



**“SS-2 DIFFERENTIAL  
PRESSURE SWITCH  
OPERATION MANUAL  
OMP# 4202XDX000**

The Ruelco “SS-2” pneumatic differential pressure switch is a three way block and bleed valve that is operated by pressure acting on a piston opposing an adjustable spring force. It functions as either a normally closed or normally open valve depending on through which the two ports the instrument pressure is supplied. These ports are marked as “HI IN” or “LO IN” on the switch body. The output port, marked “OUT” on the switch body, is the same for either mode of operation. The difference between the pressures acting on the upstream and downstream sensing ports is the differential pressure which causes the valve to operate.

When the instrument supply pressure is connected to the “HI IN” port, the switch operates as a normally open valve and is called a high switch. If the differential pressure acting on the piston is at normal levels, it is insufficient to overcome the spring force. The middle o-ring on the spool is positioned between the “LO IN” and the “OUT” port, thus preventing the instrument pressure from passing to the “LO IN” port of the switch body, but allowing it to pass from the “HI IN” port to the “OUT” port. When the differential pressure acting on the piston becomes large enough to overcome the spring force, the spool shifts and the center o-ring moves between the “HI IN” port and the “OUT” port. Instrument pressure at the “OUT” port and downstream “BLEEDS” to atmosphere thru the “LO IN” port while supply pressure at the “HI IN” port is blocked from entering the “OUT” port.

The pressure switch “BLOCK AND BLEED” action is the same when the instrument pressure is connected to the “LO IN” port and “HI IN” port is left unused. For this mode of operation, the switch acts as a normally closed valve and is called a low switch. When normal differential pressure is acting on the piston, the center O-ring on the spool is between the “HI IN” port and the “OUT” port thus preventing the instrument pressure from passing to the “HI PORT” of the switch body, but allowing it to flow from the “LO IN” port to the “OUT” port of the switch body. When the differential pressure decreases to an abnormal level, the spring force shifts to the spool and the middle o-ring on the spool becomes positioned between the “LO IN” port and “OUT” port. Pressure at the “LO IN” port is “BLOCKED” from entering the “OUT” port and pressure at the “OUT” port “BLEEDS” to atmosphere from the “HI IN” port.

Changing the differential pressure value when the switch is used as either a high or low is done by altering the force of the spring. Changing the spring force is accomplished by turning the spring cap to increase or decrease the spring compression.

## 2.0 INSTALLATION:

The “SS-2” differential can be panel mounted (with optional panel mount nut) or supported by piping from the sense port in either vertical or horizontal positions. If the switch is mounted horizontally, it is recommended that the small vent hole in the side of the switch body be oriented in a downward position. This will prevent any debris from accumulating in the spring cavity or above the sense piston.

Proper pipe thread sealant should be used on any pipe fittings threaded into the pressure switch ports. If stainless steel fittings are used, a sealant that will prevent galling is required. The supply gas flowing through the switch body should be filtered and free of large particles. If compressed air is used, it does not have to be lubricated. If natural gas is used as the instrument pressure, then it should contain as little condensate or crude oil as possible. This will extend the life of the seals. When the switch is mounted using the 1/4” NPT base connection and the instrument pressure ports are not in the desired position after the base connection is adequately tightened, **DO NOT** loosen the body from the base to re-position the ports. Instead, remove the switch and re-make the 1/4” NPT connection.

## 3.0 DISASSEMBLY (See Spec Sheet)

Tools and materials required for proper disassembly, repair and assembly are as follows:

1. 7/8” and 1” open end wrenches or two crescent wrenches of adequate size.

2. Small pliers.
3. High quality silicone base lubricant.
4. An appropriate safety solvent.

## 3.1 PARTIAL DISASSEMBLY

### A) Spring Removal

- 3.1.1) If the switch is installed in an operating instrument system, it is not necessary to remove any instrument supply or sense pressure. If the unit is a high switch, it will trip when changing the spring; if it is a low switch, then it will not. So precautions should be taken to avoid any unwanted reactions in the instrumentation system.
- 3.1.2) To obtain access to the spring (Item 2), rotate the lock ring (Item 4) clockwise to loosen it from the spring cap (Item 1).
- 3.1.3) Rotate the spring cap (Item 1) counterclockwise until it is disengaged from the switch body (Item 8).
- 3.1.4) Remove the spring from its cavity in the switch body.
- 3.1.5) Follow the procedures in repair and assembly section (Steps 4.1.4 and 4.14) of this manual to re-install the spring.

## **B) Piston Removal**

- 3.1.6) 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 base that would prevent the base from being removed. When the switch is supported by the ¼" NPT connection on its base (Item 12), disconnect any piping or tubing from the switch body that would prevent its removal from the switch base. **CAUTION:** Be sure that all instrument or sense pressures are completely bled to zero before disconnecting any piping or tubing.
- 3.1.7) Use the appropriate wrenches to hold and loosen the base from the switch body. Unthread the base completely from the switch body.
- 3.1.8) Unthread the lower housing (Item 18) from the base assembly. Use appropriate wrench to loosen the hex nut (Item 19) from the shaft-piston assembly.
- 3.1.9) Remove the installed cup seal (Item 16) from the piston (Item 17).
- 3.1.10) Procedure for re-installing the piston cup seal and the shaft seal is in the repair and assembly procedure of this manual.

## **3.2 FULL DISASSEMBLY**

**NOTE:** Use the following instructions to completely disassemble the pilot for repair and cleaning. **CAUTION:** Be sure

that all instrument or sense pressures are completely bled to zero before disconnecting any piping or tubing.

- 3.2.1) Follow the procedures stated under partial disassembly to remove the spring and piston.
- 3.2.2) Remove the spool (Item 8) from the switch body. If it is necessary, use the small pliers and grip the large end of the spool.
- 3.2.3) The seals on the spool, (Item 8) may now be replaced as per instructions given in the repair and assembly section of this manual.

## **4.0 REPAIR AND ASSEMBLY (See product data sheet for replacement part numbers).**

- 4.1) Remove the seals from the spool and piston.
- 4.2) Clean all parts using an appropriate safety solvent.
- 4.3) Inspect the spool for any major damage such as burrs or nicks on its outside diameter. Also inspect it for straightness. Replace the spool (Item 10) if damaged.
- 4.4) Examine the polished bores of the switch body (Item 8) and base (Item 12) for gouges and rough surfaces. Be sure that all heavy dirt deposits have been removed. Replace any damaged pieces.

- 4.5) Replacement seals from an authentic **RUELCO REPAIR KIT** is recommended to ensure proper switch performance.
- 4.6) Install new seals on the spool and lightly lubricate the seals and spool. **CAUTION:** Do not leave excessive lubricant on the spool. Doing so may prevent the switch from operating.
- 4.7) Verify the required switch range from the **Range Selection Chart** on the specification sheet 4XXX-12-95.
- 4.8) Install the required cup seal (Item 16) on the large piston and the o-ring on the shaft (Item 20).
- 4.9) Lightly lubricate the piston seal and piston. **DO NOT** over lubricate or the switch performance may be adversely affected.
- 4.10) Install the spool completely into the switch body. Move it in and out of the body approximately ¼” to check that it moves freely.
- 4.11) Install the shaft in to the piston and tighten the hex nut. Install the shaft-piston assembly into the lower housing (Item 18) and grip the shaft on the shaft-piston assembly with the small pliers and move the piston back and forth in the base to verify that it moves freely. Thread the upper housing onto the lower housing.
- 4.12) Thread the switch base into the switch body and firmly tighten.
- 4.13) Install the lock ring onto the switch body and place the spring plate into the body cavity. **NOTE:** If the switch is panel mounted, install it into the panel and secure with a panel mounting ring prior to installing the lock ring (Item 4) and spring plate (ITEM 6).
- 4.14) Install the spring into the switch body. **CAUTION:** Verify that the spring is the proper color for the range required as shown on the **Range Selection Chart** on the Specification Sheet \$XXXX-12-95.
- 4.15) Thread the spring cap onto the switch body. Adjust the switch operation as per user requirements and methods.

## 5.0 RECOMMENDED MAINTENANCE

### PROCEDURE

- 5.1) