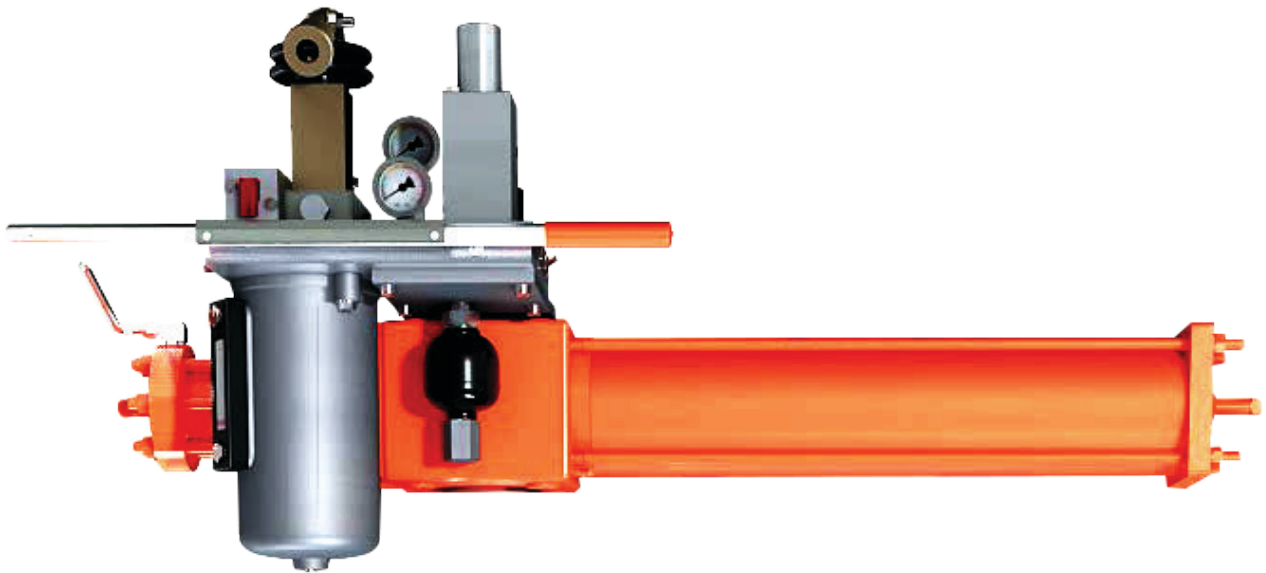


Bettis™ PressureGuard™ Self-Contained Hydraulic Emergency Shutdown Systems

For Rotary or Non-API 6A Linear Valves



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Section 1: Safety Warning

All personnel involved should read and understand all applicable sections of this manual before attempting to install, operate, service, or perform maintenance on any operators. Adhere to any tags, warning labels, or instructions presented on the operator. These may provide more specific and significant information regarding the operator than this general manual can.

It is the responsibility of the user to ensure proper safety. Always take necessary precautions and utilize proper personal protective equipment when dealing with compressed air, compressed hydraulic fluid, pinch points, and electricity.

It is necessary to rig and lift valve and operator separately. Service personnel need to ensure the lifting capacity of the crane/hoist/rigging is appropriate for the desired load.

Block the signal pressure supply if present and depressurize the system before attempting to install or service.

Caustic gases and fluids may be contained in the operators and valves in most applications. Vent all poisonous or flammable gases and store all liquids in a safe location to prevent personnel injury. Discharge at sonic velocity may occur when venting or releasing pressure; service personnel must utilize proper hearing protection.

The following are general instructions since there are variations of linear operators and valves. It is critical to install the operator properly so that performance and safety are guaranteed. Any technicians using the following instructions must be trained and knowledgeable regarding valve operators and valves.

It is required to go through the above instructions which will help to prevent personnel injury, property damage, and damage to operator.

Safety notices (Warning, Caution, and Note) are presented in this manual in three forms:

WARNING

If not observed, user incurs a high risk of severe damage to operator and/or fatal injury to personnel.

CAUTION

If not observed, user may incur damage to operator and/or injury to personnel.

NOTE:

Advisory and informational comments provided to assist maintenance personnel to perform maintenance procedures.

Please refer to the applicable section for details and further information.

Section 2: Introduction

2.1 General Service Information

Bettis™ PressureGuard™ is a self-contained hydraulic Emergency Shutdown (ESD) system. It is designed to provide reliable valve shutdown on production wellheads in remote locations where automatic local valve ESD is required, but a power source is not available and/or local supervision is minimal.

Available as a complete, tailored-solution, Bettis PressureGuard usually consists of a self-contained hydraulic module, a hydraulic operator, and application-specific shutdown trigger accessories. PressureGuard™ systems can be configured for rotary hydraulic operators for use with ball, plug, and other quarter-turn valves, as well as non-6A linear-operated valves. A variety of shutdown trigger controls including pressure pilots, solenoid valves, and a temperature-sensing fusible plug are available to suit application requirements. Instructions for installing Bettis PressureGuard system are provided in Section 5, (Installation).

Under normal conditions, Bettis PressureGuard maintains the valve in its operational position by resisting the spring force with hydraulic fluid pressure. In an event requiring automatic ESD valve operation, the PressureGuard™ employs a control component to shift hydraulic fluid from the valve operator to an internal reservoir. Without fluid pressure, the compressed spring in the operator moves the valve to its shutdown position. Further information on the operation of Bettis PressureGuard is provided in Section 4, (Operation).

Through robust design and quality construction, minimal maintenance is required of Bettis PressureGuard. The ESD system is shipped fully-lubricated and serviced. Depending upon service type, a varying degree of maintenance is required and will be detailed subsequently in Section 6, (Maintenance). Troubleshooting guide is also provided in Section 6.2, (Troubleshooting) in an unlikely event the ESD system displays a problem.

Additional drawings and valve-specific information is provided in Appendix C (List of Drawings).

2.2 Definition of Terms

The abbreviations included in this IOM are listed in the table below:

Table 1. Definition of Terms

Abbreviated Term	Definition
IOM	Installation, Operation, and Maintenance
SCH	Self-Contained Hydraulic
ESD	Emergency Shutdown
GVO	Gate Valve Operator Series
FS	Fail-Safe
SR	Spring-Return
HP	High Pressure
LP	Low Pressure
MAWP	Maximum Allowable Working Pressure
ID	Inside Diameter
OD	Outside Diameter

2.3 Scope

This manual is a resource for technicians involved in the installation, operation, and maintenance of Bettis PressureGuard. It serves as a guide and must be thoroughly understood prior to any work on the operators such as installation, operation, or maintenance. For any questions, please contact the manufacturer.

Section 3: Storage Instructions

Proper storage is required when the operator will not be used immediately.

1. Remove all dirt, dust, grease, and contaminants from any exposed, unpainted surface (for example, Drive Rod OD, Yoke ID) by using a soft cloth dampened with an appropriate oil based solvent. Avoid using abrasive material when cleaning rod surfaces.
2. Lightly grease any exposed, unpainted surfaces.
3. Any plastic plugs used to plug the pressure ports during assembly should be removed and replaced with steel plugs. All controls should also be plugged with steel plugs.

NOTE:

Sealants such as pipe dope or Teflon tape should be applied to steel plug threads.

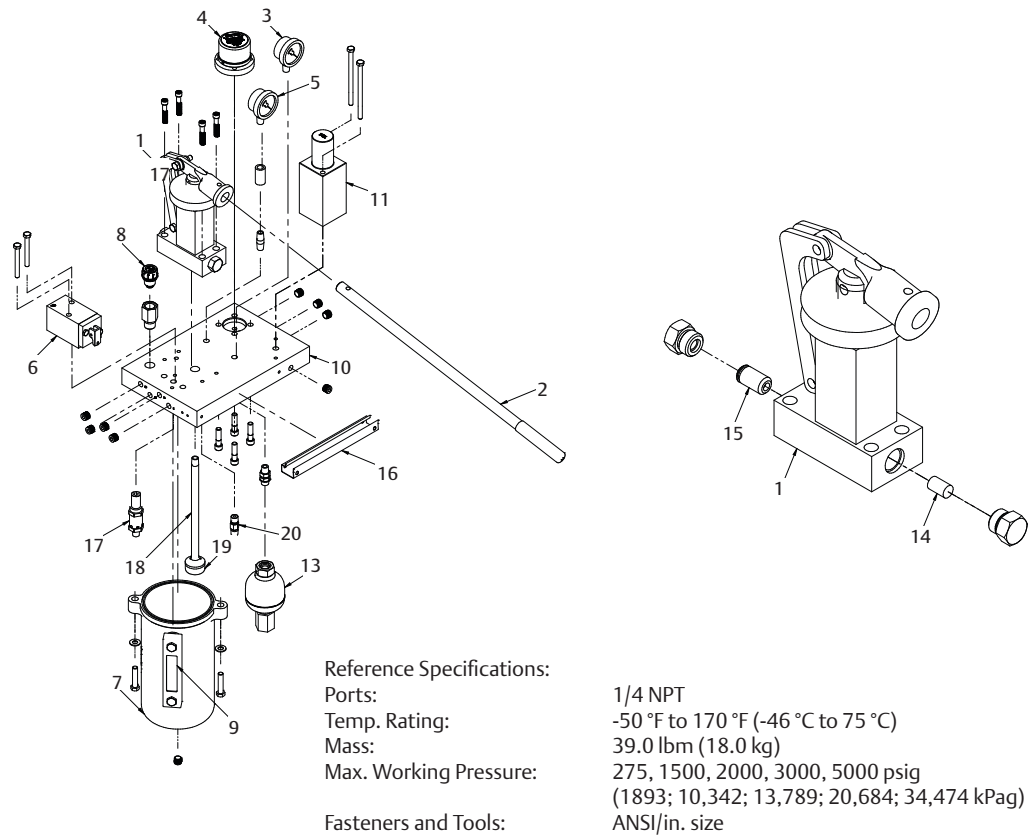
4. Lightly lubricate all exposed threads and unpainted surfaces (for example, mounting surfaces).
5. Cover the PressureGuard to prevent accumulation of dirt and debris.
6. Repeat the storage steps listed above to ensure the proper storage condition (in case the PressureGuard will be moved and stored again).

Indoor environment is the ideal storage condition for Bettis PressureGuard. For additional information on storage, please contact the manufacturer.

Section 4: Operation

Before operating Bettis PressureGuard system, it is critical to know its components and understand what they do. Refer to Figure 1 (SCH Module Portion of Bettis PressureGuard), Figure 3 (Bettis PressureGuard Schematic) and Table 2 (Bettis PressureGuard Components and Descriptions) for components in Bettis PressureGuard system.

Figure 1 SCH Module Portion of Bettis PressureGuard



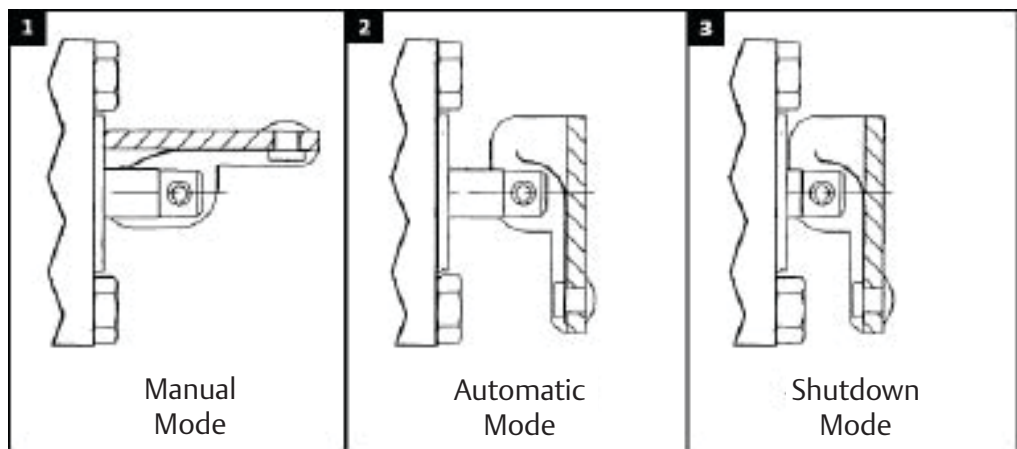
Item	Component
1	Handpump
2	Handpump Handle
3	High Pressure Gauge (optional)
4	Regulator
5	Low Pressure Gauge (optional)
6	Pilot to Close Valve
7	Reservoir
8	Filler/Breather
9	Reservoir Level Gauge
10	Manifold

Item	Component
11	LP Accumulator
12	Cover (optional)
13	HP Accumulator
14	Handpump Filter
15	Check Valve
16	Handle Clip
17	High Pressure Relief Valve
18	Riser
19	Suction Strainer
20	Low Pressure Relief Valve

4.1 Manual Mode

1. Lift/pull the toggle on the Reset Valve (23) and latch it in the upward position pane #1 of Figure 2, (Three Modes of Reset Valve).
2. Stroke the Handpump (3) to pressurize the SCH module and begin applying pressure to the operator's Piston (refer to Appendix C, (List of Drawings) for diagrams of typical rotary and linear operators) to move the valve to its operational position.

