to protect the dryer from contaminants and extend the element life in the high efficiency coalescing filter (filter "C").
- B. AIR DRYER** - (Refrigerated or Desiccant). An air dryer is recommended if water vapor condensation is a problem.
- C. HIGH EFFICIENCY COALESCER FILTER** - It is recommended that a Wilkerson "C" element coalescer (particle removal down to 0.01 micron; maximum downstream remaining oil content 0.01 ppm/wt) be installed to protect the compressed air system from oil and particulate contamination.
- D. OIL VAPOR FILTER** - The Type D element filter (maximum downstream remaining oil content 0.003 ppm/wt) is an adsorption type for removing oil vapors, oil-associated odors, whether petroleum base or synthetic base and nearly 100% of any remaining solid contaminants.
- E. DIFFERENTIAL PRESSURE INDICATOR/GAUGE** - Maximum recommended pressure drop across coalescer filters is 7 psi (0.5 bar). This can be monitored by installing a Wilkerson DP2 differential pressure indicator.
- F. VALVE** - Do not use a valve or shutoff device in conjunction with a coalescer filter that will allow a momentary or surge pressure drop greater than 50 psid (3,4 bar). To avoid high surges which can either ruin the element or momentarily allow downstream contamination, use a slow-opening type valve.

MAINTENANCE

1. The element operates effectively when it is saturated. The element's useful life will end only when the Differential Pressure Indicator is completely red. The element cannot be cleaned or reused and must be replaced at the end of its useful life.
2. IF THE UNIT HAS A MANUAL DRAIN, DRAIN THE UNIT ONCE EVERY 8 HOURS MINIMUM. If the unit is equipped with an automatic drain clean the screen around the drain. Clean screen by blowing off with air gun.
3. When bowl becomes dirty, replace the bowl or clean by wiping with a clean, dry cloth.
4. Before placing the unit in service, make sure that the bowl is securely bolted in place per noted torque specification.

(See reverse side for Repair and Replacement Kits)



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REPAIR KITS AND REPLACEMENT PARTS

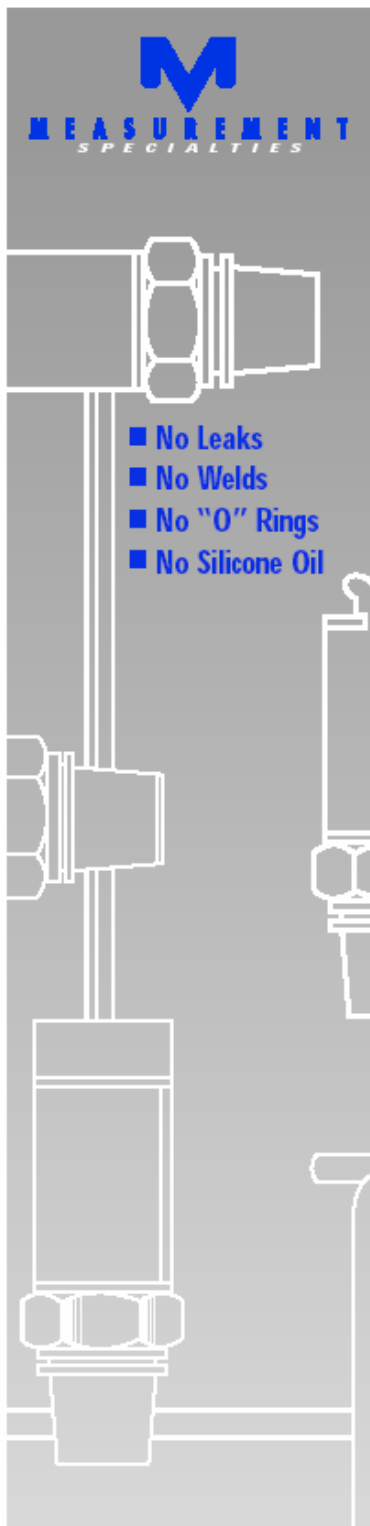
Filter Element Kit (kit includes filter element, element o-ring, and retainer o-ring)

	Element Types		
	Type B1 (1 micron)	Type C (0.01 micron)	Type D (oil vapor, adsorption)
M43	MSP-95-876	MTP-95-562	MXP-95-565
M45	MSP-95-500	MTP-95-500	MXP-95-500

Drain Plate Kit

- Drain Plate 3/16" diameter (Use with internal automatic mechanical float drain no. GRP-95-981 or GRP-96-300)..... **GRP-95-391**
- Drain Plate (1/4" NPT)..... **GRP-95-392**
- Drain Plate (R₁/4")..... **GRP-95-394**
- Drain Plate (1/2" NPT)..... **GRP-95-393**
- Drain Plate (R₁/2")..... **GRP-95-395**
- Bowl O-ring Kit..... **GRP-95-290**
- Differential Pressure Indicator (Standard)..... **DP2-01-001**
- Differential Pressure Indicator Removal Cap Kit (for 300 psig appl.)..... **GRP-95-022**
- Internal Drains:**
 - Automatic Mechanical Drain (Fluorocarbon 1/2" NPT seals w/ stem)..... **GRP-95-981**
 - Automatic Mechanical Drain (Fluorocarbon R₁/2" seals w/ stem)..... **GRP-96-300**
 - Manual Override for Auto Drain (GRP-95-981)..... **GRP-96-000**
 - (GRP-96-300)..... **GRP-96-100**
- External Drains**
 - External Automatic Mechanical Drain..... **X01-04-000**
 - External Automatic Mechanical Drain..... **X02-04-F00**
 - External Automatic Mechanical Drain..... **XB3-04-000**

MODEL NUMBER KIT	PORT SIZE	ORIFICE SIZE	ELECTRICAL	OPERATING PRESS	
				MIN.	MAX.
X20-02-EE00	1/2" NPT	1/16"	115 VAC/1Ph/50-60Hz	2 psig	300 psig
X20-02-ED00	1/2" NPT	1/16"	230 VAC/1PH/50-60Hz	2 psig	300 psig
X20-02-EC00	1/2" NPT	1/16"	24 VDC	5 psig	300 psig
X20-04-EE00	1/2" NPT	1/16"	115 VAC/1Ph/50-60Hz	2 psig	300 psig
X20-04-ED00	1/2" NPT	1/16"	230 VAC/1PH/50-60Hz	2 psig	300 psig
X20-04-EC00	1/2" NPT	1/16"	24 VDC	5 psig	300 psig



Microfused Technology

MSP-300 Stainless Steel Isolated Pressure Transducer



- Low Cost OEM
- 100% Leak Proof
No "O" Rings, No Silicone Oil, No Welds

Features

- One-piece Stainless Steel Construction
- Ranges up to 10,000 PSI or 700 BAR
- Millivolt or Amplified Outputs
- Excellent Accuracy
- Wide Operating Temperature Range

Applications

- Pumps and Compressors
- Hydraulic/Pneumatic Systems
- Automotive Test Systems
- Energy and Water Management
- Pressure Instrumentation
- Refrigeration — Freon and Ammonia Based
- Agriculture — Sprayers and Dusters



Description

The MSP series pressure transducers set a new price-performance standard for low cost, high volume, commercial and industrial applications. This series is suitable for measurement of liquid or gas pressure, even for difficult media such as contaminated water, steam, and mildly corrosive fluids or gases.

The transducer pressure cavity is machined from a solid piece of 17-4 PH stainless steel. The standard version includes a 1/4 NPT pipe thread allowing a leak-proof, all metal sealed system. There are no o-rings, welds or organics exposed to the pressure media. The durability is excellent.

Measurement Specialties proprietary Microfused technology, derived from demanding aerospace applications, employs micromachined silicon piezoresistive strain gages, fused with high temperature glass to a stainless steel diaphragm. This approach achieves media compatibility simply and elegantly providing an exceptionally stable sensor without the p-n junctions of conventional micromachined sensors.

This product is geared to the OEM customer using medium to high volumes. The standard version is suitable for many applications, but the dedicated design team at our Transducer Engineering Center stands ready to provide a semi-custom design where the volume and application warrants.

SPECIFICATIONS

Performance at 77°F (25°C):

Pressure range	0 to 100, 250, 500, 1000, 2500, 5000, 10000 PSI (0 to 7, 17, 35, 70, 175, 350, 700 BAR)
Accuracy (combined linearity, hysteresis and repeatability)	< 1% of FS (for higher accuracy consult factory)
Media compatibility	17-4 PH stainless steel (for other material consult factory)
Pressure ports	1/4" NPT (for other ports consult factory)
Pressure cycles	>10 ⁶ full pressure cycles
Pressure overload	2X rated pressure
Burst pressure	5X or 20000 PSI whichever is less
Long term stability (1 year)	± 0.25% FS (Typical)

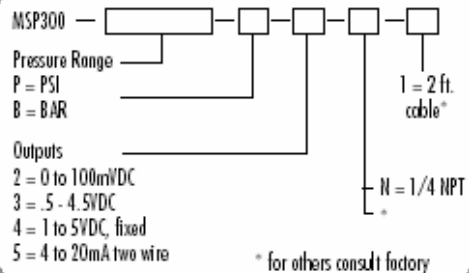
Electrical:

Supply voltage	5VDC	10-30VDC
Supply current	<10mA	<15mA
Outputs	0-100mVDC, ratiometric to supply (2) 0.5-4.5VDC, ratiometric to supply (3)	1-5VDC, fixed (4) 4-20mA, two wire (5)
Interface	2 ft. PVC jacketed cable (for other options consult factory)	
Zero offset	± 3% of FS for 0-100mV/ ±2% for amplified (for tighter tolerances consult factory)	
Span tolerance	± 2% of FS (for tighter tolerances consult factory)	
Output load	1M Ohm for millivolt output / 5K Ohm min for high level voltage 0 Ohms @ 10V (1100 Ohms @ 30V) for 4-20mA	
Noise	< 2mVRMS - for amplified	
Bandwidth (-3dB)	DC to 1KHz - for amplified	

ENVIRONMENTAL

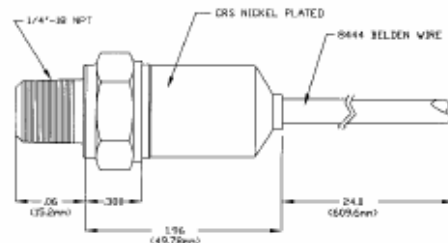
Operating temperature range	-4 to 185°F (-20 to 85°C), (For other temperature ranges consult factory)
Compensated temperature range	30 to 130°F (0 to 55°C)
Zero thermal error	< ± 2% of FS
Span thermal error	< ± 2% of FS
Storage temperature range	-40 to 185°F (-40 to 85°C)
Shock	50g, 11msec half sine shock per MIL standard 202F, method 213B, condition A
Vibration	±20g MIL-STD-810C, Procedure 514.2, Figure 514.2-2, curve L

ORDERING



Electrical Connections:

Outputs:	2	3/4	5
Red	+Supply	Red +Supply	Red +Supply
Black	-Supply	Black Ground	Black Output
White	-Output	White Output	
Green	+Output		



UNITED STATES
Measurement Specialties, Inc.
PO Box 799
Valley Forge, PA 19482
Tel: (610) 650-1500 Fax: (610) 650-1509
Email: sensors@mstusa.com
Web site: www.mstusa.com
P/N: 2001312 10/00



REVISED		DATE	DRAWN BY	CHECKED BY
EDN	REV	DESCRIPTION	DATE	12/16/04
	01	PER EWR 1178	SYA	SAH

PROVISIONAL

Industrial DIN Connector
Hirschmann Type GSSR 300
P/N: 933-114-100
DIN 43650-C

Vent hole

Pin 1: +Excitation
Pin 2: +Output
Pin 3: Power & Signal Common
Pin 4: Chassis

MSP 300 Label

1/4" NPT Pressure port

MATING CONNECTOR
P/N: 933 024-100
Gasket P/N: 730 185-002

TRANSDUCE SPECIFICATIONS:

1. Pressure range: 0-150 psi
2. Minimum resistance between transducer body & any wire - 50M Ohms @ 250 Vdc
3. Accuracy (combined linearity, hysteresis, & repeatability) <1% of FS BSFL.
4. Pressure cycles: 10⁶ minimum full pressure cycles.
5. Pressure overload: 2x rated pressure.
6. Burst pressure: 5x rated pressure or 20,000 psig.
7. Long term stability (1 year): ±0.25% of FS, typical.
8. Supply Voltage: 10-30 Vdc
9. Supply Current: <10ma
10. Output: 1 to 5V
11. Zero offset: ±2% of FS.
12. Span tolerance: ±2% of FS.
13. Operating temperature range: -20° to 85°C.
14. Compensation temperature range: 0° to 55°C.
15. Zero thermal error: <±2% of FS.
16. Span thermal error: <±2% of FS.
17. Load impedance greater than 5K Ohms for quoted performance.
18. Pressure port material: 17-4 PH
19. Sensor type: gauge pressure

REFERENCE COPY
DO NOT USE FOR MANUFACTURE

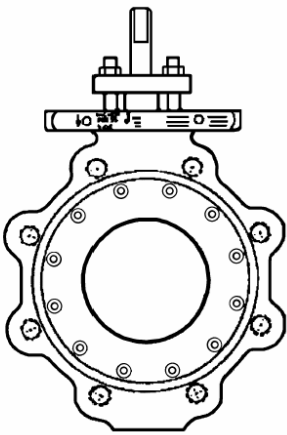
CUSTOMER APPROVAL: _____
DATE: _____

msisensors 1000 LUCAS WAY HANFORD, VIRGINIA 23066 TITLE: OUTLINE DRAWING MSP-300-150-P-4-N-X-XXXX	
DRAWN BY: SYA DATE: 12/13/04	SIZE: A DWG. NO.: PROTO-2431TC117B DATE: 12/15/04 SCALE: X SHEET: 1 OF 1

OTHER RANGE UNLESS OTHERWISE SPECIFIED:
 1. TYPICAL
 2. MAXIMUM
 3. MINIMUM
 4. RANGE
 5. PLACE DECIMAL
 ANGLES: ±1/2°

THE USE OF THIS DRAWING AND/OR DISCLOSURE OF ITS CONTENT IN WHOLE OR IN PART AND/OR ITS REPRODUCTION WITHOUT THE EXPRESS WRITTEN PERMISSION OF MEASUREMENT SPECIALTIES, INC. IS STRICTLY PROHIBITED.





IMO - 308 Issue Date: 12/02

INSTALLATION, MAINTENANCE, AND
OPERATING INSTRUCTIONS

MODEL C
WAFER-SPHERE®

Read entire instructions carefully before installation or servicing

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1 GENERAL

This instruction manual contains important information regarding the installation, maintenance, and operation of Jamesbury Model C *Wafer-Sphere*. Please read the instructions carefully and save them for future reference.

The Jamesbury *Wafer-Sphere* Valve is a high performance butterfly valve design. Maximum shutoff pressure rating depends on the materials chosen.

1.1 WARNING

SAFETY FIRST! FOR YOUR SAFETY, ASK THE FOLLOWING QUESTIONS BEFORE REMOVING THE VALVE FROM THE LINE, AND BEFORE ANY DISASSEMBLY:

1. WHAT'S IN THE LINE?

BE SURE YOU KNOW WHAT FLUID IS IN THE LINE. IF THERE IS ANY DOUBT, DOUBLE-CHECK WITH THE PROPER SUPERVISOR.

2. ARE YOU PROTECTED?

WEAR ANY PROTECTIVE CLOTHING AND EQUIPMENT NORMALLY REQUIRED TO AVOID INJURY FROM THE PARTICULAR FLUID IN THE LINE.

3. IS THE LINE DEPRESSURIZED?

DEPRESSURIZE THE LINE AND DRAIN THE SYSTEM FLUID. THE *WAFER-SPHERE* BUTTERFLY'S OFFSET SHAFT CREATES GREATER DISC AREA ON ONE SIDE OF THE SHAFT. THIS MEANS THAT A *WAFER-SPHERE* VALVE TENDS TO OPEN WHEN PRESSURIZED ON THE INSERT SIDE WITHOUT A HANDLE OR AN ACTUATOR ON THE VALVE.

4. IS THE VALVE CLOSED?

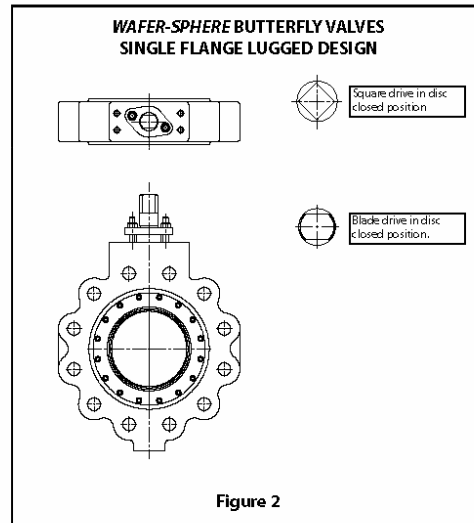
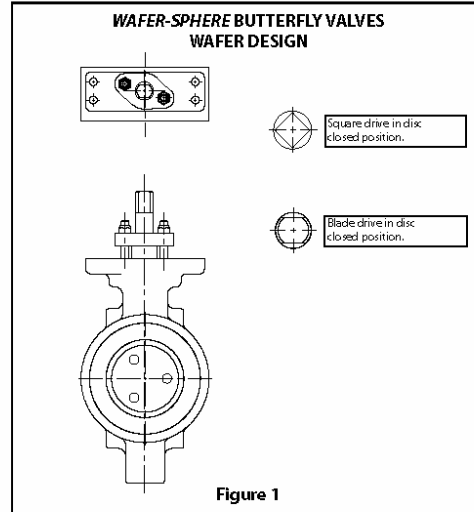
BEFORE YOU INSTALL A *WAFER-SPHERE* VALVE IN, OR REMOVE IT FROM THE LINE, FULLY CLOSE THE VALVE. THE *WAFER-SPHERE* BUTTERFLY VALVE MUST BE REMOVED FROM THE LINE IN THE CLOSED POSITION. THIS WILL PREVENT MECHANICAL DAMAGE TO THE DISC SEALING EDGE, THE BLADE DRIVE FLATS OR LINE ON TOP OF THE SHAFT WILL INDICATE THE POSITION OF THE DISC. (SEE FIGURES 1 AND 2)

1.2 Description

Refer to the tag attached to each valve for this rating. Do not use a valve at service conditions that exceed the rating on the name plate.

