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'MODEL SS-E'
PRESSURE SWITCH
OPERATION MANUAL
OMP # 4E02 01/01

I. INTRODUCTION

The Ruelco Model "SS-E" pressure switch is a patented, field proven design for electric indication of an abnormal production or process system pressure. Its rugged construction makes it ideal for use in applications requiring superior performance as well as extreme durability.

The design utilizes a piston/spring sensing system with a unique piston/base configuration. This concept, in combination with easily changed springs, permits various ranges of sensing pressures without base/piston replacement. For most applications, the simple removal and installation of an o-ring is all that is required to alter the sensing range; a feature that minimizes spare parts requirements.

The Model "SS-E" may be used as a high or low pressure sensor for pre-determined operation or 'trip' pressures. A discrete switch output (either SPDT or DPDT) is produced and connection of the appropriate switch lead will program the switch as a 'high' or low' switch. Set point adjustment is made by changing the spring compression within any selected range.

II. OPERATION – (SEE DATA SHEET)

Sense pressure acting at the 'sense port' forces the piston (Item 14) against the spool (Item 12) and a load is applied to the pre-compressed spring (Item 2) through the spring plate (Item 7). A push rod assembly (Item 11) contacting a ramp on the spool will operate the switch assembly (Item 8) as the spool moves with sense pressure changes.

If the sense pressure is insufficient to overcome the spring force, the spool remains in the lowermost position and the push rod will not depress the switch assembly lever. The switch contacts will be in their normal state; (i.e., normally open (N.O.) contacts will be open and normally closed contacts (N.C.) will be closed).

When the pressure acting on the piston becomes high enough to overcome the spring force, the spool will shift toward the spring. The push rod will slide up the spool ramp and depress the switch assembly lever. This reverses the switch state (i.e., N.O. contacts will be closed and N.C. contacts will be open).

Installed as a switch to detect high pressure, the Model "SS-E" will change state as the shaft moves toward the spring. When set up to detect abnormal low pressures, the switch will trip as the spool moves toward the base and the push rod deactivates the switch assembly.

When the switch is used to detect low or high pressure, the trip pressure is controlled by altering the force of the spring, the size of the sensing piston diameter or both. Changing the spring force is accomplished by rotating the spring cap (Item 1) to increase or decrease the spring compression. The piston diameter is changed by adding or removing an o-ring on the piston or using an optional piston/base configuration. The standard base has bores for the three (3) piston diameters of 1.25", .5" and .25". The standard piston has the 1.25" and .5" diameters with a mounting hole for the optional .25" piston.

This base/piston configuration does not have to be changed as long as the required operation pressure is between 10 and 10,000 PSI. Two other base/piston assemblies are offered for pressures above and below that range. A 3" diameter piston can be used for trip pressures from .5 to 80 PSI and a .187" diameter piston for trip pressures of 2,000 to 20,000 PSI.

III. INSTALLATION

INSTALLATION NOTES

1. The Model "SS-E" may be mounted in either the vertical or horizontal positions. If mounted outside in a horizontal position, it is recommended that the small vent holes in the side of the body be oriented in a downward position. This will prevent any debris from accumulating in the spring cavity or above the piston.
2. When connecting pipe fittings to the sense port in the base, a pipe thread sealant should be used. If stainless steel fittings are used, an anti-galling compound as well as a thread sealant is recommended.

PANEL/RACK MOUNTING

1. The "SS-E" can be panel or rack mounted (with optional panel mount nut) in either vertical or horizontal positions. A 1.87" diameter hole is needed and the maximum panel thickness is .25". 2" diameter holes may be used if additional panel mount nut is used.
2. Follow procedures as stated in Section III for spring removal to remove spring cap. NOTE: If the pressure switch trip point was pre-set prior to panel installation, panel mounting will require the trip point to be reset.
3. Install the panel into the panel or rack hole and thread the optional panel mount ring. Firmly tighten the ring against the panel or rack. NOTE: If installation hole size requires a back-up panel mount ring, install the ring onto the body prior to placing the switch into the panel or rack.
4. Re-install the spring cap and set the trip point per normal field procedures.