Figure 2 Three Modes of Reset Valve



3. The resistance of the Handpump (3) to pumping will increase noticeably when the valve reaches its full operational position. Pump approximately one-quarter of additional stroke at this point. The optional High Pressure Gauge (9) will read above the minimum operating pressure of the operator, and if so equipped, its needle will rest in the middle of the green band.
4. At this point, hydraulic fluid pressure in the SCH module and operator cylinder compresses the operator spring to hold the line valve in position.

NOTE:

Plug the Low Pressure Port (L) if the signal device is not connected to the manifold to prevent fluid loss from the manifold. Follow the instructions above to operate the unit.

4.2 Automatic Mode

The primary mode for Bettis PressureGuard is its Automatic Mode. This is the mode in which the system is to be set in the field when technicians are not actively inspecting or maintaining wellhead components or resetting the system.

1. Bettis PressureGuard enters and stays in Automatic Mode after step #4 in the preceding section is completed as long as signal device(s) (for example, Pressure Pilot [14]) are satisfied and Solenoid Valve(s) (20) (if any) are returned to normal operating condition.
2. In Automatic Mode, the Reset Valve (23) toggle will extend past its latched position from Manual Mode and will hang loosely (pane #2 of Figure 2, [Three Modes of Reset Valve]).

4.3 Shutdown Mode

There are several ways in which Bettis PressureGuard can move the valve and enter in shutdown mode.

1. Manual Shutdown

Technician can manually close the valve by pushing in/or down the toggle on the Reset Valve (23) or switching the Selector Valve to **“Manual”**. Manually initiated shutdown mode will usually be used for servicing the pipeline of Bettis PressureGuard system.

2. Signal Devices

- a. If the Pressure Pilot (14) senses that the pipeline pressure is outside the customer’s defined setpoints, it will release holding pressure from the operator, letting the operator’s spring move the valve to its shutdown position.

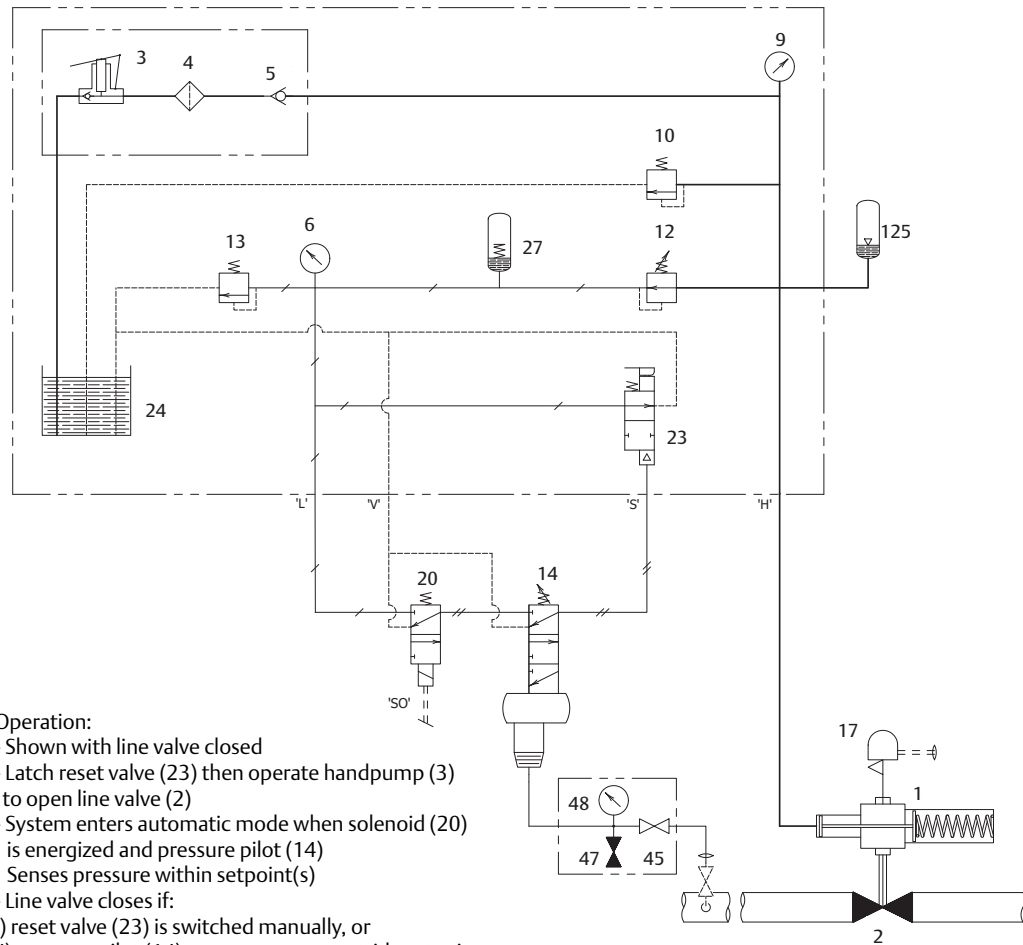
If the Solenoid Valve(s) (20) receives an electrical signal, it will also release holding pressure from the operator, letting the operator’s spring move the valve to its shutdown position.

Shutdown initiated by the signal device(s) will likely be an ESD event.

The Reset Valve (23) toggle will be unlatched and flattened against the valve body (pane #3 of Figure 2, [Three Modes of Reset Valve]) regardless of how shutdown occurs. Returning the valve to its operational position can only be accomplished manually and will require a technician to go to the valve and reset Bettis PressureGuard.