Offset Shaft Design

One of the design features of the *Wafer-Sphere* valve that is responsible for its superior performance is the valve's offset shaft design. The shaft is offset in two planes: (1) away from the valve disc centerline and (2) behind the disc sealing plane (See Figure 3). Offset shaft design makes the rotating disc "cam" back and away from the seat, completely eliminating the usual wear points at the top and bottom of the seat. Because the disc rotates off the seat in an eccentric arc, it operates in one quadrant only (See Figure 3).



Positive Stop Feature

To prevent seat damage from over-travel of the disc beyond the closed position (usually during field mounting of a handle or actuator), a "positive stop" feature has been designed into the *Wafer-Sphere* butterfly valve. The "positive stop" feature also makes it possible to adjust the actuator travel stops in-line. The location of this feature is shown in (Figure 3).

Actuation

High line pressure may create high enough forces to pull a manual handle out of an operator's hand. With Types 815W, 815L, 830W, and 830L valves, either a manual gear

operator, a pneumatic or an electric actuator should be used in place of a detent handle on 2-1/2," 3" and 4" (DN 65, 80 and 100) valves when differential pressure exceeds 300 psi (20.7 bar), on 5", 6" and 8" (DN 125, 150 and 200) valves when differential pressure exceeds 150 psi (10.35 bar), and on 10" and 12" (DN 250 and 300) valves when differential pressure exceeds 50 psi (3.45 bar).

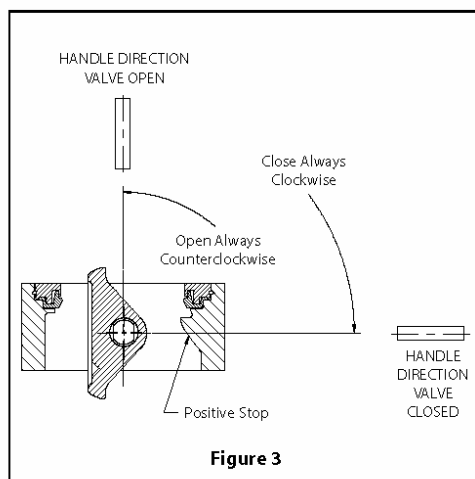
Wafer Body Design

Some wafer designs (See Figure 1) contain flange bolt holes or slots in the body to hold the valve and assist with correct alignment during installation in the line. The centering holes or slots in wafer bodies alone are not suitable, or intended for containing line pressure, and are only for use in conjunction with a fully bolted pipeline flange.

2 INSTALLATION

For lowest torque, *Wafer-sphere* butterfly valves should be installed with the body insert toward the higher pressure, (shaft downstream).

1. Read the **WARNING** Section on Page 2 carefully.
2. **IMPORTANT:** Only operating handle stops or actuator stop set screws must be used to stop the disc in position. DO NOT use the "positive stop" by itself to limit travel.
3. Visually check the position of the disc when the valve is in the closed position and the insert is fully compressed. The disc should be parallel to the flanges within 1/32" (.79 mm).
4. Before installing a closed valve in the pipeline, be sure that the handle or actuator is attached so that a counter-clockwise rotation, viewed from above, opens the valve (See Figure 3). Fully dose the valve again before installing it in the pipeline.



5. **THE PIPELINE:** The *Wafer-sphere* butterfly valve must be centered between flanges to avoid disc-pipe contact which could damage the disc and shaft. Any flange or pipeline welding should be done prior to installation of the valves. If this is impossible, protective covering or shields must be placed in the pipeline between the valve and the area being welded prior to welding. Not only must the valve be protected against weld slag, but also against any excessive heat, which could cause seat damage. It is essential that all weld slag, rods, debris, tools, etc., be removed from the pipeline before valves are installed or cycled.
6. Secure the valve between flanges. Compress the flange gasket **EVENLY** by tightening the fasteners in an alternating sequence.

IMPORTANT: The valve should be tightened between flanges using appropriate gaskets and fasteners for the service, in compliance with applicable piping codes and standards. Recommended fastener lengths are listed in Bulletin T104-1.

7. If there is seepage past the shaft seal upon installation, the valve may have been subject to wide temperature variations in shipment. Leak tight performance will be restored by a simple packing adjustment described in the **MAINTENANCE** Section.

TABLE 1		
Insert Screw Torque Table (lb - ft Unless Otherwise Specified)		
Screw Size	Torque Carbon Steel FT·LBS (N·m)	Torque Stainless Steel FT·LBS (N·m)
#10	50 (IN-LBS (6)	23 (IN-LBS (3)
1/4"	14 (19)	6 (8)
5/16"	30 (41)	11 (15)
3/8"	50 (68)	20 (27)
7/16"	80 (109)	30 (41)
1/2"	120 (163)	40 (55)

TABLE 2	
Cover Plate Screw Torque Table	
Screw size	Torque - FT·LBS (N·m)
3/8"	35 (48)
1/2"	80 (109)
9/16"	110 (149)
5/8"	180 (244)
3/4"	270 (366)

3 MAINTENANCE

3.1 General

Routine maintenance consists of periodically tightening down the compression plate to compensate for shaft seal wear. The compression plate, however, should not be tightened down too tight, since this will shorten the life of the seals. More extensive maintenance such as seat, seal and bearing replacement is described below.

3.2 Valve Removal

1. Read the **WARNING** Section on Page 2 carefully.
2. Valve must be fully closed before removing it from the pipeline.
3. **CAUTION:** Valves equipped with spring-to-open (air-to-close) actuators must be disconnected from the actuators and then closed. Valves must be closed while removing them from the pipeline.

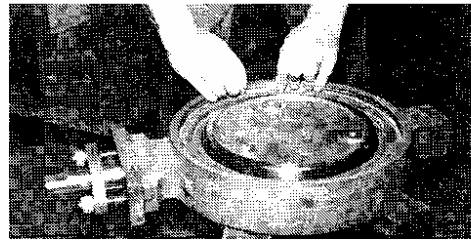
3.3 Seat Replacement Standard Valves

Numbers in () refer to items shown in (Figure 5).

1. After removing the valve from the line, place it on a bench. Take care not to damage the sealing edge of the valve disc.
2. Insert Styles:
 - A. Bolted Insert:**
Remove the insert screws (21) and the insert (2). If the insert does not lift out easily, tap it out from the shaft side using a wooden or plastic rod and a hammer. Do not strike the valve directly with a hammer.
 - B. Snap-In Insert (See Figure 4):**
Using a wooden or plastic rod and hammer, drive the insert out of the body from the shaft side. The rod should be placed on either side of the positive stop in the body. Do not strike the valve directly with a hammer. (**NOTE:** Removal of the insert often results in damage to the seat being replaced.)
3. Remove the seat (5) and discard it.
4. Remove the body seal (40) when applicable, (2-1/2", 3" and 4" [DN 65, 80 and 100] Series 815L and 830L valves).
5. Clean the valve, and deburr the insert.
6. Carefully clean and polish the disc sealing surface. It should be free of all grooves and scratches.



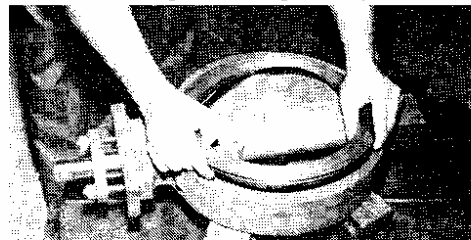
Removing Insert



Placing Spring Into Groove



Tapping End Of Spring Into Body

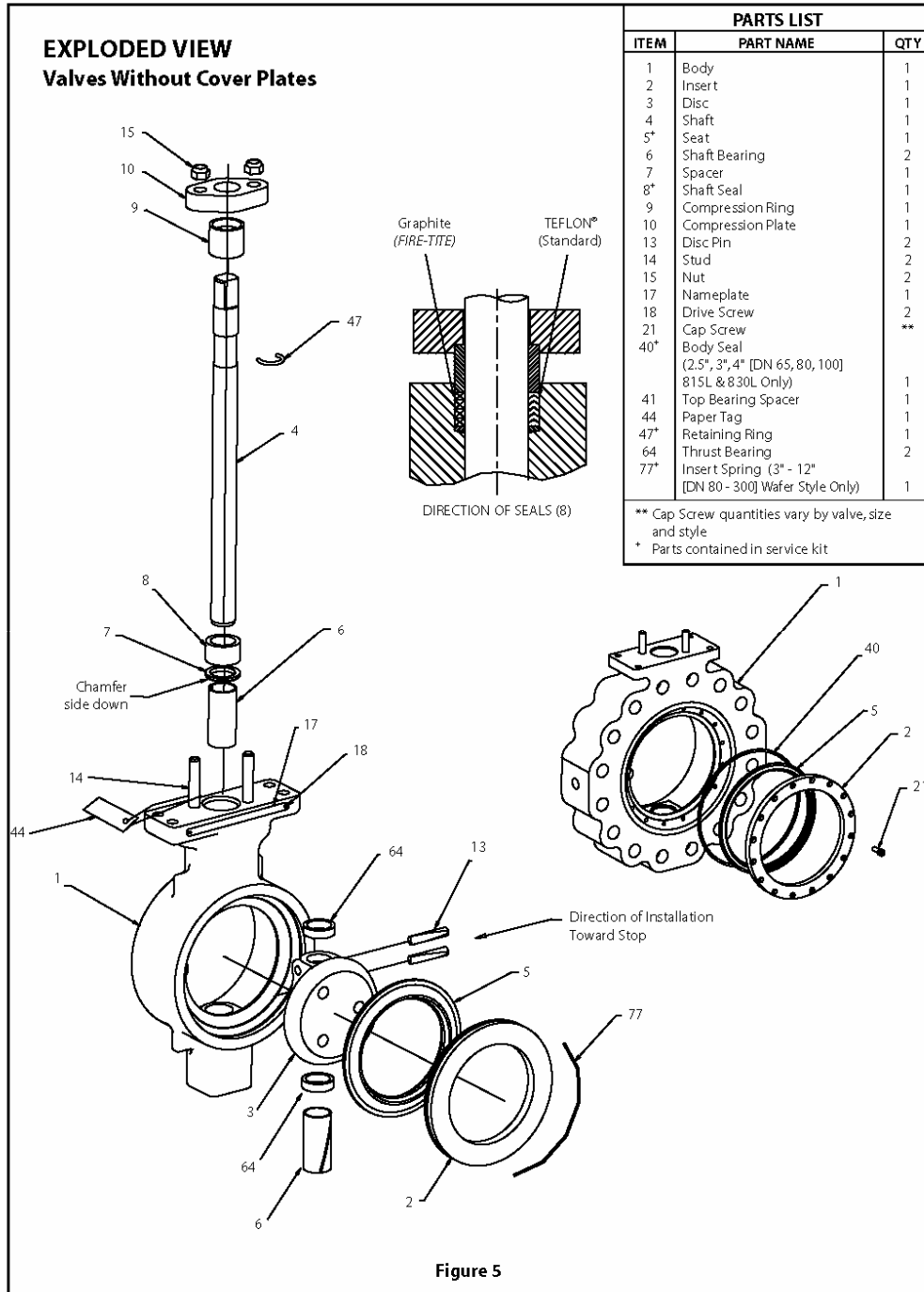


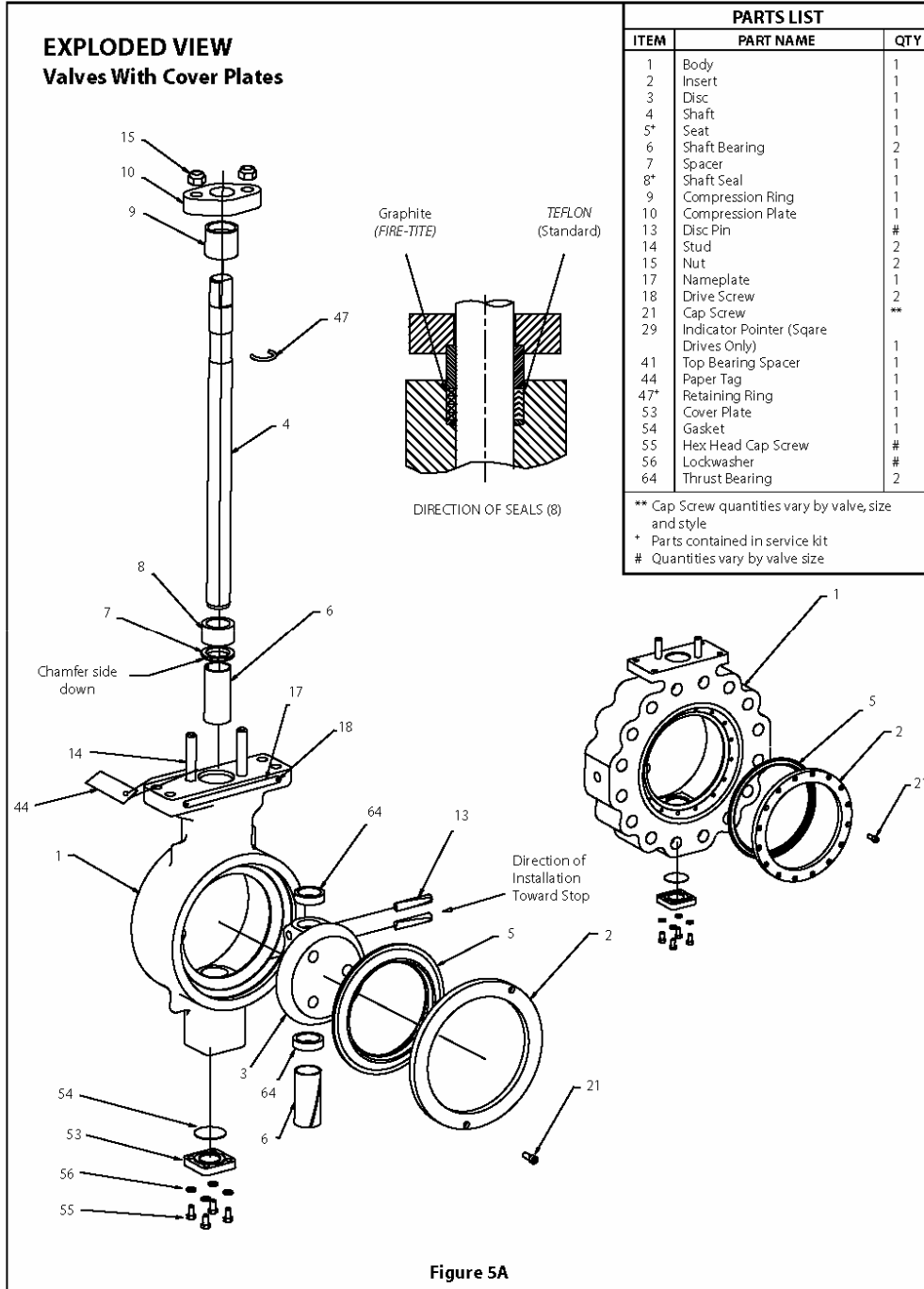
Installing Seat And Insert Assembly Into Body.
Angled As To Engage Insert Spring



Tapping Insert Assembly Into Body

Figure 4





7. If the disc is slightly damaged, it may be possible to smooth the sealing surface with crocus cloth, a fine stone, or the equivalent. If deep scratches are present, replace disc or return the valve to the factory for service.
8. Place the new body seal (40) into the groove in the body (when applicable).
9. Install the seat (5) into the insert (2).
10. Insert Styles:

A. Bolted Insert:

With the valve in the closed position, replace the insert and seat together, using the insert screws. Tighten the screws uniformly. Torque values are given in (Table 1). Open the valve and retorquing the insert screws per (Table 1). Take care not to damage the sealing edge of the disc. Close the valve.

B. Snap-In Insert:

Place the insert spring (77) into the groove in the body, opposite the positive stop (See Figure 5). Lightly tap one end of the spring into the body groove. Be sure the spring is positioned snugly into the groove. Lightly tap the other end of the spring into the groove. Make sure that the ends of the spring are embedded into the body groove to prevent spring movement. With the seat assembled into the insert and the disc slightly open, install the assembly into the body such that it is angled into the body to engage the insert spring. Once the insert spring is engaged, "pop" the opposite side of the insert into the body by lightly tapping the insert with a block of wood and a hammer. Close the valve.

11. Set the handle or actuator stops as described in the **SETTING HANDLE STOP** Section or **ACTUATOR MOUNTING INSTRUCTION** Section. **NOTE:** After installation of a new seat, torque will be higher for a few cycles.

3.4 Seat Replacement FIRE-TITE Valves

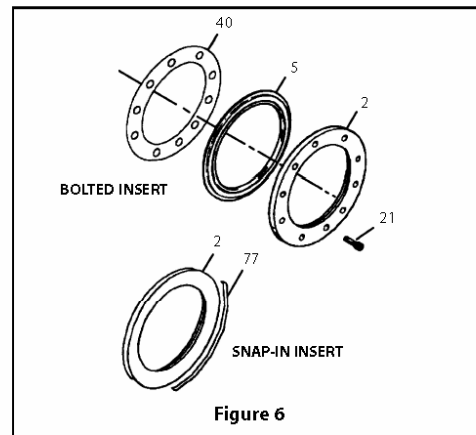
Numbers in () refer to items shown in (Figure 6).

1. After removing the valve from the pipeline, place it on a bench and cycle it open. Take care not to damage the sealing edge of the valve disc.
2. Insert Styles:
 - A. Bolted Insert:**
Remove the insert screws (21) and the insert (2). If the insert does not lift out easily, tap it out from the shaft side using a wooden or plastic rod and a hammer. Do not strike the valve directly with a hammer.