SENSOR BASE MOUNTING

1. When mounting the "SS-E" on a process line or using other piping, be sure that there is adequate support for the switch.
2. If after properly tightening the switch sense port connection to a fixed process port, the electric switch assembly (Item 8) is not oriented at the proper position, DO NOT loosen the body from the base to reposition the switch assembly. Remove the switch and re-make the connection.
3. When mounting an "SS-E" with a .187" base to the mating high pressure fitting, verify that the gland collar (Item 31) is threaded up onto the base (Item 26) until the top of the gland nut is almost touching the base. If the collar needs adjustment, rotate it counterclockwise (left-hand thread).

IV. ELECTRICAL CONNECTIONS

CAUTION: REMOVE AND LOCKOUT ALL ELECTRICAL POWER BEFORE CONNECTING THE SWITCH LEADS. BE SURE TO FOLLOW ALL APPLICABLE ELECTRICAL CODES & REGULATIONS WHEN CONNECTING WIRING OR INSTALLING CONDUIT TO THE SWITCH ASSEMBLY.

1. When connecting or removing conduit connections to the switch assembly 1/2" NPT thread, use a 1-1/8" open end wrench or a suitable adjustable wrench on the hex portion of the switch assembly to provide proper back-up. This will prevent damage to the connecting thread between the electric switch assembly and the "SS-E" body.

2. The electric switch leads are labeled and color coded for the type of switch contact. Connection of these leads for the desired switch operating function is shown on the data sheet.

V. CHANGING PRESSURE SWITCH RANGES (SEE DATA SHEET)

Tools and materials recommended for all switches:

- 7/8", 1" and 1-5/16" open end or suitable adjustable wrenches
 - Small pliers
 - O-ring pick or small screwdriver
 - High quality silicon base lubricant
 - An appropriate safety solvent
1. Spring Change - If the switch is being used in an operating instrument system, it is not necessary to disconnect any electrical power or sense pressure. The switch may inadvertently trip while removing or changing the spring. Precautions should be taken to avoid any unwanted reactions in the instrumentation system.
 2. Rotate the lock ring (Item 5) clockwise to loosen it from the spring cap (Item 1) and turn the spring cap counterclockwise until it is removed from the body (Item 3).
 3. Remove the spring (Item 2) from its cavity in the switch body. Be careful not to lose any parts tube that may be inside the spring.
 4. Install the proper spring for the new range as selected from the Range Chart as shown on the data sheet.
 5. Reverse the procedures for removal to re-install the spring cap and any parts tube.

PISTON DIAMETER CHANGE FOR STANDARD BASES

CAUTION: BE SURE THAT ALL PRESSURE IN THE SS-E BASE AND INTERCONNECTING PIPING OR TUBING IS COMPLETELY

REMOVED BEFORE ATTEMPTING TO REMOVE THE BASE.

1. If the switch is panel mounted, it is not necessary to remove it from the panel. It will be necessary to disconnect any piping or tubing from the sense pressure port that could prevent base removal.
2. When the "SS-E" is panel mounted, loosen and remove the base using the appropriate wrench to rotate it counterclockwise. It is recommended that a back-up wrench be used on the body when loosening the base.
3. For base mounted units, it will be necessary to remove any electrical connections, conduit or junction boxes that will prevent the rotation of the body. Use the appropriate wrench to loosen and rotate the body counterclockwise to remove it from the base. It is recommended that a back-up wrench be used to hold the base when loosening the body.
4. Use the small pliers to grip the raised ridge on top of the piston (Item 14) and pull it from the switch base.
5. If the .25" diameter piston (Item 17) is installed and must be removed from the large piston, use the .25" diameter wrench to hold the small piston and grip the large piston with the pliers on the small diameter above the groove for the .5" piston o-ring (Item 16). Rotate either one counterclockwise to loosen and separate the pistons.
6. Remove any installed o-rings (Item 13 or 16) from the piston prior to installing a .25" piston or any other o-rings.
7. Clean the base and pistons with a safety solvent and inspect all pieces for damage or extreme wear. There should be no indentations or deep scratches in the base inside diameters. Replace any worn or damaged parts.

8. Install the proper o-ring or if necessary, the .25" piston for the new range as selected from the range chart shown on the data sheet.
9. Apply a thin coat of silicon lubricant to the o-rings and appropriate base I.D. for that piston.
10. To reassemble the "SS-E", reverse the procedures above and reinstall any sense pressure connections that were removed.