Section 5: Installation

Figure 3 Bettis PressureGuard Schematic



- Operation:
- Shown with line valve closed
 - Latch reset valve (23) then operate handpump (3) to open line valve (2)
 - System enters automatic mode when solenoid (20) is energized and pressure pilot (14) senses pressure within setpoint(s)
 - Line valve closes if:
 - I) reset valve (23) is switched manually, or
 - II) pressure pilot (14) senses pressure outside setpoints, or
 - III) solenoid (20) is de-energized

Item	Component
1	Operator
2	Line Valve
3	Handpump
4	Filter
5	Check Valve, Discharge
6	Gauge, LP
9	Gauge, HP
10	Relief Valve, HP
12	Pressure Regulator
13	Relief Valve, LP

Item	Component
14	Pressure Pilot
17	Limit Switch
20	Solenoid Valve, N.C
23	Reset Valve
24	Reservoir
27	Accumulator, LP
45	Isolation Valve
47	Side Valve
48	Pressure Gauge
125	Accumulator, HP

Table 2. Bettis PressureGuard Components and Descriptions

Item	Component	Description
1	Operator	Rotary or linear hydraulic operator.
2	Line Valve	Ball, plug, and others, quarter-turn or linear valve.
3	Handpump	Used to manually pressurize Bettis PressureGuard and open a valve.
4	Filter	Filters hydraulic fluid before entering Handpump (3) and controls.
5	Check Valve	Holds high pressure when Handpump (3) is stroked.
6*	Gauge, LP	Stainless steel liquid-filled gauge shows the control pressure (low-range).
8	Breather	Ventilates Reservoir (24) as volume changes.
9*	Gauge, HP	Stainless steel liquid-filled gauge shows the operator pressure (high-range).
10	High-Pressure Relief Valve	A high-pressure relief valve protects the operator and control system from overpressurization caused by thermal expansion.
12	Pressure Regulator	Regulates the hydraulic fluid pressure in the control circuit.
13	Low-Pressure Relief Valve	A low-pressure relief valve protects control circuit from overpressurization caused by thermal expansion.
14*	Pressure Pilot	Directly monitors pipeline pressure and can trip ESD.
17	Limit Switch	Provides electrical indication of valve position.
20*	Solenoid Valve, N.C.	Allows remote command of ESD.
23	Reset Valve	A latching trip relay reset valve provides quick closing speeds. A manual reset function for local reopening of the valve and manual closing function.
24	Fluid Reservoir	Contains the hydraulic fluid for the operator Cylinder and controls.
26	Fluid Level Gauge	For visual indication of the hydraulic fluid level and condition.
27	Accumulator, LP	Prevents cyclic transfer due to temperature change of fluid from high pressure operator supply circuit to the low pressure control circuit.
45*	Isolation Test Valve	Typically used to isolate the pressure from the pipeline to the sensing device (Pressurematic™).
47	Side Valve	Allows testing of the pressure pilot setpoint.
48	Pressure Gauge	Stainless steel liquid-filled gauge shows the pressure pilot sensing pressure.
125*	Accumulator, HP	Prevents temperature-induced pressure change of the high pressure circuit, and thereby prevents creep of the operator.

* = Optional component, per customer specification.

5.1 SCH Installation

Please refer to Figure 3, (Bettis PressureGuard Schematic) for an example of ESD system. While not necessarily a typical configuration, Figure 3, (Bettis PressureGuard Schematic) illustrates the connections, operating method, and a variety of sensing and control options available from Bettis PressureGuard system.

The Self-Contained Hydraulic (SCH) module is fully-lubricated, filled with hydraulic fluid, and adjusted as-delivered from the factory. An aviation grade hydraulic fluid (UNIVIS HVI 13 or equivalent) is used in all operator systems, unless a different fluid is requested by the customer. The SCH module is usually factory installed on the operator, but can be field installed by the user.

NOTE:

Any hydraulic or electrical connections that need to be made in the field will be tagged at the factory.

Typical specifications of available SCH modules includes:

- Medium pressure SCH module with HP-2 Handpump:
275 psi MAWP
 - HP Relief set at 275 psi
 - LP Relief set at 140 psi
 - Regulator set at 85 psi
 - Optional 0 to 600 psi HP gauge and 0 to 200 psi LP gauge

- High pressure SCH modules available for several pressures:
2000 psi MAWP with HP-2 or HP-3 Handpumps
 - HP Relief set at 1500 to 1750 psi
 - LP Relief set at 140 psi
 - Regulator set at 85 psi
 - Optional 0 to 2000 psi HP gauge and 0 to 200 psi LP gauge
3000 psi MAWP with HP-1 Handpump
 - HP Relief set at 2000 to 3000 psi
 - LP Relief set at 140 psi
 - Regulator set at 85 psi
 - Optional 0 to 3000 psi HP gauge and 0 to 200 psi LP gauge

- Additional higher pressure SCH modules are available. Please consult factory for details.

Common components of the low and high pressure systems includes:

- Reset Valve requiring 40 to 60 psi on the signal port to sustain auto mode. The reset valve may also be referred to as ‘pilot to close valve’, ‘toggle valve’, or ‘manual pilot valve’.
- Solenoid valve with voltage of 12 V DC, 24 V DC, 125 V DC, or 120 V AC with MAWP 150 psi to be specified by user.
- Optional high pressure accumulator must be precharged to factory specified pressure prior to operation to prevent damage. Charging kit available separately, consult factory.
- Standard reservoirs are:
 - Cast aluminum (for volumes less than or equal to 200 cu in.)
 - Fabricated steel (for volumes greater than 200 cu in.)

NOTE:

Advise the model and serial number of equipment when requesting for parts.

To install in the field, first mount the SCH to the operator using the provided brackets and mounting bolts. Second, make the hydraulic connections per the schematic in Figure 3, (Bettis PressureGuard Schematic) and the factory-placed tagging.

Ports on the manifold assembly will be identified as:

- (H)** High-pressure hydraulic supply to the operator.
- (L)** Low-pressure hydraulic supply for monitoring/devices.
- (S)** Low-pressure hydraulic signal for Reset Valve (23) from monitoring/ESD devices.
- (V)** Vent or return line to allow off-panel devices to return the hydraulic oil to reservoir.

Depending upon customer specifications, the control portion’s Solenoid Valve(s) (20), if applicable, have been factory installed and tubed and are ready for electrical connections.

Also, depending upon customer specifications, a Pressure Pilot (14) may be included and require tubing to a pressure signal line. The breather/fill port of the Reservoir (24) may be plugged with a metal or plastic plug: if so, remove and replace with the Breather (8) provided in the bag attached to the unit.

NOTE:

Check all hydraulic connections for leak.

5.2 Operator Installation

Bettis PressureGuard system is usually delivered from the factory with the SCH module installed on the operator. In this case, install the system per the instructions provided in the Installation, Operation, and Maintenance manual applicable to the type of operator in the system. Please refer to Table 3, (Operators and IOM Manuals) for this information.

Table 3. Operators and IOM Manuals

Operator Type	Installation, Operation, and Maintenance Manual Number
E-Series Rotary and Linear Operators	I-0004
Gate Valve Operator Type GVO-LP-FS/SR	E-90090003

Make the electrical and hydraulic connections required by the SCH module after installing the operator with its integrated SCH module.

NOTE:

Check all hydraulic connections for leak.

Section 6: Maintenance

NOTE:

It is recommended to read this manual entirely prior to performing any maintenance work on Bettis PressureGuard.

Contact Bettis for assistance should the technician have any questions or feel that a certain procedure cannot be performed safely.

⚠ CAUTION

Proper personal protective equipment should be worn at all times while working on the equipment. Operator assemblies contain pressurized fluids and compressed springs.

Do not attempt to remove any components or perform any service work with the operator under pressure. Bleed off all control pressure and disconnect control pressure supply lines before performing any service to the operator. Failure to do so could result in equipment damage or serious personal injury.

NOTE:

Keep all elastomers and/or replacement parts in original packaging until its ready to install. Inspect all parts (new or used) for burrs, sharp edges, or damages prior to reassembly. Special attention should be given to all sealing surfaces for damage. All parts should be clean and properly lubricated prior to reassembly.

6.1 Regular Maintenance

Regular maintenance (though rarely called for) is critical to ensure that Bettis PressureGuard will function within its ESD capacity when needed.

1. SCH Maintenance

NOTE:

Perform routine maintenance on SCH module each autumn (at minimum) or more frequently if it better aligns with the requirements of the valve.

NOTE:

This product is only intended for use in large-scale fixed installations excluded from the scope of Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS 2).

1. Drain any accumulated moisture from Fluid Reservoir (24) by opening the drain plug.
2. Check, clean and/or replace the Filter Element(s) (4).
3. Check the Pressure Relief Valves' (10 and 13) setpoints and reset values.
4. Check the operation and calibration of the control equipment if possible using the Isolation Test Valve (28) (Pressure Pilot [14] and/or Solenoid [20]).
5. Top up the hydraulic fluid with compatible fluid.
6. If equipped, check the high pressure accumulator precharge setpoint.

Refer to Bettis Pressurematic manual (document number 'I-0220', available from the factory or online at www.emerson.com).

2. Operator Maintenance

Routine maintenance is required for the operator to function as designed. Refer to the IOM manual for the specific type of operator in the system per Table 3, (Operators and IOM Manuals).

6.2 Troubleshooting

1. SCH Module Troubleshooting

Any visible leaks from the SCH module should draw troubleshooting focus.

NOTE:

Figure 3, (Bettis PressureGuard Schematic) shows that the high pressure side of the system supplies the low pressure regulated side. Therefore, any leakage on the low pressure side will cause significant changes in high pressure side in a short time period.

Depressurize the system before removing/disassembling any components on the manifold.

Vent/return lines will assist in tracing the leakage. This will be done without cycling the unit but with the pressurized removal of the reservoir and off-panel device.

To accomplish this:

1. Remove the vent line from the pilot/solenoid vent port. This isolates it from the SCH module and allows for observation of any oil leakage through the device. This checks poppet/spool and spool sleeve O-ring seal in operating positions.
2. Remove the reservoir from module to observe components (reliefs and reset valve) for oil leakage while under normal operating pressures.

3. Remove the filter plug, spring, and filter in Handpump sub plate to observe the backside of HP discharge. Check for leakage across and around it with high pressure being applied.
4. Remove the fitting and tubing or plug from module second vent port to observe any oil leakage due to manifold porosity between the LP channel and the Vent channel.
5. Remove the operator inspection cover/plate and/or tubing from the Cylinder plate port to observe any oil leakage across the Piston seal and the Piston center O-ring.

In case of pumping problems, access to pump suction valve is gained by removing the pump assembly from sub plate. Pumping difficulties usually result from dirty filter element, contaminated oil (water, methanol), or incorrect fluid type.

Failure of the regulator is indicated by pressure on the optional LP Gauge (9) exceeding the setpoint by more than 5 psi.

2. Operator Troubleshooting

Refer to IOM manual listed in Table 3, (Operators and IOM Manuals) to assist in troubleshooting the specific operator portion of Bettis PressureGuard.

Section 7: Document Revision

Table 4. Revision Overview

ECN	DATE	REV		BY *	DATE
Released	March 2014	A	COMPILED	J. Quilon	March 2014
Reviewed			CHECKED		
Approved			APPROVED	E. Carrillo	April 2014
	January 2021	B			

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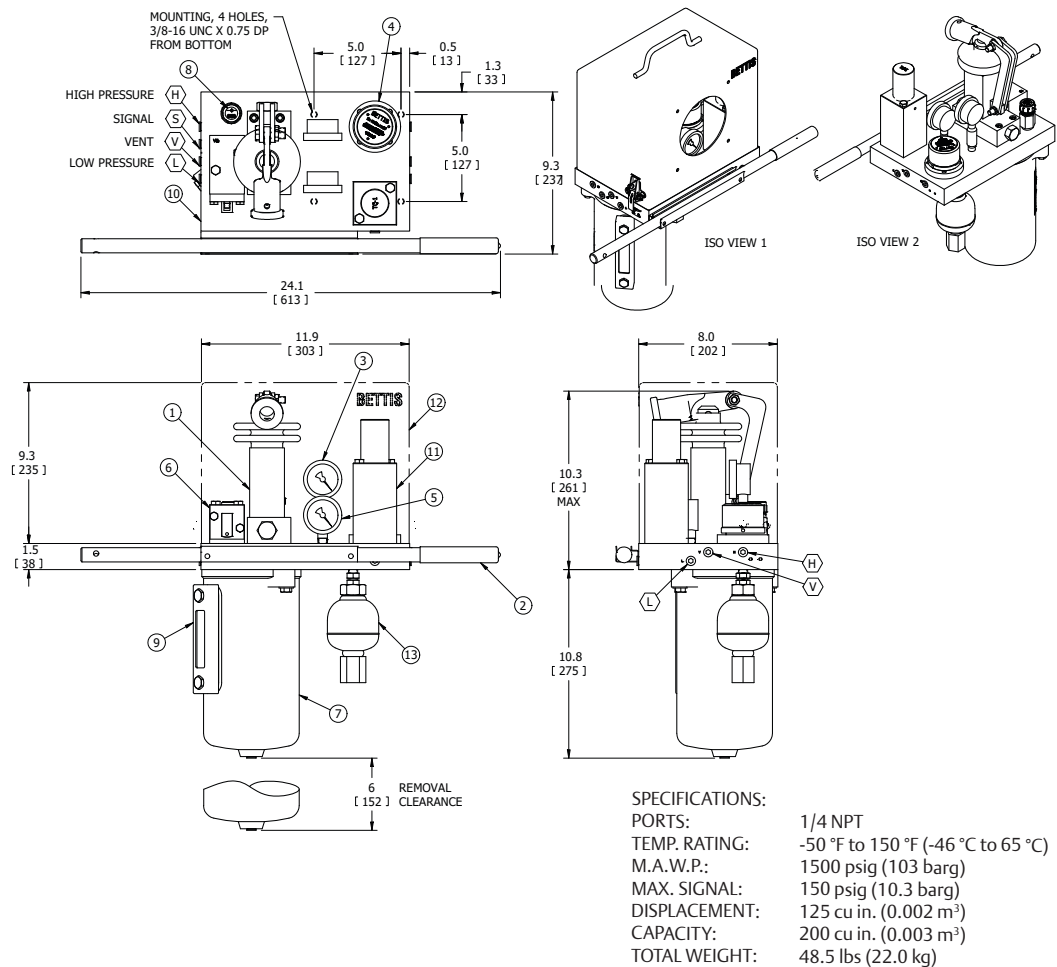
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Appendix C: List of Drawings