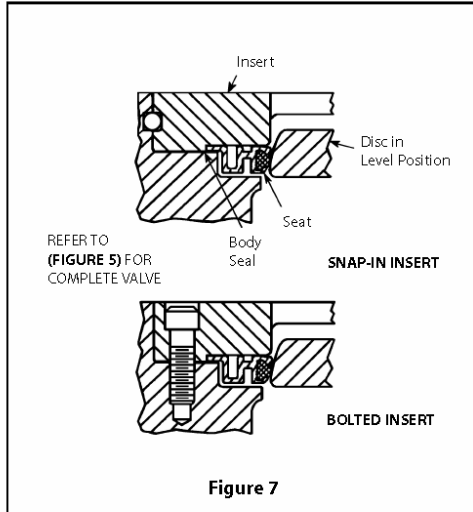
B. Snap-In Insert:

Using a wooden or plastic rod and hammer, drive the insert out of the body from the shaft side. The rod should be placed on either side of the positive stop in the body. Do not strike the valve directly with a hammer. **NOTE:** Removal of the insert often results in damage to the seat being replaced.)

3. Remove the seat (5) and discard. Remove the body seal (40) from the insert and body.
4. Carefully clean the gasketing surfaces with a suitable solvent. They should be free of all grooves and scratches. If deep scratches are present, polish or repair is required.
5. Clean the valve and deburr the insert.



6. Carefully clean and polish the disc. It should be free from all grooves and scratches.
7. If the disc is slightly damaged, it may be possible to smooth the sealing surface with crocus cloth, a fine stone, or the equivalent. If deep scratches are present, replace disc or return the valve to the factory for service.
8. Cycle the valve closed.
9. A body seal (40) is required between the seat tail and body as shown in (Figure 7). The valve uses a graphite type gasket. This is installed in accordance with the following steps:
 - a. **IMPORTANT:** Exercise care at all times not to damage the gasket. A break may cause the gasket to leak.
 - b. The bottom surface of the insert is to be free of all foreign particles. Clean thoroughly with suitable solvent.
 - c. Apply the gasket to the body, and if a lug style, take care to align the holes in the gasket with the insert screw holes.



10. Verify that the disc is in the level position. Install new seat and insert. (See Figure 6 & 7.) For bolted inserts, install the insert screws, and tighten them uniformly. Torque values are given in (Table 1). Whenever possible, open the valve and retorque the insert screws per (Table 1). Take care not to damage the sealing edge of the disc. Close the valve. For snap-in inserts, place the retaining spring into the groove in the body, opposite the positive stop. (See Figure 4.) The tips of the spring should be toward the insert side of the valve. Lightly tap one end of the spring into the body groove. Be sure the spring is positioned snugly into the groove. Lightly tap the other end of the spring into the groove. Make sure the tips of the spring are embedded into the body groove to prevent spring movement. With the seat assembled into the insert, and the disc slightly open, install the assembly into the body, such that it is angled into the body to engage the retaining spring. Once the retaining spring is engaged, "pop" the opposite side of the insert into the body by lightly tapping the insert with a block of wood and a hammer.

11. Set the actuator stops as described in the **ACTUATOR MOUNTING INSTRUCTIONS** Section. Do not install and tighten flanges on a newly resealed valve until the actuator stops are properly set and the valve is fully closed. Incorrect disc positioning may cause damage to a new seat when the valve is compressed between flanges for the first time. **NOTE:** After installation of a new seat, torque will be higher for a few cycles.

3.5 Shaft Seal Replacement

Numbers in () refer to items shown in (Figure 5).

See IMO-317 for live loaded shaft seals.

CAUTION: Read the **WARNING** Section (Page 2) before continuing.

1. Remove the handle or actuator coupling.
2. Remove the nuts (15) from above the compression plate (10). Remove the compression plate (10). The studs (14) do not have to be removed.
3. Remove C-shaped retainer ring (47) from the shaft.
4. Remove the compression ring (9).
5. Remove the old shaft seal (8) segments. Do not score the shaft or body bore!
6. The spacer (7) need not be removed for shaft seal replacement.
7. Replace the old shaft seal with a new shaft seal.
8. Reinstall the compression ring (9), the retainer ring (47), the compression plate (10), the nuts (15).

*If the compression ring initially sits too high to install the retainer ring it may be necessary to precompress the shaft seals somewhat. In that case, install the compression plate and tighten the nuts enough to accomplish the precompression. Remove the compression plate to install the retainer ring and then complete the reassembly.

9. Close the valve.

10. With the valve closed, tighten the nuts (15) on the compression plate evenly until the packing is adequately compressed to prevent leakage. This should require tightening the nuts approximately 1-1/2 to 2 full turns after they have both come into contact with the compression plate.

3.6 Valve Disassembly

Numbers in () refer to items shown in (Figure 5 & 5A).

NOTE: If complete disassembly becomes necessary, replacement of seats and all seals is recommended.

1. Place the valve on a bench or other suitable working space.
2. If the seat is to be replaced or removed, follow Steps 2, 3, 4 and 5 in the **SEAT REPLACEMENT** Section. **NOTE:** It is good practice to replace the seat, shaft and body seals and bearings any time a valve is disassembled.

3. Remove the shaft seal compression hardware as detailed in Steps 1-4 in the **SHAFT SEAL REPLACEMENT** Section. The seal material itself can be more easily removed after the shaft has been removed from the valve.
4. Remove the disc pin welds by grinding or machining off the welds. Drive out the pins opposite the installation direction shown in **(Figure 5)**.
5. Remove screws (55) and cover plate (53), and remove gasket (54).
6. Remove the shaft (4). **NOTE:** When removing the shaft and freeing the disc, be careful not to scratch the sealing surface of the disc.
7. Remove the disc (3) and upper and lower thrust bearings (64).
8. Remove the top bearing (6) either through the top of the valve or the waterway.
9. Remove the bottom bearing (6).
8. Insert the disc pins (13), as shown in **(Figure 5)**, and drive them into place. The pins must be driven so that both pins are the same depth within 1/16" (1.56 mm). When they are correctly installed the drive shaft will be as shown in **(Figures 1 and 2)**. Weld both ends of the pins, small end first, grounding the shaft only (body on blocks of wood). After the disc cools, clean the welds with a wire brush. **CAUTION:** Use care to keep contamination out of the valve.
9. Install the upper bearing spacer (41) when applicable, the spacer (7) with chamfered side toward disc, the shaft seal (8), the compression ring (9) and the retainer ring (47). If the shaft seal is of the PTFE V-ring type, be certain that it is installed in the orientation shown in **(Figure 5)**.
10. If the studs (14) have been removed from the valve, reinstall them in the holes shown in **(Figure 5)**, using Loctite® or other locking compound to prevent vibration loosening. Stud protrusion should be 2" (50.8 mm) for the 3", 4", 6" and 8" (DN 80, 100, 150 and 200) valves and 2-1/4" (57.15 mm) for the 10" and 12" (DN 250 and 300) valves.

3.7 Valve Assembly

Numbers in () refer to items shown in **(Figure 5)**.

1. Clean all valve components.
2. Inspect all components for damage before assembling the valve. Look for damage to the sealing areas on the disc, shaft, and body, and for wear in the bearing areas.
3. Carefully clean and polish the disc sealing surface. It should be free from all grooves and scratches.
4. If the disc is slightly damaged, it may be possible to smooth the sealing surface with crocus cloth, a fine stone, or the equivalent. If deep scratches are present, replace the disc or return the valve to the factory for service.
5. Install the bearings (6) into the body bores.
6. To ease assembly of the shaft into the disc, it may be necessary to coat the shaft and the disc bore lightly with a lubricant compatible with the media to be handled by the valve.
7. Slide the shaft through the top bearing and engage the top thrust bearing (64). With the two pin holes toward the bonnet, place the disc in the waterway and slide the shaft through the shaft bore in the disc. Place the lower thrust bearing (64) below the disc, slide the shaft through and into the lower shaft bearing (6). Use caution to prevent damage to the shaft bearings and disc sealing surface.
11. Install new gasket (54), and secure cover plate to valve body using screws (55). To ensure even gasket loading tighten screws, in an alternating sequence to torque in **(Table 2)**.
12. If the handle ratchet plate has been removed from the valve, reinstall it in the orientation shown in **(Figure 6)**. Install lock washers and screws in the two bonnet holes. Do not tighten the screws until the stops are set. (See **SETTING HANDLE STOP** Section or **ACTUATOR MOUNTING INSTRUCTIONS** Section.)
13. Place the compression plate (10) over the shaft (4) and studs (14). Install the nuts (15), but do not tighten.
14. Cycle the valve fully closed. Install new unused seat and body seal. See the **SEAT REPLACEMENT** Section for details.
15. With the valve still closed, tighten the nuts (15) on the compression plate evenly until the shaft seals are adequately compressed to prevent leakage. This should require tightening the nuts approximately 1-1/2 to 2 full turns after they have both come into contact with the compression plate.
16. Set the handle or actuator stops as described in the **SETTING HANDLE STOP** Section or **ACTUATOR MOUNTING INSTRUCTIONS** Section. Tighten the screws holding the ratchet plate.

4 VALVE TESTING PROCEDURE

Should it become necessary to perform a leak test of the valve prior to its installation in the pipeline, follow the procedure outlined below.

1. In the following test, suitable gaskets are required between the faces of the valve and the test hardware.
2. Before pressurizing the valve be sure all actuator linkage fasteners are tight, and that the power or pressure is applied to the actuator to maintain the valve in the closed position. The offset design on the valve may cause it to rotate when the test pressure is applied to one side of the disc.
3. The valve should be installed between flanges or in a testing apparatus. If flanges are used, refer to **INSTALLATION** Section, part 6. If a testing device other than flanges is used, the clamping force of the device must be comparable with flange bolt loads on the valve.
4. Slightly open the valve. Verify that you do not have a seal between the seat and the disc. Exercise caution when cycling a valve in the test apparatus to avoid possible disc damage from the disc striking the test fixture.
5. Cap the downstream vent and apply 100 psi (6.9 bar) to the valve. Check the shaft seals, and flange gaskets for leakage. This can be done by applying a liquid mixture of soap and water at all seal joints and watching for bubbles.

IMPORTANT: If leakage is detected between the valve and flanges **STOP IMMEDIATELY**. Mark the area of leakage. Vent the valve, and when it has returned to 0 psi (0 bar), retighten the flange bolts in the area. Repressurize the valve checking the gasket again. If leakage persists, disassemble and inspect for damage.

6. If leakage is detected at the shaft seals, tighten the bonnet nuts only enough to stop the leak.
7. Vent the valve, and when it has returned to 0 psi (0 bar), cycle the valve closed.
8. Attach a small tube or hose to the downstream flange (shaft side of the valve).
9. Be sure power/pressure is still applied to the actuator. Pressurize the upstream flange (insert side of valve) to 100 psi (6.9 bar). Check for leakage passing through the free end of the tube/hose.
10. If leakage is detected, vent the valve and make an actuator close-stop adjustment as described in the appropriate Jamesbury actuator IMO, listed on Page 11.

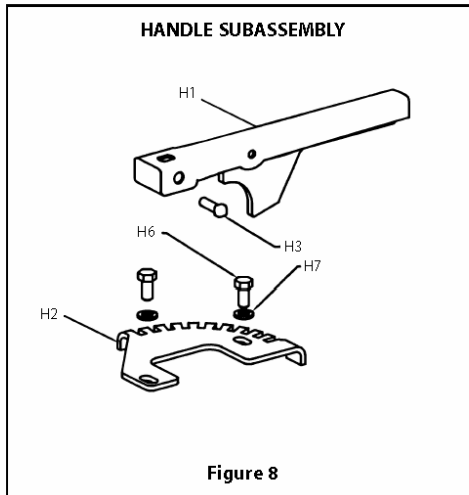
11. Repressurize the valve and check the leakage. If valve still leaks, repeat step 10. If leakage cannot be stopped, adjust the actuator stop so that leakage is minimized.

12. Rebuilt valves may have some minor leakage due to damage to the disc. With the valve still pressurized, insert the free end of the tube/hose into a beaker of water and check for bubbles. In the absence of other test standards, observe leakage after it has reached a stable condition. Because of the volume of air that must be exhausted from a cycled valve, it may be necessary to wait several minutes for the leakage to stabilize or stop. One bubble per inch (25.4 mm) of valve diameter per minute may be considered acceptable for rebuilt soft seated or *Fire-Tite* valves.

5 MANUAL HANDLES

5.1 Handle adjustment

1. Depressurize the line.
2. 2-1/2" thru 6" (DN 65 thru 150) Valves - To ensure proper handle/shaft engagement, the handle must be mounted on the shaft such that it rests on the bottom of the shaft blade. (See Figure 8.)



3. 8" 10" and 12" (DN 200, 250, and 300) Valves - Handles for these valves are of solid cast construction. Adjusting these handles along the blade to assure proper ratchet plate engagement is permitted.

NOTE: Handles not available on square drives.

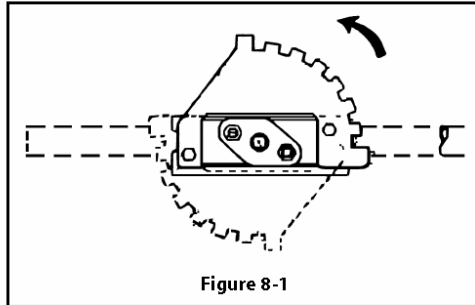


Figure 8-1

5.2 Change of Handle Quadrant

If it is necessary to remount the handle 180 degrees from its standard direction (Figure 8-1).

1. Depressurize the line. Remove the handle, hex head cap screws (H6) and lockwashers (H7). Do not remove the studs (14), nuts (15), or compression plate (10).
2. Lift the ratchet plate up and rotate it 180 degrees. Do not turn it upside down.
3. Reinstall all the components which were just removed. Do not tighten the ratchet plate fasteners until the plate has been properly adjusted as described below in the **SETTING HANDLE STOP** Section. If the valve is not installed in the line, do not install it until the ratchet plate is properly adjusted.

5.3 Setting Handle Stop

1. It is recommended that the valve be out of the pipeline for proper adjustment. If this is not possible, valve must be depressurized before adjustment is made.
2. Loosen the two hex head cap screws (H6) clamping the ratchet plate to the valve.
3. Close the valve until the disc is parallel with the flange faces within 1/32" (.79 mm). Do not over close the valve, so that the disc is in contact with the positive stop in the body.
4. If the handle (H1 in Figure 8-1) has been removed from the valve, reinstall it on the shaft drive blade and tighten. Cast handles use a screw (H3) and nut (H5). Fabricated handles use only a set screw (H3). With the handle locking tab in the last (closed) notch of the ratchet plate, rotate the ratchet plate clockwise (when viewed from above the handle) until it is stopped by the locking tab. The disc/handle assembly is now trapped between the disc stop in the body and the ratchet plate.
5. Tighten the two screws (H6) holding the ratchet plate.

TABLE 4

Actuator	IMO
QUADRA-POWR	IMO-31, 32
ST-50	IMO-22
ST-60, 90, 115, 175MS	IMO-23
ST-200/400	IMO-26
ST-600/1200	IMO-24, 38
ST-160, 240, 290, 440MS	IMO-27, 39
ST-1800	IMO-506
Manual Gears	IMO-63
SP	IMO-512
BC, B1C	5 BC 70-A
BJ, B1J	5 BJ 70-A
EU Series	IMO-515
ER Series	IMO-516

6 ACTUATOR MOUNTING

6.1 WARNING

BEFORE INSTALLING THE VALVE AND ACTUATOR, BE SURE THAT THE INDICATOR POINTER ON TOP OF THE ACTUATOR IS CORRECTLY INDICATING THE VALVE POSITION. FAILURE TO ASSEMBLE THESE PRODUCTS TO INDICATE CORRECT VALVE POSITION COULD RESULT IN PERSONAL INJURY.

CAUTION: WHEN INSTALLING A LINKAGE OR SERVICING A VALVE/ACTUATOR ASSEMBLY, THE BEST PRACTICE IS TO REMOVE THE ENTIRE ASSEMBLY FROM SERVICE.

CAUTION: AN ACTUATOR SHOULD BE REMOUNTED ON THE VALVE FROM WHICH IT WAS REMOVED. THE ACTUATOR MUST BE READJUSTED FOR PROPER OPEN AND CLOSE POSITION EACH TIME IT IS REMOUNTED.

CAUTION: THE LINKAGE HAS BEEN DESIGNED TO SUPPORT THE WEIGHT OF THE Jamesbury ACTUATORS AND RECOMMENDED ACCESSORIES. USE OF THIS LINKAGE TO SUPPORT ADDITIONAL EQUIPMENT SUCH AS PEOPLE, LADDERS, ETC. MAY RESULT IN THE FAILURE OF THE LINKAGE, VALVE OR ACTUATOR AND MAY CAUSE PERSONAL INJURY.

WARNING: WHEN MOUNTING THE ACTUATOR MAKE SURE THAT THE VALVE AND ACTUATOR ARE BOTH IN THE SAME POSITION. MOUNTING AN OPEN ACTUATOR TO A CLOSED VALVE MAY RESULT IN VALVE STEM DAMAGE.

NOTE: WHEN A SINGLE-ACTING STMS PNEUMATIC SPRING-RETURN ACTUATOR IS MOUNTED TO A WAFER-SPHERE VALVE, IT CAN BE MOUNTED ONLY IN THE SPRING-TO-CLOSE MODE (AIR-TO-OPEN).

6.2 Actuator Mounting Instructions

1. When a spring-return actuator is being mounted, the valve should be in the closed position for spring-to-close operation or in the open position for the spring-to-open operation. When an electric or double-acting pneumatic actuator is being mounted, the valve position should correspond to the indicated actuator position.

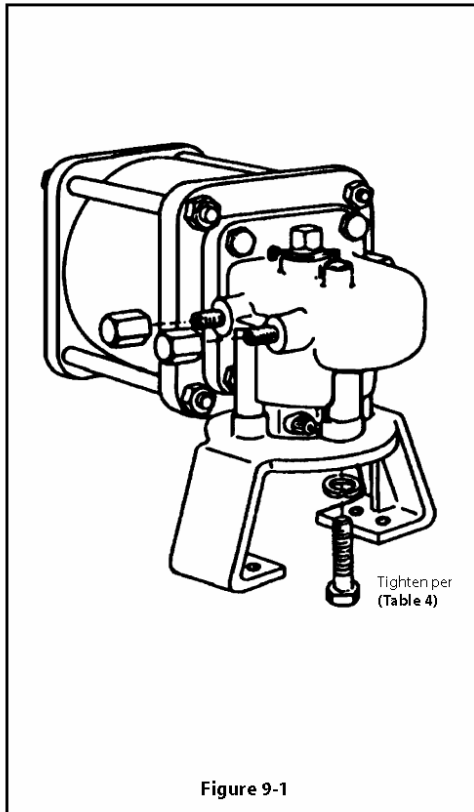


Figure 9-1

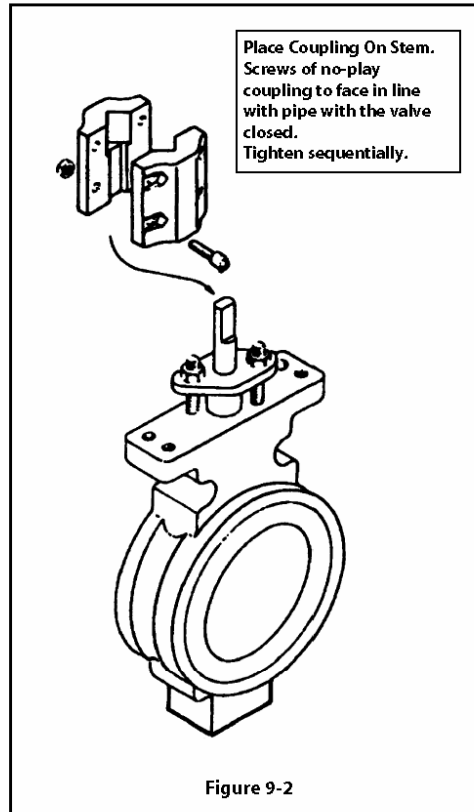


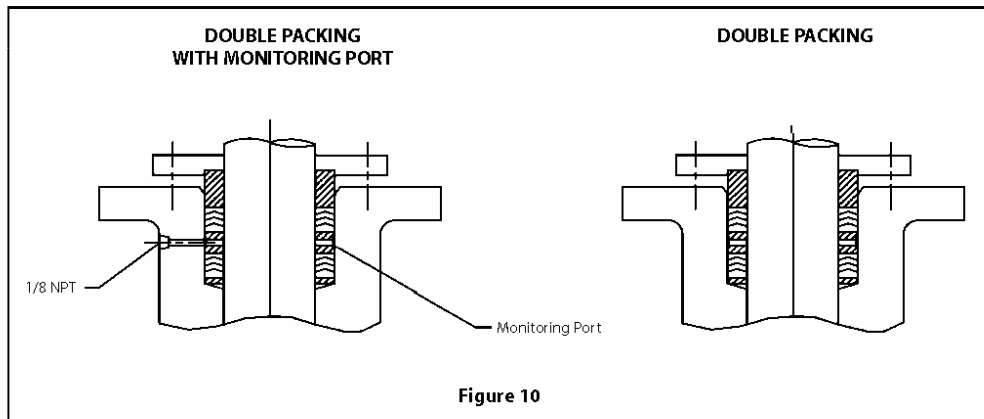
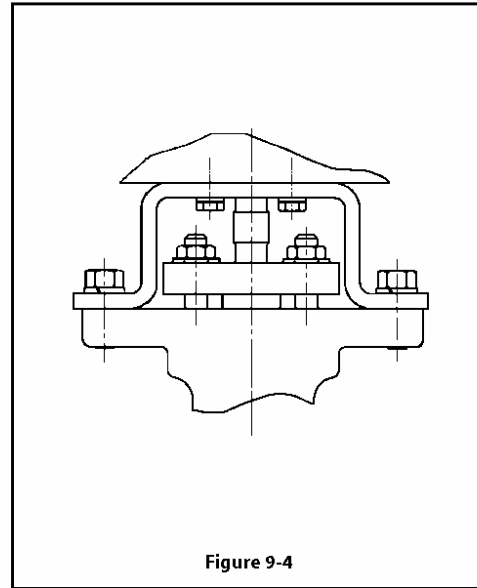
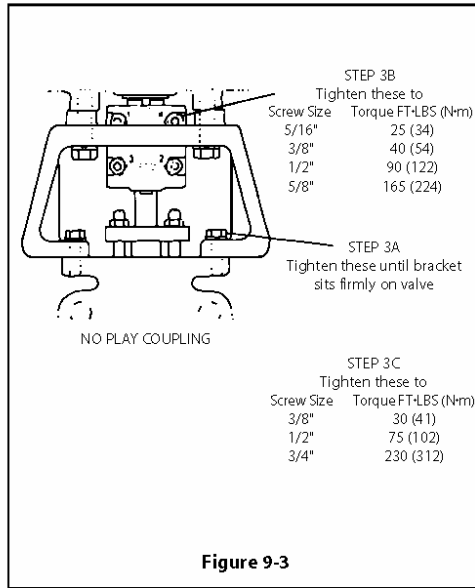
Figure 9-2

2. Assemble bracket to actuator as shown in (Figure 9-1). Tighten to torque listed in (Table 4).
3. Place the coupling onto the valve stem. If the valve has a two-piece "no-play" bolted coupling, assemble the coupling loosely on the valve stem. Use socket head cap screws and lock nuts. (See Figure 9-2.)
4. Lower actuator and bracket onto valve while engaging actuator stem driver into coupling. Tighten screws just enough to firmly mate bracket to valve. This should allow bracket to shift, allowing the coupling to align the valve and actuator shafts. (See Figure 9-3, Step 3A.)
5. Tighten the no-play coupling screws to torques shown in (Figure 9-3, Step 3B). Use alternating sequence shown.
6. Cycle actuator. See actuator instructions.
7. Fully tighten the screws holding the bracket to the valve, as shown in (Figure 9-3, Step 3C).
8. Recheck no-play coupling screw torques, using the torques in (Figure 9-3, Step 3B). Use alternating sequence shown.
9. Adjust the actuator travel stops as described in the actuator instructions to these proper valve open and closed positions:

Valve Open:	Disc face (or shaft blade) perpendicular with the flange face.
Valve Closed:	Disc face parallel to flange face within 1/32" (.79 mm).

6.3 Direct Drive Mounting

Follow instructions per Paragraph 6.2 except for coupling assembly. (See Figure 9-4.)



7 REPAIR KITS/SPARE PARTS

Service kits include one seat (seat assembly for *Fire-Tite* valves), and a set of shaft seals. When ordering service kits, seat and shaft seal materials must be specified. For example, a kit for a 10" (DN 250) type 815L valve with filled PTFE(M) seat and PTFE(T) seals is ordered as RKW-362MT. Wafer

style valves will also include insert springs. 2-1/2", 3" and 4" (DN 65, 80 and 100) lug style **only** will also include body seals.

For further information on spare parts and service or assistance visit our web-site at www.jamesbury.com.

TABLE 4 Bracket Bolting Torques for GR.5 Hex Cap Screws				
	Torque to Aluminum Body Actuators		Torque to Cast/Ductile Body Actuators	
Bolt Size	No Lubrication to Screws			
inches	FT•LBS	N•m	FT•LBS	N•m
1/4	6	—	8	—
5/16	12	—	16	—
3/8	20	—	27	—
7/16	30	—	45	—
1/2	50	—	67	—
9/16	70	—	100	—
5/8	90	—	135	—
3/4	160	—	225	—
7/8	250	—	335	—
1	360	—	520	—
1-1/8	520	—	700	—
1-1/4	700	—	990	—
M6	—	6.8	—	9.5
M8	—	14.9	—	19.0
M10	—	30	—	38
M12	—	52	—	65
M16	—	122	—	156
M20	—	230	—	305
M30	—	773	—	1062
M36	—	1288	—	1826

WAFER-SPHERE REPAIR KITS				
MODEL C				
Size	Soft Seat		FIRE-TITE	
	Wafer	Lug	Wafer	Lug
2-1/2" (DN 65) 815 2-1/2" (DN 65) 830	RKW-470 RKW-470	RKW-471 RKW-471	O/A O/A	O/A O/A
3" (DN 80) 815 3" (DN 80) 830	RKW-352 RKW-352	RKW-358 RKW-358	RKW-364 RKW-364	RKW-370 RKW-370
4" (DN 100) 815 4" (DN 100) 830	RKW-353 RKW-353	RKW-359 RKW-359	RKW-365 RKW-365	RKW-371 RKW-371
5" (DN 125) 815	RKW-468	RKW-469	RKW-472	RKW-473
6" (DN 150) 815 6" (DN 150) 830	RKW-354 RKW-405	RKW-360 RKW-409	RKW-366 RKW-413	RKW-372 RKW-417
8" (DN 200) 815 8" (DN 200) 830	RKW-355 RKW-406	RKW-361 RKW-410	RKW-367 RKW-414	RKW-373 RKW-418
10" (DN 250) 815 10" (DN 250) 830	RKW-356 RKW-407	RKW-362 RKW-411	RKW-368 RKW-415	RKW-374 RKW-419
12" (DN 300) 815 12" (DN 300) 830	RKW-357 RKW-408	RKW-363 RKW-412	RKW-369 RKW-416	RKW-375 RKW-420
14" (DN 350) 815 14" (DN 350) 830	RKW-678 RKW-673	RKW-678 RKW-673	RKW-663 RKW-668	RKW-663 RKW-668
16" (DN 400) 815 16" (DN 400) 830	RKW-660 RKW-674	RKW-660 RKW-674	RKW-664 RKW-669	RKW-664 RKW-669
18" (DN 450) 815 18" (DN 450) 830	RKW-661 RKW-675	RKW-661 RKW-675	RKW-665 RKW-670	RKW-665 RKW-670
20" (DN 500) 815 20" (DN 500) 830	RKW-662 RKW-676	RKW-662 RKW-676	RKW-666 RKW-671	RKW-666 RKW-671
24" (DN 600) 815 24" (DN 600) 830	RKW-334 RKW-676	RKW-334 RKW-676	RKW-667 RKW-672	RKW-667 RKW-672

OA = ON APPLICATION

Metso Automation, Field Systems Division

Europe, Levytie 6, P.O.Box 310, 00811 Helsinki, Finland. Tel. int. +358 20 483 150. Fax int. +358 20 483 151

Europe (UK), 2 Lindenwood, Crockford Lane, Chineham Business Park, Basingstoke, RG24 8QY UK. Tel. int. +44 (0) 8706 061478. Fax int. +44 (0) 1256 707661

North America, 44 Bowditch Drive, P.O.Box 8044, Shrewsbury, Massachusetts, 01545-8044 USA. Tel. int. +1 508 852 0200. Fax int. +1 508 852 8172

Latin America, Av. Central, 181- Cháracas Reunidas, 12238-430, São Jose dos Campos. Tel. int. +55 12 335 3500. Fax int. +55 12 335 3535

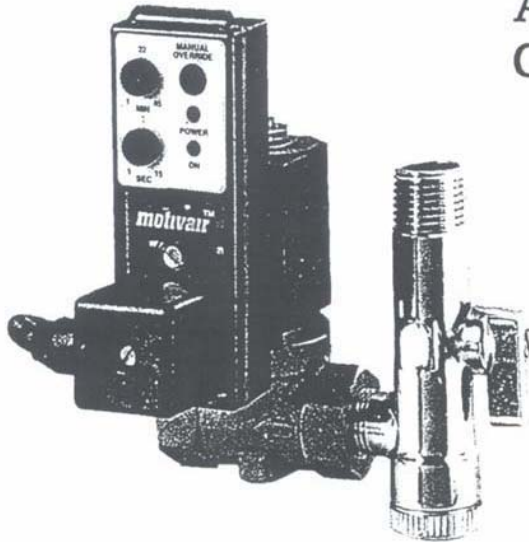
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www.jamesbury.com



motivair™

Automatic Condensate Removal



EDM 20-1 Electronic Timer-Solenoid

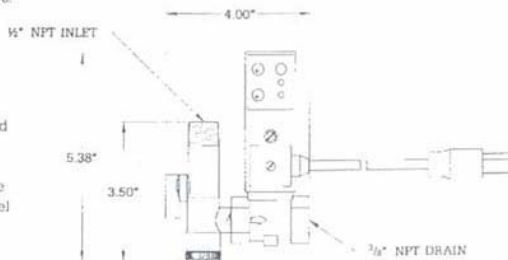
- 200 psig rating
- Strainer/isolation valve
- Push-to-test

The Motivair EDM 20-1 was developed to meet the growing demand for a reliable timer/solenoid drain. The assembly consists of an inlet isolation valve and strainer, NEMA 4 timer enclosure and solenoid valve. The NEMA 4 enclosure houses a solid-state timer with adjustable interval and cycle functions, monitoring LEDs and push-to-test pad. The isolation valve permits in-service cleaning and inspection of the strainer basket and solenoid valve.

EDM 20-1 TECHNICAL DATA

TIMER	VALVE	
Material: Plastic Polyamide	Material: Brass	
Interval: 1-45 minutes	Design: Pilot operated	
Cycle: 1-15 seconds	diaphragm	
Voltage: 115 or 230/1/60	Orifice: 7/16"	
Class: NEMA 4	Isolation valve: Brass/Chrome	
	Strainer: Stainless Steel	

* Additional connection sizes and pressures are available. Contact Motivair for assistance.



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EDM 20-1 Electronic Timer-Solenoid

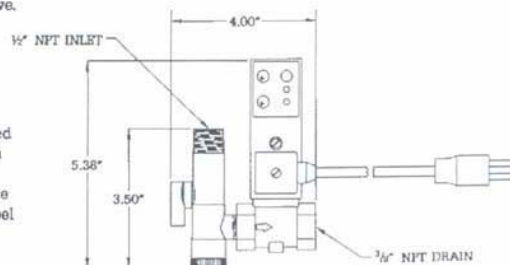
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Interval: 1-45 minutes	Design: Pilot operated diaphragm	
Cycle: 1-15 seconds	Orifice: 7/16"	
Voltage: 115 or 230/1/60	Isolation valve: Brass/Chrome	
Class: NEMA 4	Strainer: Stainless Steel	

* Additional connection sizes and pressures are available. Contact Motivair for assistance.



(5) Electrical Connections:

- a. Power supply: Make sure that power supply matches power requirements of valve as listed on the solenoid coil.
- b. A six foot, three wire grounded power cord is supplied.
- c. Power rating, 20 watts for 120 volt.

**MOTIVAIR EDM20-1
ELECTRONIC TIMER/SOLENOID**

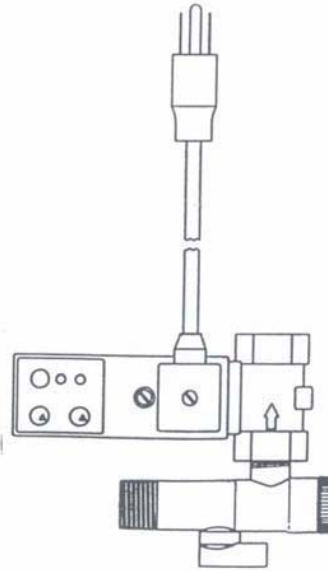
(1) Programming Timer:

- a. Valve open time: Valve open time set "valve open" time, move slot on left hand knob to align with desired valve open time.
- b. Valve closed time is in minutes. To set "valve closed" time (time between drain cycles), move slot on right hand knob to align with desired valve closed time.

INSTALLATION, MAINTENANCE

&

(2) Lights:
a. Red light illuminates when timer is energized.
b. Green light illuminates when valve is energized.



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IMPORTANT:

Before using this equipment, check for shipping damage and report any claim to carrier immediately. Study the following instructions to insure correct installation.

CAUTION:

- (1) Pressurized Devices – This equipment is a pressure containing device.

- Do not exceed maximum operating pressure as noted by the valve size.
 - 1/4" = 300 PSIG
 - 3/8" = 200 PSIG
 - 1/2" = 150 PSIG

- Make sure equipment is depressurized before working on or disassembling it for service.

Electrical –

- This equipment requires electricity to operate.
 - pipng into inlet/outlet valve ports.
 - Standard equipment is supplied with NEMA 4 electrical Enclosures and is not intended for installation in hazardous environments.
 - performing any electrical service.

GENERAL:

- (1) Description - The automatic electric drain is an electrically operated solenoid valve. The valve is controlled by a solid state electronic timer that can be programmed within the following limits.

Valve Open Time:

Minimum: 1.0 second
Maximum: 15 seconds

Valve Closed Time:

Minimum: 1.0 minute
Maximum: 45 minutes

The valves can be used to discharge collected liquid from receivers, separators, drip legs, dryers, filters and other pneumatic equipment. They can also be used for other gas and liquid applications requiring periodic flow for a present timer period.

INSTALLATION:

- (1) Preparation: Remove plastic thread protectors.
(2) Location: Do not install where ambient temperatures are greater than 120°F (48.8°C). Make sure the electrical enclosure is sufficient for the environment.

- (3) Physical Arrangement: Drain may be installed in any position (upside down or at any angle) Inlet/outlet connections are adjustable 360°. Solenoid coil is adjustable 180°. Cord set is adjustable 360°.

(4) Piping:

- a. Flow Direction: Install so that flow direction is in the direction of the arrow stamped on the valve.
b. Use pipe sealant or teflon tape when installing. Install equipment in compliance with national and local electrical codes. c. When used

follow these instructions:

- i. Inlet piping: The inlet pipe to the valve should not be smaller than the inlet connection so Disconnect power supply to equipment when that flow is not restricted. A strainer to protect valve for ease of valve servicing may be added to the piping ahead of the valve. Install drain below level of device being drained where possible to allow condensate to flow to drain by gravity.

- ii. Outlet piping: Piping may run from the outlet connection to an adequate sump or floor drain. Make sure the line to the drain is not obstructed. (NOTE: Liquid discharge is at system pressure and may require that the line be anchored.)

<h2 style="margin: 0;">Installation & Maintenance Instructions</h2> <p style="margin: 0;">3-WAY OR 4-WAY, 2 POSITION SINGLE OR DUAL SOLENOID VALVES FOR NAMUR ACTUATORS – 1/4 NPT PRESSURE & 1/8 NPT EXHAUST CONNECTIONS AIR OR INERT GAS SERVICE – ANODIZED ALUMINUM CONSTRUCTION</p>	<p style="margin: 0;">SERIES</p> <p style="margin: 0;">8551</p> <p style="margin: 0;">Form No.V7418</p>
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Service Notice

Except for coil replacement, the Series 8551 are not repairable. When any performance problems are detected during routine inspection, replace valve immediately.