VI. FULL DISASSEMBLY

Tools and materials recommended for all switches:

- 7/8", 1" and 1-5/16" open end or suitable adjustable wrenches
- Small pliers
- O-ring pick or small screwdriver
- High quality silicone base lubricant
- An appropriate safety solvent.

For switches using the .25" diameter piston:

- 1/4" open end or suitable adjustable wrench

For switches using the 3" diameter piston base:

- 1-1/4" open end or suitable adjustable wrench
- Pipe wrench with 4" minimum jaw opening

For switches using the .187" diameter piston/base:

- 7/8" open end or suitable adjustable wrench

1. For full disassembly, it is necessary to remove the "SS-E" from any panel, rack or pipe mounting.

CAUTION: BE SURE THAT ALL PRESSURE IN THE SS-E BASE AND INTERCONNECTING PIPING OR TUBING IS COMPLETELY

REMOVED BEFORE ATTEMPTING TO REMOVE THE BASE.

2. Remove any electrical connections, conduit or junction boxes that will prevent the rotation of the body. Use the appropriate wrench to loosen and rotate the body counterclockwise to remove it from the base. It is recommended that a back-up wrench be used to hold the base when loosening the body.

CAUTION: REMOVE AND LOCKOUT ALL ELECTRICAL POWER BEFORE DISCONNECTING THE SWITCH LEADS. BE SURE TO FOLLOW ALL APPLICABLE ELECTRICAL CODES ON REGULATIONS WHEN WORKING ON ELECTRICAL CIRCUITS.

3. Use the appropriate wrench to remove the switch assembly by rotating it counterclockwise from the body. The push rod assembly (Item 11) is loose and care should be taken not to lose it.
4. Rotate the lock ring (Item 5) clockwise to loosen it from the spring cap (Item 1) and turn the spring cap clockwise until it is removed from the body (Item 3).
5. Remove the spring (Item 2) and spring plate from the switch body cavity. Be careful not to lose any parts tube that may be inside the spring.
6. If a standard base assembly is being used, follow the procedures given in Paragraph 7 through 10. For SS-E's with 3" diameter pistons, follow the instructions in Paragraphs 11 and 12. Use procedures in Paragraph 13 and 14 for .187" diameter bases.
7. For the standard piston, loosen and remove the base using the appropriate wrench to rotate it counterclockwise from the body.

8. Use the small pliers to grip the raised ridge on top of the piston (Item 14) and pull it from the switch base.
9. If the .25" diameter piston (Item 17) is installed and must be removed from the large piston, use the .25" diameter wrench to hold the small piston and grip the large piston with the pliers on the small diameter above the groove for the .5" piston o-ring (Item 16). Rotate either one counterclockwise to loosen and separate the pistons.
10. Remove any installed o-rings (Item 13 or 16) from the piston (Item 14) prior to installing a .25" piston or any other o-rings.
11. For 3" base, use the pipe wrench to hold the upper housing and a suitable wrench to rotate the SS-E body off the base assembly. With the pipe wrench still on the upper housing, loosen and remove the lower housing (Item 23) in a counterclockwise direction.
12. Pull the 3" piston assembly from the lower housing and remove the seal (Item 22) from the piston.
13. For .187" diameter bases, remove the base from the body. Pull the retainer sleeve with the piston from the base and remove the piston from the retainer.
14. Using the small pick or o-ring tool, remove the back-up ring (Item 28) and seal (Item 29) from the base.
15. Using the pliers, pull the spool from the SS-E body. Remove the o-ring and wear rings with the small screwdriver or o-ring pick. **DO NOT** discard the wear rings if they are not to be replaced.

VII. REPAIR and ASSEMBLY

1. Clean all metal parts using a suitable safety solvent.
2. Inspect the piston and base for any signs of damage or excessive wear and verify

that the polished bores in the base are free of deep scratches and pitting.