C.1 SCH Module and Components

Figure 4

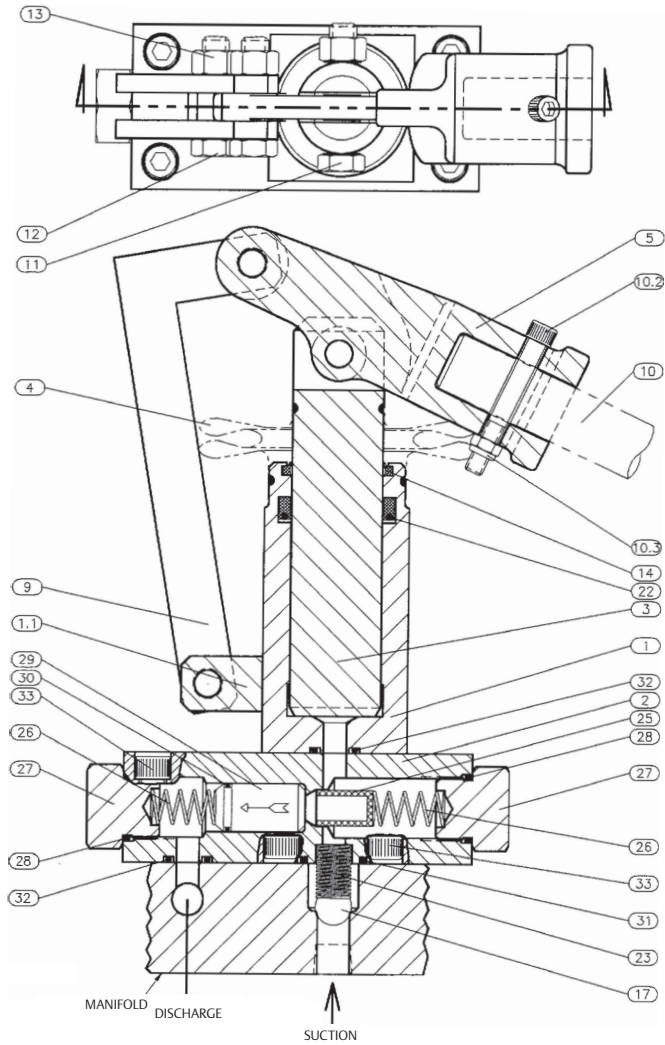


Item	Component
1	Handpump
2	Handpump Handle
3	High Pressure Gauge (optional)
4	Regulator
5	Low Pressure Gauge (optional)
6	Pilot to Close Valve
7	Reservior

Item	Component
8	Filler/Breather
9	Reservior Level Gauge
10	Manifold
11	LP Accumulator
12	Cover (optional)
13	HP Accumulator (optional)

NOTE:
- Manifold cover shown in ISO view 1 only.

Figure 5

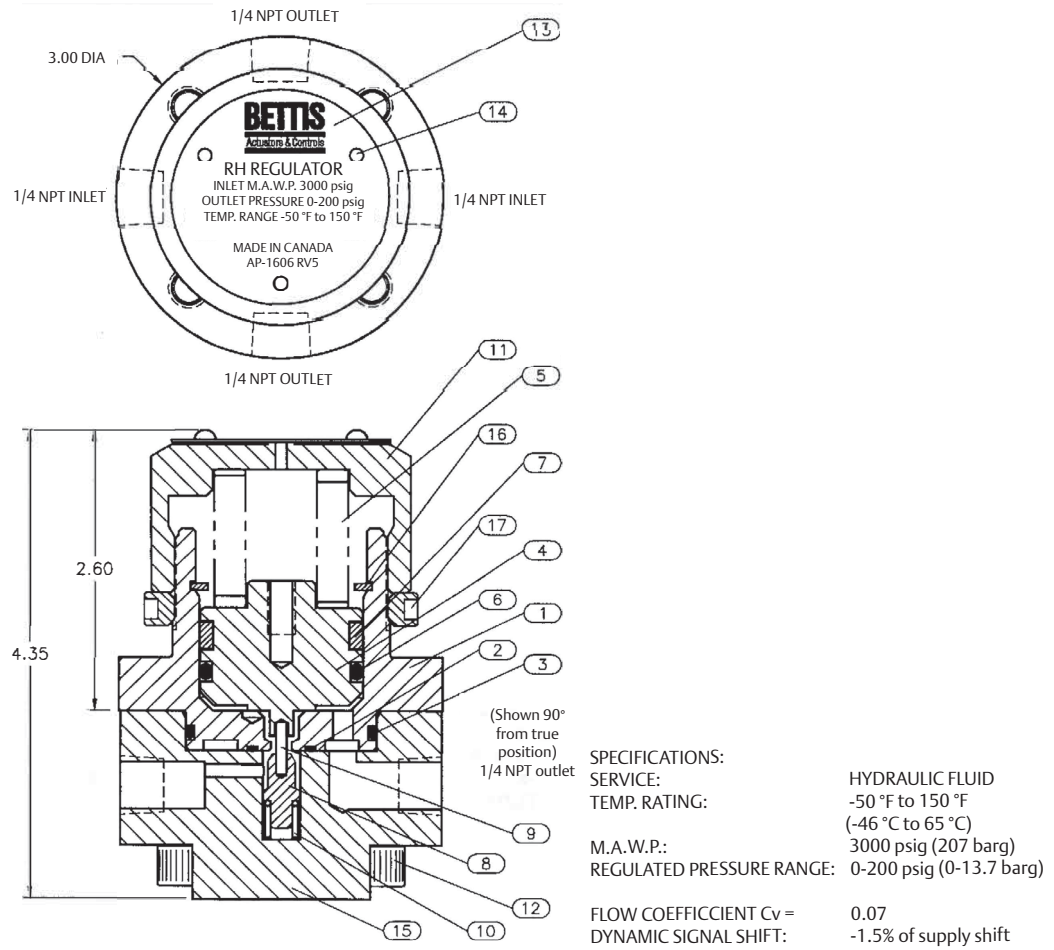


SPECIFICATIONS:
 TEMP. RATING: -50 °F to 150 °F (-46 °C to 65 °C)
 MASS: 8.3 lbs (3.77 kg)
 M.A.W.P.: 2000 psig (13,789 kPag)
 DISPLACEMENT: 2 cu in. (32 ml) per cycle

Item	Part No.	Description	Material	Qty	Note	Item	Part No.	Description	Material	Qty	Note
1	908-040	BODY	AISI C1020 ZN P	1	(W)	14	908-014	WIPER	URETHANE	1	(Y)
1.1	908-001	PIVOT	A516-70	1		33	908-033	CAPSCREW	HXSC SS 304	8	
2	908-002	BASE	AL 6061-T6	1		17	908-017	BALL, SUCTION PORT	SS 304	1	
3	908-006	RAM	AISI C1045 CH PL	1		22	908-022	POLYPAK, RAM	URETHANE/NITRILE	1	(Y)
*4	908-007	BOOT	EPDM	1		23	908-023	SPRING, SUCTION	SS 302	1	
5	908-005	LEVER/HANDLE CONNECTOR	D.I. 65-45-12 PL	1		25	908-025	FILTER ELEMENT	SS 316	1	
9	908-008	LINK	AISI C1018 ZN PL	2		26	908-026	SPRING	SS 302	2	
10	908-015	HANDLE	AL 2011-T3 ANDZ	1		27	908-027	END PLUG	AL 7075-T651	2	
10.1	908-016	HANDLE GRIP	VINYL	1	(H)	28	908-028	O-RING, END PLUG	NITRILE	2	(Y)
10.2	950-155	CAPSCREW	HXSC SS 304	1		29	908-029	CHECK VALVE	CS / NITRILE	1	
10.3	950-181	LOCKNUT	HEXL SS 304	1		30	908-030	O-RING, CHECK VALVE	NITRILE	1	(Y)
11	908-011	CAPSCREW, RAM	HXHC SS 304	1		31	908-031	O-RING, SUCTION PORT	NITRILE	1	(Y)
12	908-012	CAPSCREW, LINK	HXHC SS 304	2		32	908-032	O-RING, BODY	NITRILE	2	(Y)
13	908-013	LOCKNUT, LINK	HEXL SS 30	3		33	908-033	CAPSCREW	HXSC SS 304	8	

NOTE:
 - (W) Welded construction
 - (Y) Soft parts repair kit part no. SPRK-HP2_SC
 - (H) Not shown
 - Fasteners and maintenance tools are ANSI/inch size

Figure 6

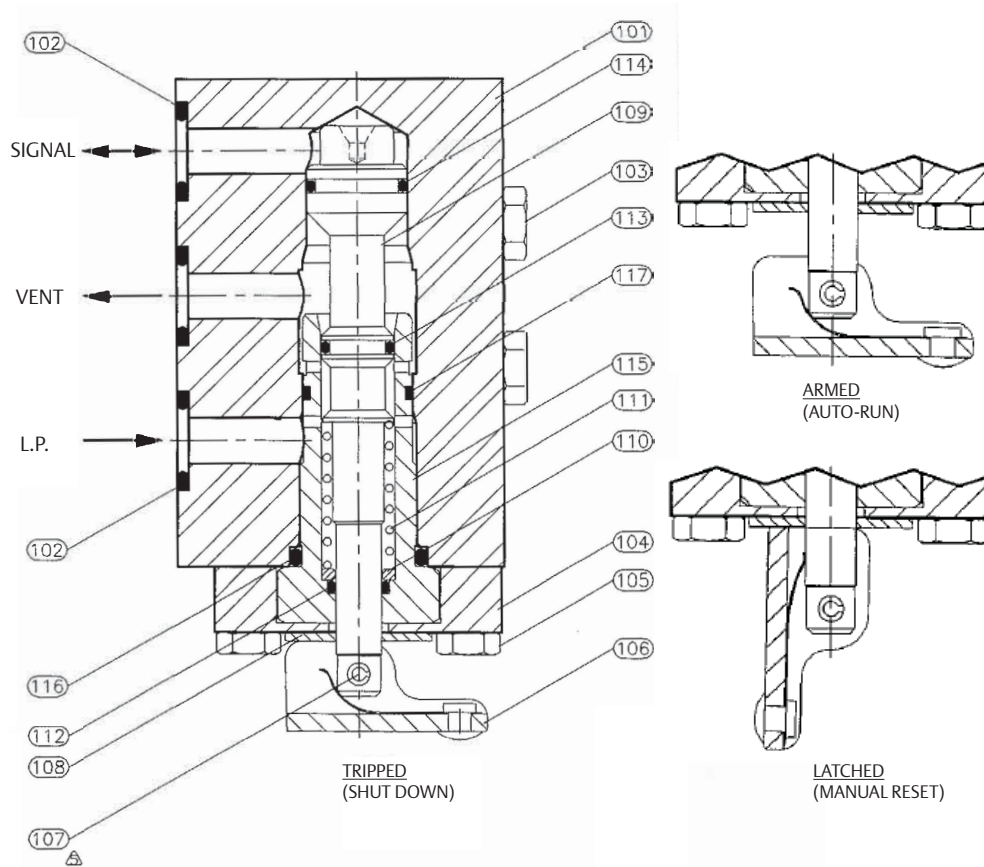


Item	Description	Material	Qty	Note
1	BODY	AL 6061-T6	1	
2	O-RING, BODY	NITRILE	1	(Y)
3	O-RING, MANIFOLD	NITRILE	1	(Y)
4	PISTON	AL 6061-T6	1	
5	SPRING, PISTON	CR-V ALLOY	1	
6	O-RING, PISTON	NITRILE	1	(Y)
7	WEAR RING, PISTON	MOLYGARD	1	(Y)
8	POPPET	KEL-F	1	(Y)
9	DOWEL PIN, POPPET	SS 304	1	

Item	Description	Material	Qty	Note
10	SPRING, POPPET	SS 302	1	
11	CAP	AL 6061-T6/ANDZ	1	
12	BOLT	SS 304	4	
13	NAMEPLATE	AL 3003-H14	1	
14	DRIVE SCREW, NAMEPLATE	SS 301/304	3	
15	BASE	AL 6061-T6	1	
16	RETAINING RING	15-7 PH	1	
17	LOCK NUT, CAP	AL 6061-T6	1	

NOTE:
 - (Y) Recommended spare parts
 - Fasteners and maintenance tools are ANSI/inch size
 - Shown adjusted for approximately 150 psig signal pressure

Figure 7

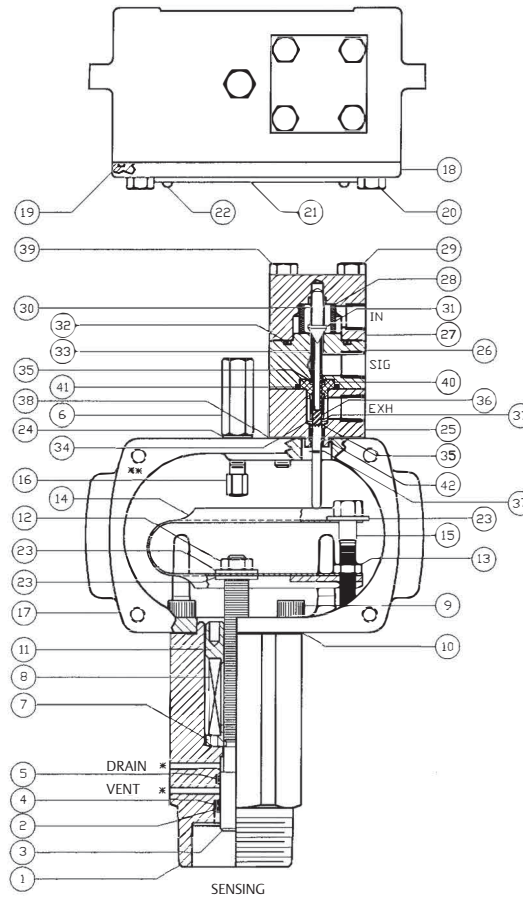


Item	Description	Material	Qty	Note
101	BODY, RESET VALVE	AL 6061-T6	1	
102	O-RING, RESET VALVE	NITRILE	3	(Y)
103	CAPSCREW, RESET VALVE	SS 304	3	
104	SLEEVE RETAINER	AL 6061-T6	1	
105	CAPSCREW, SLEEVE RETAINER	SS	2	
106	TOGGLE ASSEMBLY	AL 6061-T6/SS 301	1	
107	SLOTTED SPRING PIN	SS 420	1	
108	WASHER TOGGLE	NYLON	1	(Y)
109	SPOOL, RESET VALVE	AL 6061-T6	1	
110	WASHER, SPRING	AL 6061-T6	1	
111	SPRING, RESET VALVE	SS 302	1	
112	O-RING, SLEEVE STEM	NITRILE	4	(Y)
113	O-RING, SPOOL	NITRILE	1	(Y)
114	O-RING, SPOOL PISTON	NITRILE	3	(Y)
115	SLEEVE, RESET VALVE	TEFLON	1	
116	O-RING, SLEEVE HEAD	NITRILE	1	(Y)
117	O-RING, SLEEVE	NITRILE	1	(Y)

NOTE:

- (Y) Recommended spare parts/repair kit
- Fasteners and maintenance tools are ANSI/inch size

Figure 8



Item	Description	Material	Qty	Note
1	BODY	C1018	1	
2	RETAINING RING, BODY	SS 304	1	
3	PISTON	SS 316	1	
4	SEAL #1, PISTON	TFE	1	(Y)
5	SEAL #2, PISTON	NITRILE	1	(Y)
6	HIGH TRIP BLIND NUT	AL 2011-T3	1	
7	SPRING SEAT	CS PL	1	
8	RANGE SPRING	CR-V ALLOY	1	(V)
9	BOLT, BODY	SS 304	2	
10	GASKET, BODY	PLANT FIBRE	1	(Y)
11	RANGE SCREW	SS 416	1	
12	JAM NUT, TRIP SPRING	SS 304	1	
13	JAM NUT, LOW STRIP BOLT	SS304	1	
14	TRIP SPRING ASSEMBLY	SS 301	1	
15	LOW TRIP ADJUSTMENT BOLT	AL 6061-T6	1	
16	HIGH TRIP BOLT	SS 316	1	
17	HOUSING	AL CAST	1	
18	COVER PLATE	AL CAST	1	
19	O-RING, COVER	NITRILE	1	(Y)
20	BOLT, COVER	SS 304	4	
21	NAMEPLATE	SS 304	1	

Item	Description	Material	Qty	Note
22	DRIVE SCREW, NAMEPLATE	SS 18-8	4	
23	WASHER, TRIP SPRING	SS 304	3	
24	STAT-O-SEAL	CS/NITRILE	1	(Y)
25	LOWER BODY, PILOT	AL 6061-T6	1	
26	UPPER BODY, PILOT	AL 6061-T6	1	
27	END CAP, PILOT	AL 6061-T6	1	
28	FILTER ELEMENT, PILOT	CELLULOSE/RESIN	1	(Y)
29	CAPSCREW, END CAP	SS 304	2	
30	SPRING, POPPET	SS 302	1	
31	POPPET, PILOT	TFE	1	(Y)
32	O-RING, UPPER BODY	NITRILE	1	(Y)
33	SPOOL, PILOT	SS 304	1	
34	RETAINING RING, SEAL	SS 304	1	(Y)
35	O-RING, SPOOL	NITRILE	2	(Y)
36	SPRING, SPOOL	SS 302	1	
37	RETAINING RING, SPOOL	SS 304	2	
38	GASKET, PILOT	PLANT FIBRE	1	(Y)
39	CAPSCREW, PILOT MOUNTING	SS 304	1	
40	SLEEVE, PILOT	DELIRIN	1	(Y)
41	O-RING, SLEEVE	NITRILE	1	(Y)
42	BUSHING, SPOOL	TFE	1	

NOTE:
 - (Y) Recommended spare parts/repair kit
 - (V) to be specified fasteners and maintenance tools are ANSI/inch size
 * Vent and drain shown -30° from true position
 ** Shown with cover removed

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