For catalog numbers prefixed WT or EF, see separate solenoid installation and maintenance instructions for information on: Wiring, Solenoid Temperature, Cause of Improper Operation and Coil Replacement.

DESCRIPTION

Series 8551 valves are 3-way or 4-way, 5 ported 2 position piloted spool type single or dual solenoid valves designed for air or inert gas service. Valves are made of rugged anodized aluminum. A built-in manual operator allows manual operation when desired or during an electrical power outage. Each valve may be used for 3-way (normally closed) or 4-way operation by using the appropriate flow plate provided. Flow plates are marked (3/2) for 3 Ports, 2 Positions (3-way operation) or (5/2) for 5 Ports, 2 Positions (4-way operation). These valves are supplied with all necessary hardware for a NAMUR direct mount installation i.e. flow plates, gaskets, mounting screws and a locating set screw. See *Flow Selection And Mounting section*.

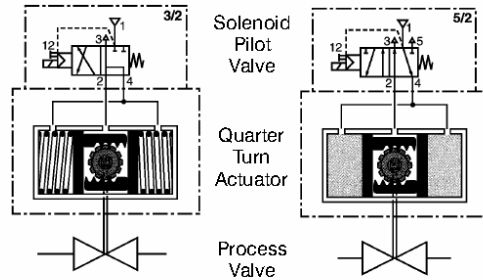
Valves catalog numbers prefixed SC are supplied with an open-frame spade plug connection coil (3x DIN 46244). A DIN Plug Connector Kit No. K226061-001, is available from ASCO.

APPLICATIONS

Typically, the 3-way (3/2) normally closed mode is used for a single acting (spring return) actuator; 4-way (5/2) mode for a double acting actuator.

Single-acting solenoid spool-valve control adapted for 3/2 operation

Double-acting solenoid spool-valve control adapted for 5/2 operation



Port Markings: 1 = Pressure, 2 & 4 = Cylinder
3 & 5 = Exhaust

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OPERATION

IMPORTANT: Minimum operating pressure differential 30 psi; maximum 150 psi.

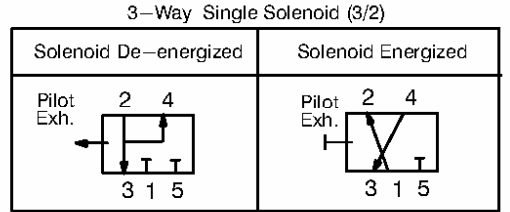
Breather Function 3-way (3/2) mode only: Allows for spring side of a spring return actuator to vent at all times through valve exhaust port 3.

Single Solenoid: This type of operation is used where automatic return of the valve on electrical power failure or loss of main line pressure is required.

3-Way NC Single Solenoid Operation

Solenoid De-energized: Flow is from port 2 to port 3. Port 4 is open to exhaust port 3 (breather function); pressure port 1 is closed. Slight pilot exhaust is also apparent. Port 5 is not used.

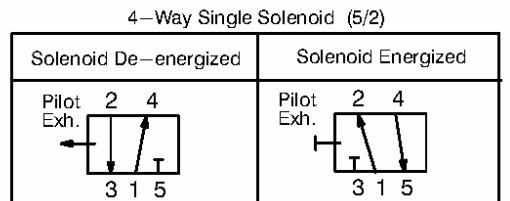
Solenoid Energized: Flow is from pressure port 1 to port 2. Port 4 is open to exhaust port 3 (breather function); pilot exhaust is closed.



4-Way Single Solenoid Operation

Solenoid De-energized: Flow is from pressure port 1 to port 4 and from port 2 to port 3. Port 5 is closed. Slight pilot exhaust is also apparent.

Solenoid Energized: Flow is from pressure port 1 to port 2 and from port 4 to port 5. Port 3 and pilot exhaust are closed.



Dual Solenoids: Solenoid may be energized momentarily or continuously depending upon application. Dual solenoid valves are used where equipment must not change position when electrical power fails. Valve operates when one solenoid is energized and returns when the other solenoid is energized.

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Page 1 of 4

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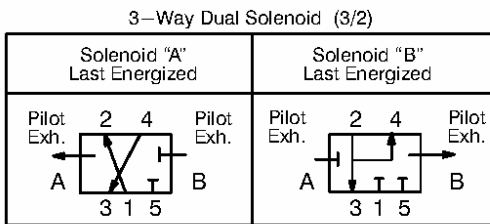
⚠ CAUTION: Do not energize solenoids A and B simultaneously, as this will cause valve to malfunction.

IMPORTANT: Minimum on time for each solenoid is 0.3 seconds.

3-Way NC Dual Solenoid Operation

Solenoid A Last Energized: Flow is from pressure port 1 to port 2. Port 4 is open to exhaust port 3 (breather function). Slight pilot exhaust is apparent when solenoid A is de-energized. Port 5 is not used.

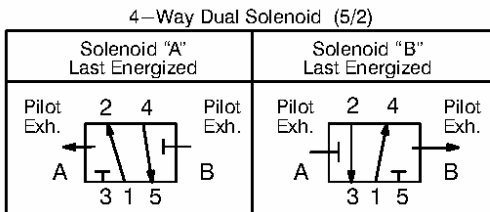
Solenoid B Last Energized: Flow is from pressure 2 to port 3. Port 4 is open to exhaust 3 (breather function); pressure port 1 is closed. Slight pilot exhaust is apparent when solenoid B is de-energized.



4-Way Dual Solenoid Operation

Solenoid A Last Energized: Flow is from pressure port 1 to port 2 and from port 4 to port 5. Port 3 is closed. Slight pilot exhaust apparent when solenoid A is de-energized.

Solenoid B Last Energized: Flow is from pressure port 1 to port 4 and from port 2 to port 3. Port 5 is closed. Slight pilot exhaust apparent when solenoid B is de-energized.



Manual Operator

Manual operator provides manual operation when desired or during an electrical power outage. To engage manual operator, rotate screw clockwise as far as possible to "1". Valve will now be in the same position as when the solenoid is energized. To disengage manual operator, rotate screw counterclockwise as far as possible to "0".

⚠ CAUTION: To prevent malfunction be sure to turn screw counterclockwise to "0" before operating valve electrically.

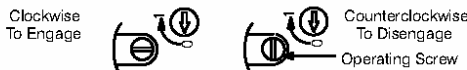


Figure 1. Manual Operator (partial view).

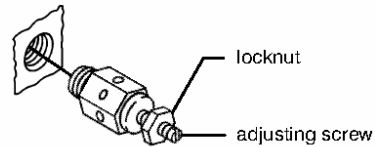
Metering Device with Filter for 1/8 NPT Connections (Optional Feature)

These metering devices can be used to vary the operating speed of the actuator/cylinder this valve is piloting. Install metering devices in 1/8 NPT exhaust connection and tighten securely. Install a metering device in port 3 and port 5 of 4-way (5/2) valves only. Because of the breather function, the use of a metering device is not recommended for the 3-way (3/2) mode.

Metering Device Adjustment:

- Loosen Locknut on adjusting screw.
- Turn adjusting screw clockwise (to reduce flow) as far as possible.
- Turn adjusting screw counterclockwise (to increase flow) no more than two turns.
- Tighten locknut using 13 mm wrench.

IMPORTANT: The steps above provide only a rough adjustment of the metering device. Final adjustments must be made with valve fully pressurized in the line of final application.



Turn clockwise to reduce flow and speed of actuator/cylinder this valve is piloting; counterclockwise to increase flow and speed.

Figure 2. Metering Device (partial view).

INSTALLATION

Check nameplate for correct catalog number, pressure, voltage, frequency, and service. Never apply incompatible fluids or exceed pressure rating of the valve. Installation and valve maintenance to be performed by qualified personnel.

⚠ WARNING: To prevent the possibility of electrical shock from the accessibility of live parts, install the open-frame solenoid in a suitable enclosure.

Future Service Considerations

Provision should be made for performing seat leakage, external leakage, and operational tests on the valve with a nonhazardous, noncombustible fluid.

Temperature Limitations

For valve ambient and fluid temperature ranges, refer to chart following. Check catalog number prefix and watt rating on nameplate.

Watt Rating AC/DC	Catalog Number Prefix	Ambient And Fluid Temperature Range
2.5 & 3 AC & DC	SC	5°F to 140°F (-15°C to 60°C)
6.3 AC	WT	5°F to 140°F (-15°C to 60°C)
	EF	5°F to 104°F (-15°C to 40°C)
6.9 DC	WT or EF	5°F to 77°F (-15°C to 25°C)

NOTE: For temperatures below 32°F (0°C) moisture-free air must be used.

Positioning

Valve may be mounted in any position.

Flow Selection and Mounting (Refer to Figure 3)

Two flow plates are provided with each valve. Flow plates are marked (3/2) for 3-way or (5/2) for 4-way. For proper orientation of the flow plate, the marking (3/2) or (5/2) must be opposite series number 8551 flow diagram label on valve body or facing solenoid “B” for dual solenoid construction. See Figure 3. for proper orientation of flow plate, gaskets, mounting screws and locating set screw. Then proceed as follows:

1. If required, install locating set screw using a 2 mm hex key wrench.
2. Install Port 2 and Port 4 gaskets and flow gasket on flow plate.
3. Position flow plate and solenoid valve on actuator. Then install two socket head cap screws in offset center holes on either side. Hand thread screws a few turns into actuator. Then tighten screws evenly using a 4 mm hex key wrench.

NOTE: Three sets of mounting screws are provided, sizes:M5, .190-24 UNC-2A and .190-32 UNF-2A.

Piping

There is pilot exhaust from the top of the solenoid when the solenoid is de-energized. The pilot exhaust may be connected to the main exhaust if the air or inert gas cannot be exhausted directly to the atmosphere. An exhaust protector is provided in the top of the plugnut/core tube assembly to prevent debris from entering pilot exhaust.

Connect piping or tubing to valve according to markings on valve body. Refer to flow diagrams in *OPERATION* section. Apply pipe compound sparingly to male pipe threads only. If applied to valve threads the compound may enter the valve and cause operational difficulty. Avoid pipe strain by properly supporting and aligning piping. When tightening the pipe, do not use valve or solenoid as a lever. Locate wrenches applied to valve body or piping as close as possible to connection point.

▲ CAUTION: To avoid damage to the valve body, DO NOT OVERTIGHTEN PIPE CONNECTIONS. If TEFLON* tape, paste, spray or similar lubricant is used, use extra care when tightening due to reduced friction.

*DuPont’s Registered Trademark

NOTE: The exhaust and/or pressure lines may be restricted to control cylinder speed on 4-way (5/2) mode only.

▲ CAUTION: To protect the solenoid valve, install a strainer or filter, suitable for the service involved, in the inlet side as close to the valve as possible. Clean periodically depending on service conditions. See ASCO Series 8600, 8601, and 8602 for strainers.

Wiring

Wiring must comply with local codes and the National Electrical Code. The open-frame solenoid may be rotated 360°. The open-frame solenoid is provided with 1/4" spade terminals and a grounding spade terminal connection.

NOTE: Valves can be converted from alternating current (AC) to direct current (DC), or vice-versa, by changing the coil.

Solenoid Temperature

Series 8551 valves are supplied with coils designed for continuous duty service. When the solenoid is energized for a long period, the solenoid coil becomes hot and can be touched with the hand only for an instant. This is a safe operating temperature. Any excessive heating will be indicated by the smoke and odor of burning coil insulation.

MAINTENANCE

▲ WARNING: To prevent the possibility of death, serious injury or property damage, turn off electrical power, depressurize valve, and vent fluid to a safe area before inspecting or servicing the valve.

Preventive Maintenance

- Prepare and follow a routine inspection schedule based on the media, environment, and frequency of use.
- Keep the medium flowing through the valve as free from dirt and foreign material as possible. Depending on medium and service conditions, clean valve strainer or filter as required to keep the valve free of contamination. In the extreme case, contamination will cause faulty valve operation and the valve may fail to shift.
- While in service, the valve should be operated at least once a month to ensure proper operation.

Causes of Improper Operation

- **Incorrect Pressure:** Check valve pressure. Pressure to valve must be within range specified on nameplate.
- **Faulty Control Circuits:** Check the electrical system by energizing the solenoid. A metallic *click* signifies that the solenoid is operating. Absence of the *click* indicates loss of power supply. Check for loose or blown fuses, open-circuited or grounded coil, broken lead wires or splice connections.
- **Burned-Out Coil:** Check for open-circuited coil. Replace coil as necessary. Check supply voltage; it must be the same as specified on nameplate.
- **Low Voltage:** Check voltage across the coil terminals. Voltage must be at least 85% of nameplate rating

Coil Replacement

1. Disconnect grounding and supply wires from coil.
2. Remove retaining clip and slip coil off the plugnut/core tube assembly.
3. Install new coil and replace retaining clip.
4. Make electrical hookup to coil.

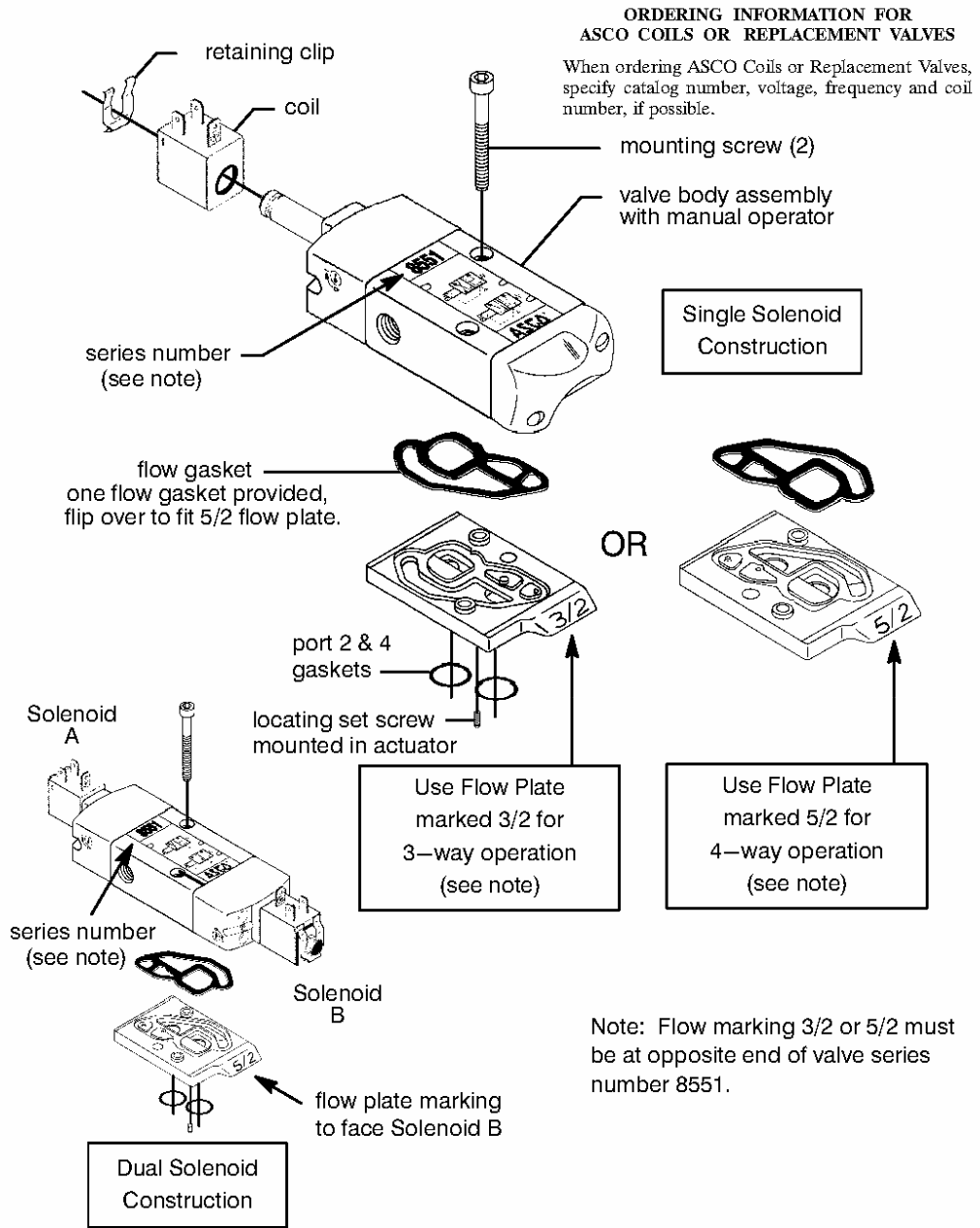


Figure 3. Series 8551 shown with prefix SC coil.



IMO - 528 Issue Date: 10/02

INSTALLATION, MAINTENANCE, AND
OPERATING INSTRUCTIONS



**VALV-POWR® VPVL
MOD B VALUE-LINE®
DOUBLE-OPPOSED
PISTON ACTUATORS**

Read entire instructions carefully before installation or servicing

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1 GENERAL

This instruction manual contains important information regarding the installation, operation, and troubleshooting of the Jamesbury VALV-POWER VPVL Mod B VALUE-LINE Double-Opposed Piston Actuators. Please read these instructions carefully and save them for further reference.

6. OPERATING THE ACTUATOR OVER TEMPERATURE LIMITS MAY DAMAGE INTERNAL AND EXTERNAL COMPONENTS (DISASSEMBLY OF SPRING RETURN ACTUATORS MAY BE DANGEROUS).
7. OPERATING OVER PRESSURE LIMITS MAY RESULT IN PREMATURE FAILURE AS WELL AS DAMAGE TO THE HOUSING.

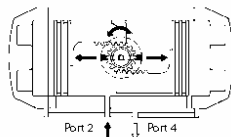
1.1 WARNING

1. KEEP HANDS AND CLOTHING AWAY FROM THE VALVE PORTS AND ACTUATOR PINION AT ALL TIMES.
2. DO NOT ATTEMPT TO DISASSEMBLE INDIVIDUAL SPRING CARTRIDGES. DISASSEMBLY OF THE CARTRIDGE MAY RESULT IN SERIOUS PERSONAL INJURY. IF MAINTENANCE OF THE CARTRIDGE IS NECESSARY, IT MUST BE RETURNED TO METSO AUTOMATION.
3. SHUT OFF AND BLEED ALL SUPPLY LINES BEFORE INSTALLATION OR SERVICING. DO NOT REMOVE END CAPS WHILE THE ACTUATOR IS PRESSURIZED.
4. BEFORE INSTALLING THE VALVE AND ACTUATOR, BE SURE THAT THE INDICATOR ON TOP OF THE ACTUATOR CORRECTLY SHOWS THE VALVE POSITION. FAILURE TO ASSEMBLE THESE PRODUCTS TO INDICATE THE CORRECT VALVE POSITION COULD RESULT IN PERSONAL INJURY.
5. AN ACTUATOR MUST BE SIZED ACCURATELY FOR PROPER OPERATION. REFER TO INFORMATION ON ACTUATOR OUTPUT TORQUES IN THIS BULLETIN AND VALVE TORQUE REQUIREMENTS IN THE APPROPRIATE VALVE BULLETIN.

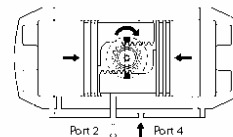
2 TECHNICAL DATA

1. **Operating Media:** Dry or lubricated air, non-corrosive and inert gas, or light hydraulic oil.
2. **Air Supply:** 116 psi (8 bar) Maximum.
3. **Temperature:**
Standard; -4° to 175°F (-20° to 80°C)
Viton O-rings: -4° to 300°F (-20° to 150°C)
Silicon O-rings: -40° to 175°F (-40° to 80°C)
4. **Lubrication:** Factory lubricated for the life of the actuator under normal operating conditions.
5. **Construction:** Suitable for indoor and outdoor use.
6. **External Travel Stops:** ±4 degree adjustment on 90 degree stroke.

Double-Acting (Top View)



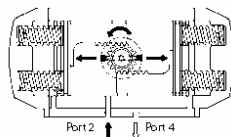
Air supplied to **Port 2** forces pistons apart and toward end positions with exhaust air exiting at **Port 4** (a counter-clockwise rotation is obtained).



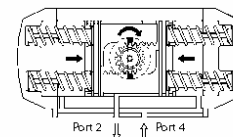
Air supplied to **Port 4** forces pistons toward center with exhaust air exiting at **Port 2** (a clockwise rotation is obtained).

Figure 1

Spring-Return (Top View) Spring-to-Close



Air supplied to **Port 2** forces pistons apart and toward end position, compressing springs. Exhaust air exits at **Port 4** (a counter-clockwise rotation is obtained).



Loss of air pressure allows springs to force pistons toward center position with exhaust air exiting at **Port 2** (a clockwise rotation is obtained).

Figure 2

3 INSTALLATION

3.1 General

1. Check to see that the desired failure mode is correct (**Figures 1 & 2**). In the spring-to-close mode, the actuator will cycle clockwise to close upon loss of pressure. If the spring-return actuator is not set up in the configuration desired, follow the disassembly procedure section 4.2. Reverse the orientation of the pistons, then reassemble following the assembly procedure, section 4.3.
2. Mount the actuator to the valve, following the direction in the linkage AMI or valve IMO.
3. Connect a regulated air supply to the NPT fitting in the actuator housing. **CAUTION: The maximum operating pressure is 116 psi (8 bar).**
4. Adjust the stop screws following assembly section 4.3.5. Stops can be adjusted by up to ± 4 degrees.

3.2 Operation

1. The actuator series, size, operating pressure, output torque, spring directions, and drive type is determined by the actuator designation.
2. The label lists the actuator series, size, operating pressure, maximum pressure, and serial number. Actuator designation example, VPVL300 SR6 B F07-N-L-19, is a spring-return series, VPVL300 double-opposed piston actuator that has 80-psi (5.5-bar) springs, a Teflon® - coated anodized housing (protection B), an end-of-stroke output torque of 41.1 FT-LBS (55.7 N·m), mounts via an F07 pattern, and uses a 19-mm female parallel square to drive the valve.

4 MAINTENANCE

4.1 General

NOTE: All VPVL actuator fasteners are metric. Under normal operating conditions the actuator requires only periodic observation to ensure proper adjustment. Service kits are available to replace seals and bearings (soft parts). These parts are identified in (**Figure 20**) and listed in (**Table 3**), Table 1 below lists kit part numbers.

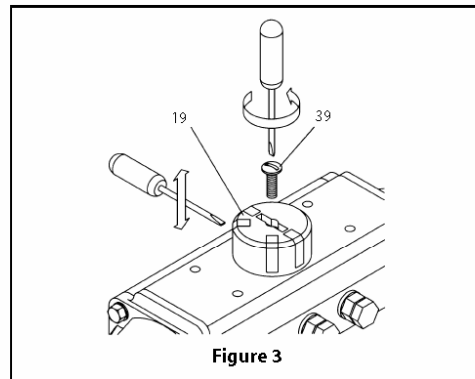
TABLE 1			
Actuator	Service Kit	Actuator	Service Kit
VPVL01/011	RKP-152	VPVL-450	RKP-160
VPVL050/051	RKP-153	VPVL-500	RKP-161
VPVL100	RKP-154	VPVL-550	RKP-162
VPVL200	RKP-155	VPVL-600	RKP-163
VPVL250	RKP-156	VPVL-650	RKP-164
VPVL300	RKP-157	VPVL-700	RKP-165
VPVL350	RKP-158	VPVL-800	RKP-166
VPVL400	RKP-159		

4.2 Disassembly

When disassembly of the actuator is required for maintenance, remove the actuator from the valve. Ensure proper lifting procedures are followed when moving or carrying actuators. (**Table 4**) lists the approximate weights of the VPVL actuators and provides outline dimensions for the double acting and spring return actuators. **CAUTION: Do not use the M5 VDE/ VDI mounting holes or the M6 hole in the pinion for lifting the actuator.**

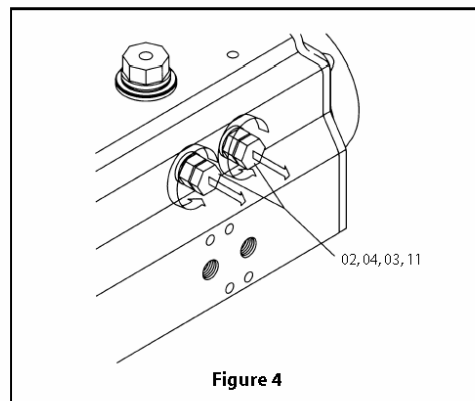
When disassembling VPVL actuators, use caution and be certain that the actuator is free from accessories and the air supply is disconnected. When the actuator is a spring-return unit, make sure that the actuator is in the failed position before disassembling.

1. Removal of Position Indicator (19,20), (Figure 3):



- A. Remove cap screw if fitted (39).
- B. Lift position indicator (19) off shaft; it may be necessary to pry gently with a screwdriver.

2. Removal of Stop Cap Screws (02), (Figure 4):



- A. Remove both stop cap screws (02) together with nut (04) and washer (03).
- B. Remove stop screw o-rings (11) and discard if replacing all soft parts.

3. End Cap (30,31) Disassembly, (Figure 5):

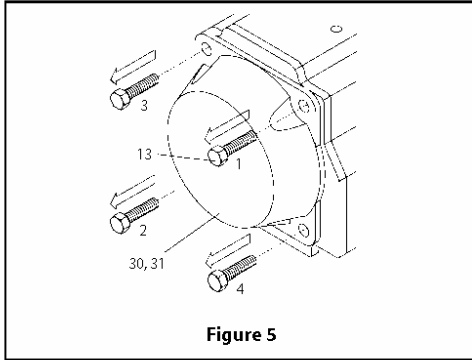


Figure 5

- A. Remove the end cap bolts (13) in the sequence shown in (Figure 5). **CAUTION: When disassembling a spring return actuator, the end cap (30, 31) should be loose after unscrewing end cap bolts (13) 4-5 turns. If there is still force on the end cap (30, 31) after 4-5 turns of the end cap bolt (13), this may indicate a damaged spring cartridge and any further disassembly should be discontinued. Further disassembly of the end-caps may result in serious personal injury. Return actuator to Metso Automation for further maintenance.**
- B. For spring return actuators, remove spring cartridges (17).
- C. Remove end-cap o-rings (14) and discard if replacing all soft parts.

4. Piston (40) Disassembly, (Figure 6):

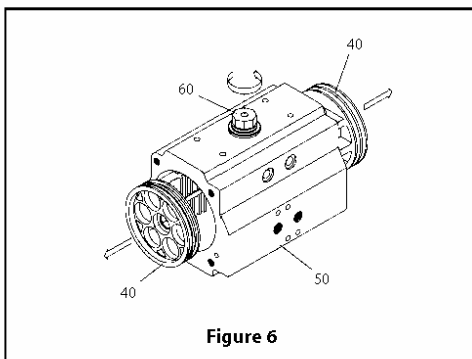


Figure 6

- A. Holding the body (50) in a vice (or similar device), rotate the drive shaft (60) until the pistons (40) are released. **CAUTION: Air Pressure should not be used to remove the pistons from the body.** Clean and inspect the piston teeth for signs of wear. Replace piston if wear seems excessive.
- B. Remove piston o-ring seal (16) using a screwdriver. Remove the piston head (15) and piston back (5) bearings. Discard bearings if replacing all soft parts.

5. Drive Shaft (60) and Bearing (6, 7) Disassembly, (Figure 7):

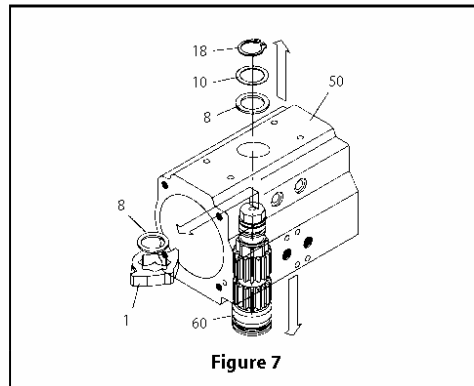


Figure 7

- A. Remove spring clip (18) carefully, using snap-ring pliers. Remove external thrust bearing (8) and thrust washer (10).
- B. Apply downward force to top of drive shaft (60) until it is partially out of the bottom of the body (50) and the octi-cam (1) and internal thrust bearing (8) can be removed. Remove the octi-cam (1) and internal thrust bearing (8). Push the drive shaft (60) completely out of the bottom of the body (50). If the shaft (60) does not move freely, gently tap with a plastic mallet.
- C. Remove the top and bottom shaft bearings (6, 7) and top and bottom shaft o-rings (21, 22). Discard if replacing all soft parts.

6. Cleaning and Inspection.

- A. When all components are disassembled, those not being replaced should be properly cleaned and inspected for wear prior to re-assembly.

4.3 Assembly

Prior to assembly, ensure that all components are clean and undamaged.

NOTE: (Table 2) lists the recommended VALV-POWER lubricants.

TABLE 2	
Recommended VPVL Lubricants	
General Use	Kluber UniGear LA 02 Grease
	Esso (Exxon) Beacon EP2
	Fina Marson EP L2
	Shell Alvania EP2
	Mobilux EP2
	Dyrdene Pyroplex EP2
O-Ring Areas	Oilsum Multiplex
	Dow-Corning Silicone 111

1. Drive Shaft (60) Assembly, (Figures 8 & 9):

- A. Install the top and bottom shaft bearings (6, 7) and o-rings (21, 22) onto the shaft (60).

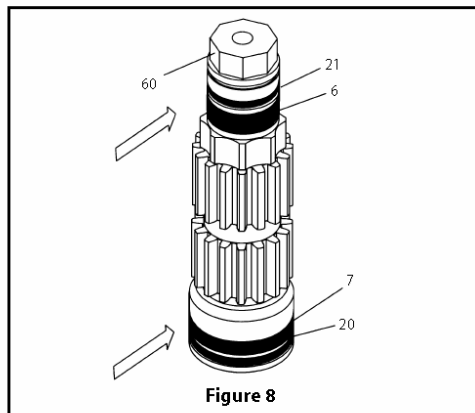


Figure 8

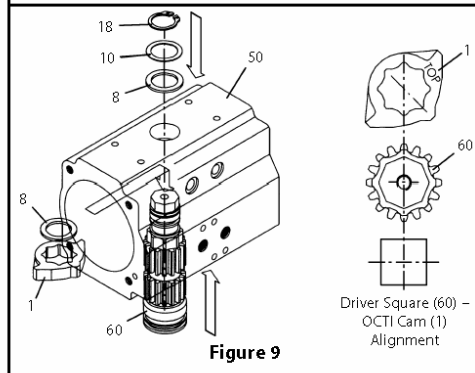


Figure 9

- B. Apply grease to the shaft bearings (6, 7), using a general purpose grease listed in (Table 2). Apply silicone grease to the shaft o-rings (21, 22) using the recommended o-ring-area grease listed in (Table 2).

- C. Partially Insert the shaft (60) into the body (50). Install the octi-cam (1) onto the shaft in the orientation shown in (Figure 9). The edges of the octi-cam (1) should align with the edges of the square in the bottom of the shaft (60). Insert the internal thrust bearing (8) over the octi-cam (1). Fully insert the shaft into the body (50).

- D. Install the external thrust bearing (8), thrust washer (10), and the spring clip (18).

2. Piston (40) Assembly, (Figures 10 through 13):

- A. Install the piston o-ring seal (16) and the piston head (15) and piston back (5) bearings.
- B. Apply silicone grease to the internal bore of the body (50) using a recommended o-ring area grease listed in (Table 2). Apply grease to the piston (40) rack teeth using a recommended general-purpose grease listed in (Table 2).
- C. Hold the body (50) in a horizontal position by inserting the top of the shaft in a vice, or inserting the bottom of the shaft connection into a male drive fitted into a vice as shown by (Figure 10).

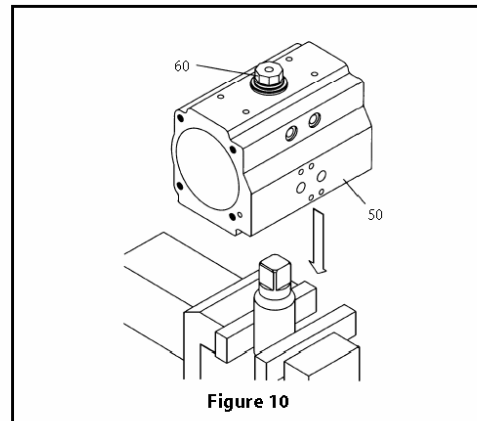
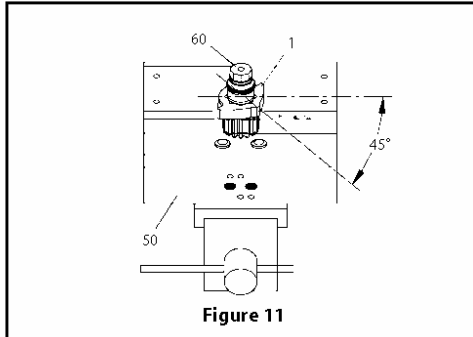


Figure 10

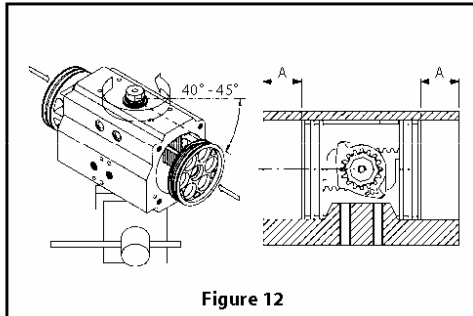
- D. Ensure that the octi-cam (1) is in the correct position as shown by (Figure 11).

- E. For standard-rotation assembly (clockwise to close) rotate the body (50) 40-45° counterclockwise (if viewing the bottom of the actuator), or clockwise (if viewing the top of the actuator) as shown in (Figure 12).

- F. Press the two pistons (40) simultaneously into the body (50) until the piston racks are engaged and rotate the body clockwise (if viewing the bottom of the actuator), or counter-clockwise (if viewing the top of the actuator), until the stroke is completed.



G. To ensure that the piston (40) teeth are evenly engaged, fully compress both pistons (40) inward and measure the distance from the edge of the body to the piston (40) face on each side, shown as dimension "A" in (Figure 12). If a different value is obtained on each side, remove the pistons and repeat from step 2d.

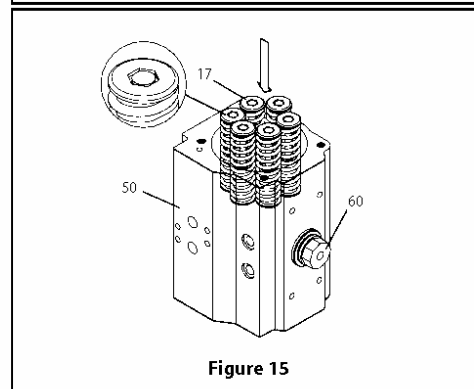
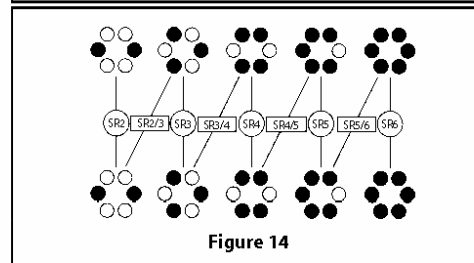
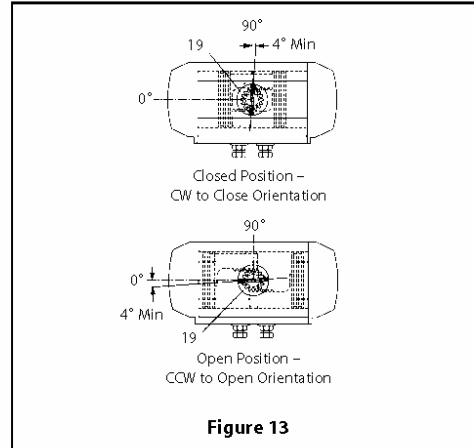


H. Temporarily install the position indicator (19) onto the shaft (60) to determine whether the correct stroke is obtained. Verify that the slot in the top of the position indicator (19) will rotate a minimum of 4° beyond the 90° vertical centerline of the actuator body (50) and a minimum of 4° beyond the 0° horizontal centerline of the actuator body as shown in (Figure 13). If the proper stroke is not obtained, remove the pistons and repeat from step 2d. Once the proper stroke is verified, remove the position indicator (19).

3. End Cap (30, 31) and Spring Cartridge (17) Assembly, (Figures 14 through 16):

NOTE: In Models VPVP550 through 800 the end caps are symmetrical and use two item (30)s.

A. For spring-return actuators, insert the proper quantity of spring cartridges (17) according to the pattern shown in (Figure 14) (referring to the total number of springs). Insert spring cartridges (17) as shown in (Figure 15).



B. Apply silicone grease to the end-cap o-ring seals, using the recommended o-ring-area grease listed in (Table 2). Fit the end-cap o-ring seals (14) into the groove in each end cap (30, 31).

C. Fit the end caps (30, 31) onto the body (50), verifying that the o-ring seals (14) remain in the grooves.

D. Insert all end-cap screws (13) and hand tighten. Complete tightening by following the sequence indicated in (Figure 16).

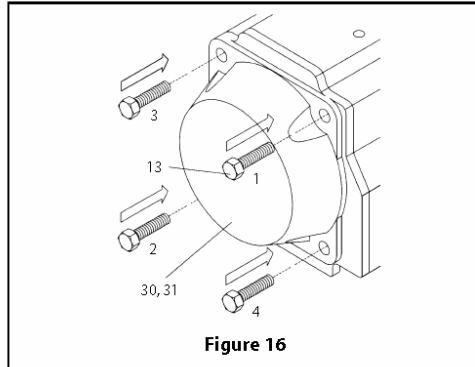


Figure 16

4. Assembly of Stop Screws (2) and Stroke Adjustment. (Figure 17):

- A. Insert the nut (4), washer (3), and o-ring (11) onto the stop screws (2).
- B. Screw the stop screws (2) into the body (50).

5. External Travel Stop Adjustment, (Figure 17):

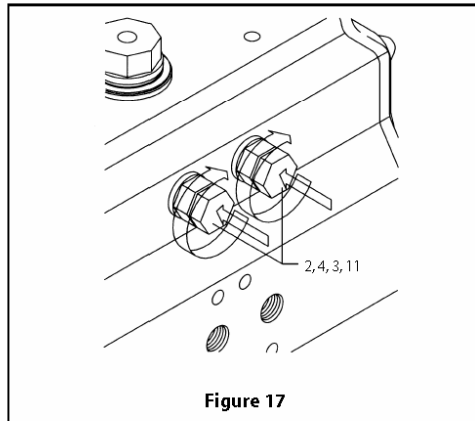


Figure 17

The stop adjustment screw (2) to the right controls the clockwise end of travel. The stop adjustment screw (2) to the left controls the counter-clockwise end of travel.

- A. Cycle the actuator/valve to the clockwise end of travel and measure to determine if the valve is in the proper position. (In most applications this will be fully closed.)
- B. If the valve is not in the correct clockwise position, turn the right stop adjustment screw (2) IN to reduce actuator travel, or OUT to increase actuator travel.
- C. When the correct clockwise position is obtained, hold the adjusting screw (2) stationary while tightening the lock nut (4).

- D. Cycle the actuator/valve to the counter-clockwise end of travel and measure to determine if the valve is in the proper position. (In most applications this will be fully opened.)
- E. If the valve is not in the correct counter-clockwise position, turn the left stop adjustment screw (2) IN to reduce actuator travel, or OUT to increase actuator travel.
- F. When the correct counter-clockwise position is obtained, hold the adjusting screw (2) stationary while tightening the lock nut (4).

6. Position Indicator (19, 39) Assembly. (Figure 18):

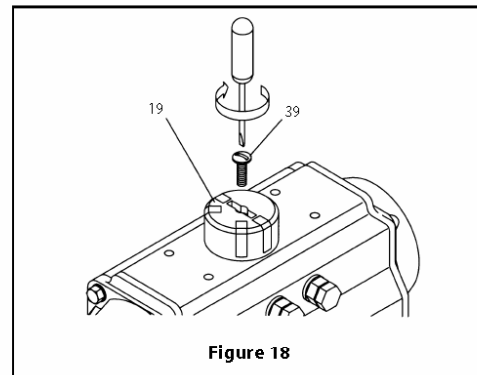


Figure 18

- A. Fit position indicator (19) on the shaft (60), verifying that it indicates the correct actuator position.
- B. Tighten cap screw (39) to secure the position indicator.

7. Setting 100% Adjustable Stop (If applicable). (Figure 19):

To limit the rotation on the stroke beyond the standard $\pm 4^\circ$ of a VPVL actuator, a stainless steel 100% adjustable travel stop option can be added. The stops, located in the end caps, allow the valve position to be set anywhere between full closed and full open. This option limits travel of only the counter-clockwise stroke for standard double-acting and spring-closed units.

Follow the proceeding steps in order to set the 100% adjustable travel stops.

Double Acting Actuators:

- A. Back off one travel stop screw, leaving it partially threaded in the end cap. Entirely remove the other stop screw from the other end cap.
- B. Open valve using air pressure. **NOTE:** actuator will leak due to removed travel stop.
- C. Use the indicator pointer on top of actuator to determine if valve is open to desired position. If

not, repeat steps 1-3, backing off or screwing in stop screw to attain proper open position of valve.

- D. Make sure O-ring is in proper position in countersunk area on end cap and the washer is in place. Tighten down nut to set stop position.
- E. Thread in the other travel stop, making sure the O-ring and washer are in the correct place. When the travel stop will not thread any further, tighten nut to set stop position.
- F. The previous steps set the open travel stop. See section 4.5 for instructions on setting the close position stop.

Spring Return Actuators:

- A. Back off one travel stop screw, leaving it partially threaded in the end cap. Entirely remove the other stop screw from the other end cap.
- B. Open valve using air pressure. Note actuator will leak due to removed travel stop.
- C. Keeping air pressure applied to actuator, use the indicator pointer on top of actuator to determine if valve is open to desired position. If not, remove air pressure and repeat steps 1-3, backing off or screwing in stop screw to attain proper open position of valve.

D. Make sure O-ring is in proper position in countersunk area on end cap and the washer is in place. Tighten down nut to set stop position.

E. Thread in the other travel stop, making sure the O-ring and washer are in the correct place. When the travel stop will not thread any further, tighten nut to set stop position.

F. The previous steps set the open travel stop. See section 4.5 for instructions on setting the close position stop.

5 ACTUATOR STORAGE

If the actuators are not for immediate use, the following precautions must be taken for storage:

- A. Store in a dry environment
- B. It is recommended that the actuator be stored in its original box.
- C. Do not remove the plastic plugs on the air supply ports.

6 REPAIR KITS/SPARE PARTS

For further information on spare parts and service or assistance visit our web-site at www.Jamesbury.com.

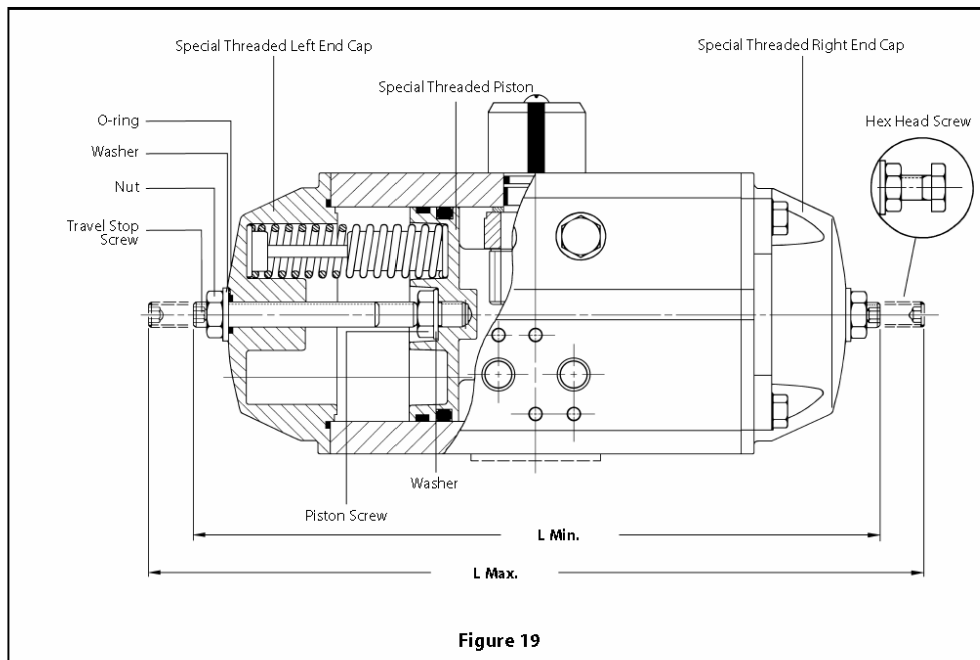


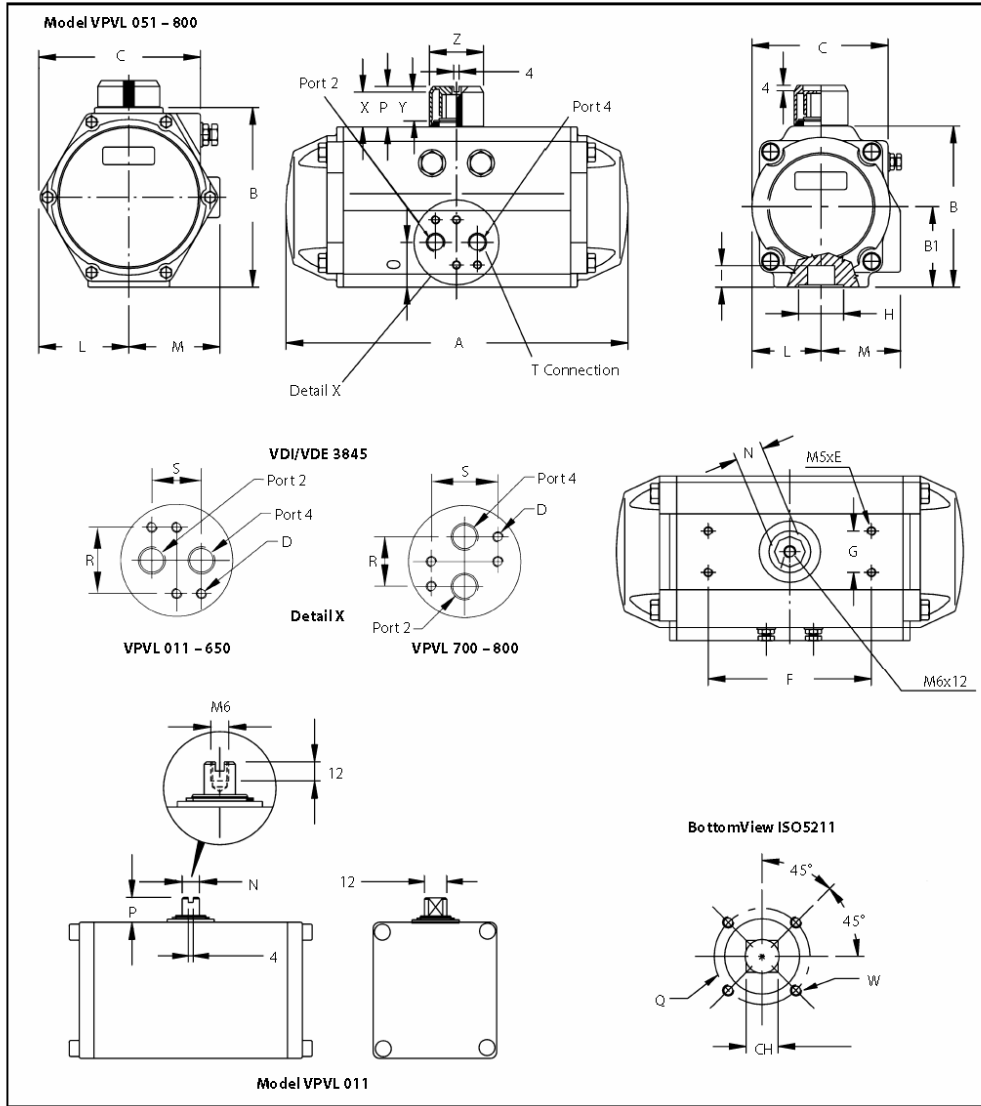
Figure 19

TABLE 3					
PARTS LIST FOR (FIGURE 20)					
Number	Quantity	Description	Material	Specifications	Corrosion Protection
1	1	Octi-Cam (Stop Arrangement)	1.4021/GS400-15 ¹	EN 10088-3/ISO 1083 ¹	
2	2	Stop Cap Screw	B8 Cl.2	ASTM A193	
3	2	Washer (Stop Cap Screw)	A2	ISO 3506	
4	2	Nut (Stop Cap Screw)	A2-70	ISO 3506	
5*	2	Bearing (Piston Back)	PPA	Amodel ET1001HS	
6*	1	Bearing (Pinion Top)	PA46	Stanyl TW300	
7*	1	Bearing (Pinion Bottom)	PA46	Stanyl TW300	
8*	2	Thrust Bearing (Pinion)	PPA	Amodel ET1001HS	
9*	2	Plug (Transfer Port)	NBR	NBR 70 Shore A	
10	1	Thrust Washer (Pinion)	1.4301	EN 10088-3	
11*	2	O-Ring (Stop Cap Screw Seal)	NBR	NBR 70 Shore A	
12	2	Piston Guide	PPA+45%GF	Amodel AS1145	
13	8/12 ²	Cap Screw (End Cap)	A2-70	ISO 3506	
14*	2	O-Ring (End Cap)	NBR	NBR 70Shore A	
15*	2	Bearing (Piston Head)	PPA	Amodel ET1001HS	
16*	2	O-Ring (Piston)	NBR	NBR 70Shore A	
17	min. 4/ max. 12	Spring (Cartridge)	SiCr Spring Alloy Steel	DIN 1223 Part 2	Epoxy Coated
18	1	Spring Clip (Pinion)	C75	DIN 17222	ENP
19	1	Position Indicator	PP+30%GF	Hostalen PPN VP7790 GV 2/30	
20*	1	O-Ring (Pinion Bottom)	NBR	NBR 70Shore A	
21*	1	O-Ring (Pinion Top)	NBR	NBR 70Shore A	
30	1 ³	Right End Cap	GD-AISI8.5Cu3.5FE	UNI S075	Polyester Coated
31	1 ³	Left End Cap	GD-AISI8.5Cu3.5FE	UNI S075	
39	1	Cap Screw (Indicator)	A2-70	ISO 3506	
40	2	Pistons	GD-AISI8.5Cu3.5FE	UNI S075	Anodized
41	1	Actuator Identification Label	Polyester Aluminum		
42	2	End Cap Label	Polyester Aluminum		
50	1	Body	Alloy 6063	ASTM B221	Anodized PTFE Coated
60	1	Drive Shaft	A105	ASTM A105	ENP
* Suggested spare parts for maintenance					
(1) AISI420 for models VPVL-050 through 300 GS400-15 for models VPVL-350 through 800					
(2) Quantity - 8 pieces for models VPVL-050 through 600 Quantity - 12 pieces for models VPVL-700 through 800					
(3) Only for models VPVL-500 through 800; right and left end-caps are symmetric					

8 OUTLINE AND DIMENSIONS

Size	Dimensions- inches / lb.																	Weight DA SR									
	A	B	B1	C	D	E	F	G	H	I	L	M	N	O	P	Q	R		S	W	X	Y	T NPT	ISO Flange	CH	Z	
011	4.50	1.70	0.00	1.70	M5x4	0.30	1.90	0.90	0.79	0.39	0.80	0.80	0.30	-	0.70	1.40	1.26	0.94	M5	-	-	1/8	F03	0.35	-	1.0	
051	5.53	2.72	1.36	2.32	M5x8	0.16	3.15	1.18	0.98	0.47	1.14	1.63	0.43	.04	0.79	1.40	1.26	0.94	M5	0.57	0.31	1/8	F03	0.43	1.57	2.1	2.3
100	6.24	3.35	1.67	2.83	M5x8	0.31	3.15	1.18	1.38	0.63	1.42	1.85	0.43	.18	0.79	1.97	1.26	0.94	M6	0.57	0.31	1/8	F05	0.55	1.57	3.3	3.8
200	8.29	4.02	2.01	3.33	M5x8	0.31	3.15	1.18	1.38	0.63	1.67	2.05	0.75	.20	0.79	1.97	1.26	0.94	M6	0.57	0.31	1/8	F05	0.55	1.57	5.9	7.0
250	9.74	4.53	2.26	3.84	M5x8	0.31	3.15	1.18	2.17	0.83	1.95	2.24	0.75	.28	0.79	2.76	1.26	0.94	M8	0.57	0.31	1/8	F07	0.75	1.57	8.4	9.7
300	10.57	5.00	2.50	4.37	M5x8	0.31	3.15	1.18	2.17	0.83	2.20	2.64	0.75	.48	0.79	2.76	1.26	0.94	M8	0.57	0.31	1/4	F07	0.75	1.57	11.9	14.3
350	12.40	5.71	2.85	5.00	M5x8	0.31	3.15	1.18	2.76	0.94	2.52	3.03	1.06	.67	1.18	4.02	1.26	0.94	M10	0.96	0.57	1/4	F10	0.87	2.20	18.5	21.7
400	13.58	6.18	3.09	5.35	M5x8	0.31	3.15	1.18	2.76	0.94	2.74	3.23	1.06	.77	1.18	4.02	1.26	0.94	M10	0.96	0.57	1/4	F10	0.87	2.20	22.5	27.8
450	16.08	6.97	3.88	6.16	M5x8	0.31	3.15	1.18	3.35	1.38	3.15	3.60	1.06	.85	1.18	4.92	1.26	0.94	M12	0.96	0.57	1/4	F12	1.06	2.56	32	40
500	17.22	7.72	3.86	6.65	M5x8	0.31	3.15	1.18	3.35	1.38	3.46	3.90	1.06	2.05	1.18	4.92	1.26	0.94	M12	0.96	0.57	1/4	F12	1.06	2.56	44	53
550	19.17	8.68	4.39	7.51	M5x8	0.31	5.12	1.18	3.94	1.57	3.90	4.13	1.65	2.28	1.97	5.51	1.26	0.94	M16	1.75	0.79	1/4	F14	1.42	3.15	55	70
600	21.38	9.65	4.80	8.39	M5x8	0.31	5.12	1.18	3.94	1.57	4.33	4.41	1.65	2.44	1.97	5.51	1.26	0.94	M16	1.75	0.79	1/4	F14	1.42	3.15	78	99
650	24.45	11.75	5.93	9.88	M6x10	0.31	5.12	1.18	5.12	1.89	5.16	5.16	1.65	3.09	1.97	6.50	1.77	1.57	M20	1.75	0.79	3/8	F16	1.81	3.15	115	139
700	26.93	12.99	6.50	11.75	M6x10	0.31	5.12	1.18	5.12	1.97	6.44	6.54	1.65	6.50	1.97	6.50	1.77	1.57	M20	1.75	0.79	1/2	F16	1.81	3.15	183	225
800	34.39	16.14	6.50	15.08	M6x10	0.31	5.12	1.18	7.87	2.24	8.03	8.43	1.65	7.28	1.97	10.00	1.57	1.77	M16	1.75	0.79	1/2	F25	2.17	3.15	295	373

Size	Dimensions- mm / kg																	Weight DA SR									
	A	B	B1	C	D	E	F	G	H	I	L	M	N	O	P	Q	R		S	W	X	Y	T NPT	ISO Flange	CH	Z	
011	114	43	0.0	43	M5x4	8	48	23	20	10	20	20	8	-	18	36	32	24	M5	-	-	1/8	F03	9	-	0.45	
051	140	69	34.5	59	M5x8	4	80	30	25	12	29	41	11	26	20	36	32	24	M5	14.5	8.0	1/8	F03	11	40	0.95	1.04
100	158	85	42.5	72	M5x8	8	80	30	35	16	36	47	11	30	20	50	32	24	M6	14.5	8.0	1/8	F05	14	40	1.5	1.7
200	211	102	51.0	85	M5x8	8	80	30	35	16	42	52	19	30	20	50	32	24	M6	14.5	8.0	1/8	F05	14	40	2.7	3.2
250	247	115	57.5	98	M5x8	8	80	30	55	21	50	57	19	33	20	70	32	24	M8	14.5	8.0	1/8	F07	19	40	3.8	4.4
300	268	127	63.5	111	M5x8	8	80	30	55	21	56	67	19	38	20	70	32	24	M8	14.5	8.0	1/4	F07	19	40	5.4	6.5
350	315	145	72.5	127	M5x8	8	80	30	70	24	64	77	27	42	30	102	32	24	M10	24.5	14.5	1/4	F10	22	56	8.4	9.8
400	345	157	78.5	136	M5x8	9	80	30	70	24	70	82	27	45	30	102	32	24	M10	24.5	14.5	1/4	F10	22	56	10	13
450	408	177	98.5	156	M5x8	8	80	30	85	35	80	91	27	47	30	125	32	24	M12	24.5	14.5	1/4	F12	27	65	15	18
500	437	196	98.0	169	M5x8	8	80	30	85	35	88	99	27	52	30	125	32	24	M12	24.5	14.5	1/4	F12	27	65	20	24
550	487	220	111.5	191	M5x8	8	130	30	100	40	99	105	42	58	50	140	32	24	M16	44.5	20.0	1/4	F14	36	80	25	32
600	543	245	122.0	213	M5x8	8	130	30	100	40	110	112	42	62	50	140	32	24	M16	44.5	20.0	1/4	F14	36	80	35	45
650	621	298	150.5	251	M6x10	8	130	30	130	48	131	131	42	78	50	165	45	40	M20	44.5	20.0	3/8	F16	46	80	53	64
700	684	330	165.0	298	M6x10	8	130	30	130	50	164	166	42	165	50	165	45	40	M20	44.5	20.0	1/2	F16	46	80	83	102
800	876	410	165.0	383	M6x10	8	130	30	200	57	204	214	42	185	50	254	40	45	M16	44.5	20.0	1/2	F25	55	80	134	169



Metso Automation, Field Systems Division

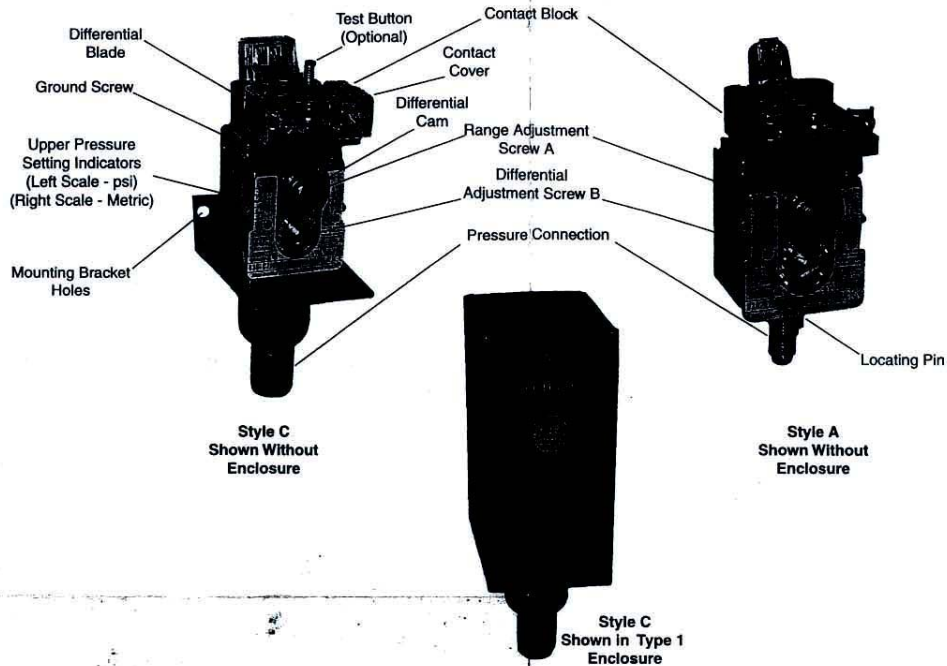
Europe, Levytie 6, P.O.Box 310, 00811 Helsinki, Finland. Tel. int. +358 20 483 150. Fax int. +358 20 483 151
Europe (UK), 8 Pipers Wood Industrial Park, Waterlooville, Hampshire PO7 7XU UK. Tel. int. +44 (0)23 9223 8500. Fax int. +44 (0)23 9223 8510
North America, 44 Bowditch Drive, P.O.Box 8044, Shrewsbury, Massachusetts, 01545-8044 USA. Tel. int. +1 508 852 0200. Fax int. +1 508 852 8172
Latin America, Av. Central, 181- Cháracas Reunidas, 12238-430, São Jose dos Campos. Tel. int. +55 12 335 3500. Fax int. +55 12 335 3535
Asia Pacific, 501 Orchard Road, #05-09 Wheelock Place, 238880 Singapore. Tel. int. +65 735 5200. Fax int. +65 735 2955
www.jamesbury.com





**BULLETIN 836
INSTRUCTIONS**

Pressure Controls



DESCRIPTION - Bulletin 836 Pressure Controls are designed for use with air, water, oil and other noncorrosive liquids, vapors, and gasses. (Type 316 stainless steel bellows are available for more corrosive liquids or gasses in pressure ranges to 375 psi.)

Bulletin 836 Controls are available in Type 1, 4 & 13, 4X, 7 & 9, 4 & 13 combination enclosures in addition to open type. The operating range pressure and differential are adjustable. Fixed differential versions are also available. Pressure ranges available from 30 in. Hg vacuum to 900 psi.

The standard contact block is single pole, double throw and can be wired to open or close on increasing or decreasing pressure.

OPERATION - A low friction, straight in-line mechanism operates a snap action switch at a predetermined pressure setting. An increase in pressure causes the normally closed circuit A-B to open and normally open circuit B-C to close. This is known as the "Trip" pressure. When the pressure returns to a lower predetermined setting, the circuit A-B will close and circuit B-C will open. This is known as the "Reset" pressure. The difference between the "Trip" and "Reset" pressure is the differential.

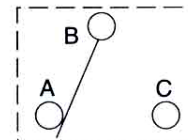
For controls which operate in a vacuum, the following sequence occurs: 1) an increase in vacuum (lower pressure toward 30 in Hg) causes circuit A-B to close and B-C to open. This is the "Trip" setting. 2) when the pressure returns to a predetermined lower vacuum (higher pressure toward 0 psi.), circuit A-B will open and B-C will close. This is the "Reset" point. The difference between the "Trip" and "Reset" setting is the differential.

CONTACT RATINGS

Non-Inductive Ratings	Control Circuit Ratings
5 Amperes, 250 Volts	AC-125 VA 24 to 600 Volts
3 Amperes, 600 Volts	DC-57.5 VA 115 to 230 Volts

Manual reset, horsepower rated and other contact block modifications are also available on devices manufactured at the factory.

40060-217-01 (5)
Printed in U.S.A.



**Standard Contact Arrangement
For Positive Pressure**

ADJUSTMENT - Generally, unless otherwise specified, controls shipped from the factory are set at the maximum operating range pressure and minimum differential.

The following procedure should be used to set the control to a particular requirement:

OPERATING RANGE ADJUSTMENT: Turn range adjustment Screw "A" counterclockwise to lower the upper and lower pressure settings. To increase the upper and lower settings, turn Screw "A" clockwise. The approximate upper pressure setting is shown by indicators on the outer edges of the nameplate.

DIFFERENTIAL ADJUSTMENT: When the differential blade is at the low point of the differential cam the control will function at minimum differential. To increase the differential, turn adjustment Screw "B" counterclockwise. This will decrease the lower pressure setting only. To decrease the differential, turn differential adjustment Screw "B" clockwise. This will raise the lower setting only.

Condensed instructions are supplied with open style controls and are on the inside of the cover of enclosed devices.

NOTE: The use of a pressure gauge is desirable when setting the control.

CAUTION: The range adjustment Screw "A" should not be adjusted beyond the pressure indicated on the pressure scale as this may cause the control to malfunction.

It is recommended that a periodic inspection of gauge pressure be made and the pressure control adjusted to compensate for application variables.

BELLOWS LIFE: The pressure applied to a bellows in a normal cycle of operation should not exceed the maximum rated Range Pressure. The bellows will withstand the rated Maximum Line Pressure but should not be cycled at this pressure. The control is designed to operate within published rated Range Pressure. For general applications a control used within 30% to 80% of Range Pressure will provide optimum bellows life and repeatability.

IMPORTANT: Bulletin 836 Style A pressure controls are normally supplied with a built in pulsation snubber. Bulletin 836 Style C devices are supplied with a removable snubber. The snubber can be removed for inspection, cleaning, or when using the control with high viscosity fluids. The snubber can be removed with a 1/4 inch nut wrench, or equivalent.

The pulsation snubber is designed to help reduce pressure transients. Transients can vary in amplitude, frequency, and duration and if not controlled with a snubber can reduce bellows life.

Pressure systems and lines must be maintained and kept free of foreign particles in air lines and sludge in fluid lines. A restricted or clogged pulsation snubber can cause the pressure control to become inoperative.

MOUNTING: The pressure control should be mounted securely to a firm base using two mounting screws. The mounting holes are provided either in the base of the enclosure or in a convenient mounting bracket which is provided as part of the open Style C control. Mounting brackets are available for the open type Style A control.

CAUTION: The control should not be supported by the electrical and pressure connections only. A support wrench should be used when tightening the electrical hub and pressure connections. The enclosed device or open type control using a mounting bracket is not intended to support connecting equipment. This equipment must be secured to support weight and to reduce vibration.

CAUTION: If a liquid thread sealant is used on the pressure connection, care must be taken to avoid excess sealant from getting into bellows orifice.

PILOT LIGHT OPTION - A high intensity neon glow pilot light is available for 120 volt, 60 hertz applications. A 24 volt DC LED pilot light is also available. The pilot light is factory wired across the N.C. contacts, circuit A-B and can easily be converted to the N.O. contacts, circuit B-C, on the standard contact block.

Unless a third wire is made available, the pilot light is connected across the load contacts which can be either the N.O. or N.C. contacts. The pilot light is on until the load is energized.

Current rating:
120 VAC high intensity neon glow 4 mA
24 VDC high intensity LED 22 mA

ATTENTION - To prevent electrical shock, disconnect from power source before installing or servicing.

CAUTION - For 24 VDC LED pilot lights, polarity must be observed. Red (+) lead of pilot light should always be connected to rear terminal (B)

To order pilot light version add X9 (120VAC), X15 (24VDC) or X18 (24VDC) to catalog number of the selected control.

REPAIRS - Due to the integral construction of the Bulletin 836 Pressure Control, only limited repairs can be made in the field. If returned to the factory for repairs, the condition of the control will be evaluated to determine economic feasibility. When practical, the control will be repaired, factory adjustments made for optimum performance and tested to specifications.

CONTACT BLOCK REPLACEMENT - To order the Bulletin 836 Contact Block replacement Kit, specify Catalog Number 836-N2.

**Rockwell
Automation**

MATERIAL SAFETY DATA SHEET

I. PRODUCT IDENTIFICATION

Trade name (as labeled) DURABLA BLACK (Compressed Gasket Material)

MANUFACTURER'S NAME DURABLA MANUFACTURING COMPANY

Address (complete mailing address): 140 Sheree Blvd., P. O. Box 700, Lionville, PA 19341

Phone number for additional information: 610-363-8900

Date prepared or revised 9/15/94 (REV) Name of preparer*

II. HAZARDOUS INGREDIENTS

Chemical Names	CAS Numbers	Percent*	Exposure Limits in Air (give units)		
			ACGIH TLV	OSHA PEL	Other (specify)
Chrysotile Asbestos	1332-21-4	Approx. 80%	0.2 f/cc	0.2 f/cc	

III. PHYSICAL PROPERTIES

Vapor density (air=1) N/A Melting point or range, °F N/A

Specific gravity 1.9 Boiling point or range °F N/A

Solubility in water Insoluble Evaporation rate (butyl acetate = 1) N/A

Vapor pressure, mmHg at 20 °C N/A

Appearance and odor: Asbestos is white and odorless, but is contained in a Styrene-butadiene or Nitrile (NBR) rubber binder which may be black or slate gray.

HOW TO DETECT THIS SUBSTANCE* (warning properties of substance as a gas, vapor, dust or mist)

*Not a required category

Note: All required categories should be addressed. If any item is not applicable, or no information is available, the space must be marked to indicate that.

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IV. FIRE AND EXPLOSION

Flash Point, °F (give method) N/A
 Auto Ignition temperature, °F N/A
 Flammable limits in air, volume %: N/A lower (LEL) N/A upper (UEL) N/A
 Fire extinguishing materials:
 water spray carbon dioxide _____ other:
 foam dry chemical
 Special firefighting procedures: Non-combustible material. Type of fire will determine extinguishing material to be used.

Unusual fire and explosion hazards: Direct flame may ignite. Material contains rubber, which will burn slowly, emitting thick smoke. Self-contained breathing apparatus should be worn.

V. HEALTH HAZARD INFORMATION

SYMPTOMS OF OVEREXPOSURE for each potential route of exposure

Inhaled: Early symptom of asbestos overexposure may be reduced breathing capacity.
 Contact with skin or eyes: Not probable route of overexposure.
 Absorbed through skin: Not probable route of overexposure.
 Swallowed: Not probable route of overexposure.

HEALTH EFFECTS OR RISKS FROM EXPOSURE. Explain in lay terms. Attach extra page if more space is needed.

Acute: None
 Chronic: Exposure to high concentrations of asbestos dust increases risk of developing lung disease. Smokers are at greater risk.

FIRST AID: EMERGENCY PROCEDURES

Eye Contact: N/A
 Skin Contact: N/A
 Inhaled: N/A
 Swallowed: N/A

SUSPECTED CANCER AGENT?

_____ NO: This product's ingredients are not found in the lists below.

YES: Federal OSHA NTP IARC

California employers using Cal/OSHA - regulated carcinogens must register with Cal/OSHA. The Cal/OSHA and Federal OSHA carcinogen lists are similar.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE

Asbestos may aggravate some medical conditions. For example, workers with emphysema can be affected.

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VI. REACTIVITY DATA

Stability: Stable Unstable

Conditions to avoid:

Incompatibility (materials to avoid): No known substances that reaction to would constitute a health hazard. Refer to product literature for application related limitations.

Hazardous decomposition products (including combustion products): None

Hazardous polymerization: May occur Will not occur

Conditions to avoid: None

VII. SPILL, LEAK AND DISPOSAL PROCEDURES

Spill response procedures (include employee protection measures):

During removal, the used gasket should be wetted and its residue placed in impermeable bags for disposal. Small particles should be vacuumed with an approved system.

Preparing wastes for disposal (container types, neutralization, etc.):

Regular methods

NOTE: Dispose of all wastes in accordance with federal, state and local regulations.

VIII. SPECIAL HANDLING INFORMATION

Ventilation and engineering controls: Provide adequate ventilation if PEL/TLV is exceeded.

Respiratory protection (type): Unnecessary under normal use. However, approved (non-disposable) respirators are necessary if permissible exposure levels (PEL/TLV) are exceeded. Refer to 29 CFR 1910.1001 for respirator selection.

Eye protection (type): Unnecessary under normal use.

Gloves (specify material): Normally not required.

Other clothing and equipment: Unnecessary under normal conditions.

Work practices, hygienic practices: The storage, handling or cutting of Durabla Black gasket material with a sharp blade or die, or the installation of a cut gasket, will not emit asbestos fibers in excess of the current OSHA action level limit. In removing a used gasket, we recommend using a gasket removal agent. If the user has reason to believe that asbestos fibers have been released, clean-up should be accomplished by using a vacuum cleaner equipped with a HEPA filter. No smoking, eating or drinking in work areas. Processes using drilling, grinding or sawing must be avoided.

Other handling and storage requirements: Store material in dry, ventilated areas.

Protective measures during maintenance of contaminated equipment:

Do not drill, saw, grind, sand or subject material to any dust-producing process without adequate dust extraction or wetting down. Approved respirators should be worn during operations which will release asbestos fibers in excess of PEL/TLV limits.

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