3. Examine the spool and visually verify that it is not bent and has no signs of galling on its O.D.
4. The small bore in the body should show no indications of galling or excessive wear.
5. The spring should not be heavily corroded or have any visual cracks.
6. The wear ring is split in one place only and should not be in more than one piece.
7. Replace any worn or damaged parts.
8. Replacement seals from an authentic Ruelco repair kit are recommended to ensure proper switch performance.
9. Install new seals on the piston and spool and apply a light coating of silicone lubricant on the seals and O.D. of the piston and spool.
10. For standard pistons, verify the required switch range from the range selection chart on the data sheet. Install the required o-ring (Item 13 or 16) on the large piston (Item 14). **CAUTION:** Do not install more than one (1) o-ring on the large piston. If the .25" diameter piston is to be used, there should be no o-rings installed on the large piston. If a seal is to be installed on the large piston, **DO NOT** re-install the .25" diameter piston on the large piston even if the .25" piston has had the seals removed. Place it in the parts tube for future use.
11. When replacing seals on the optional .25" diameter piston, install the back-up ring (Item 18) in the piston groove first. Be sure that the angle cut ends of the back-up overlap to form a flat surface. Slide the back-up toward the large piston and install the o-ring (Item 19). **CAUTION:** If using the .25" diameter piston, be sure that all seals on the large

piston have been removed. Failure to do so will prevent the switch from operating.

12. Apply a light coating of silicone lubricant on the seals and O.D. of the piston and spool. Install the piston into the base.
13. Install the 3" seal onto the piston assembly. Be sure that the cup portion of the seal is facing the flat portion of the piston assembly. Install the piston into the base.
14. Install the 3" seal onto the piston assembly. Be sure that the cup portion of the seal is facing the flat portion of the piston assembly.
15. Apply a light coating of silicon lubricant on the seals and O.D. of the piston and spool. Install the piston into the base.
16. For .187" diameter pistons, apply a light coating of silicone lubricant on the replacement seal and install into the base prior to installing the back-up ring. Verify that the o-ring seal is facing toward the sense port connection.
17. Install the retainer sleeve into the base and install the piston into the retainer sleeve.
18. Reverse the procedures for disassembly to reassemble the base.
19. Install the o-ring (Item 9) and wear rings (Item 10) into their respective grooves. Apply a light coating of silicone lubricant on the o-ring and spool O.D. Slide it into the body.
20. Place the push rod assembly into the switch housing with the set screw toward the switch assembly and reverse the disassembly procedures to re-install the switch assembly.
21. Verify that the spring is the correct range required as shown on the range chart on the data sheet. Install the spring plate and the spring with parts tube, if any, into

the cavity of the spring body. Thread the spring cap back onto the body.

VIII. CALIBRATION

1. Due to manufacturing tolerances, when replacing a switch assembly or part wear in an installed unit, it may be necessary to recalibrate the switch.
2. Remove the spring cap, spring, switch assembly and push rod assembly from the body. The push rod assembly is loose and may inadvertently fall out of the switch assembly. Care should be exercised not to lose it.
3. Remove the body from the base.

CAUTION: BE SURE THAT ALL PRESSURE IN THE SS-E BASE AND INTERCONNECTING PIPING OR TUBING IS COMPLETELY REMOVED BEFORE ATTEMPTING TO REMOVE THE BASE.

4. With the spool pushed completely into the body, reinstall the push rod and switch assemblies onto the body.
5. Connect a suitable instrument to measure continuity between the from (COM 1) and blue (NO1) switch leads. If there is no continuity, follow the procedures in paragraphs 6 and 7 of this section. If there is continuity, proceed to paragraph 8.
6. Remove the switch and push rod assemblies from the body. Use pliers to hold the body of the push rod and a 5/64" Allen wrench to turn the set screw on top of the push rod. Rotate the set screw approximately 30° counterclockwise to lengthen the push rod.
7. Install the push rod and switch assemblies. If the continuity is still zero, repeat the procedure in paragraph 6 of this section until continuity is established.

8. Once continuity is present and with the continuity tester still attached to the switch leads, slowly loosen the switch assembly until the switch operates. Slowly retighten the switch until continuity is re-established and note the angular position of the switch. Continue to tighten the switch onto the body. It should not require more than $\frac{1}{4}$ of a turn or less than $\frac{1}{8}$ of a turn to tighten the switch onto the body.
9. If more than $\frac{1}{4}$ of a turn is required to tighten, remove the switch and push rod assemblies. Turn the set screw on the end of the push rod assembly clockwise approximately 15° to shorten its length and repeat the procedures in Paragraph 8 of this section.
10. Should it take less than $\frac{1}{8}$ of a turn to tighten the switch, remove the switch and push rod assemblies. Turn the set screw on the end of the push rod assembly counterclockwise approximately 15° to increase its length and repeat the procedures in Paragraphs 7 and 8 of this section.
11. Once the procedures in paragraph 8 of this section are met, follow the necessary procedures as outlined to re-assemble the pressure sensor.

IX. RECOMMENDED MAINTENANCE:

1. Test switch trip pressure every 30 days.
2. Disassemble, inspect, and lubricate yearly or as required.
3. Replace all seals every two years or as required.

X. TROUBLE SHOOTING

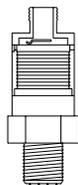
PROBLEM

PROBABLE CAUSE

Recommended Action

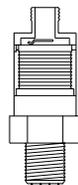
1. Switch does not operate when high or low trip pressures are exceeded during testing or normal operation	A. Switch adjustment tampered with.	Re-adjust switch per operating Requirements.
	B. Debris plugging sensor body ports.	Disassemble switch per procedures in section 3.0 and clean switch body (38). Clean instrument system filter.
	C. Spring Malfunction	Remove spring cap (1) and inspect spring for damage.
	D. Debris plugging the Base (8) sense port or the piston (7 or 9).	Remove Base (8) and Piston (7 or 9) per instructions in Section 3.0 and clean. Begin cleaning on a regular basis.
	E. More than one o-ring Installed on piston (7)	Remove extra o-ring
	F. Spool seals (40) and/ or piston seals (10,11,&13) are swollen.	Disassemble and repair per procedures in section 3.0 and 4.0. Try better filtration to keep condensate out of supply gas.
2. Gas or liquid leaking from small hole below spring cap (1)	A. Damaged Spool o-ring (40)	Disassemble and repair per procedures in section 3.0 & 4.0.
3. Gas or liquid leaking from small holes above switch base (8).	A. Damaged Spool o-ring (40) or piston o-ring (10,11,&13)	Disassemble and repair per procedures in section 3.0 & 4.0.
4. Deadband and set point repeatability are larger than the switch specifications	A. Switch o-rings dry.	Follow procedures in section 3.0 & 4.0 to disassemble the switch lubricate all seals and reassemble.
	B. Cause 'E' for Problem	Same as Problem #1.
	C. Cause 'F' for Problem	Same as Problem #1.

SPDT



LOW PRESSURE OPERATION

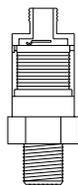
Blue N.D. CONTACT OPENS ON FALLING PRESSURE
 Brn. C. COMMON CONTACT
 Red N.C. CONTACT CLOSES ON FALLING PRESSURE
 Grn. GND. SWITCH GROUND



HIGH PRESSURE OPERATION

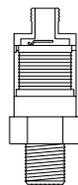
Blue N.D. CONTACT CLOSES ON RISING PRESSURE
 Brn. C. COMMON CONTACT
 Red N.C. CONTACT OPENS ON RISING PRESSURE
 Grn. GND. SWITCH GROUND

DPDT



LOW PRESSURE OPERATION

Blue N.D. CONTACT OPENS ON FALLING PRESSURE
 Brn. C. COMMON CONTACT
 Red N.C. CONTACT CLOSES ON FALLING PRESSURE
 Pur. N.D.2 CONTACT 2 OPENS ON FALLING PRESSURE
 Yel. C.2 COMMON 2 CONTACT
 Blk. N.C.2 CONTACT 2 CLOSES ON FALLING PRESSURE
 Grn. GND. SWITCH GROUND



HIGH PRESSURE OPERATION

Blue N.D. CONTACT CLOSES ON RISING PRESSURE
 Brn. C. COMMON CONTACT
 Red N.C. CONTACT OPENS ON RISING PRESSURE
 Pur. N.D.2 CONTACT 2 CLOSES ON RISING PRESSURE
 Yel. C.2 COMMON 2 CONTACT
 Blk. N.C.2 CONTACT 2 OPENS ON RISING PRESSURE
 Grn. GND. SWITCH GROUND

COM 1 - BROWN
 COM 2 - YELLOW
 N.O. 1 - BLUE
 N.C. 1 - RED
 N.O. 2 - PURPLE
 N.C. 2 - BLACK
 GND. - GREEN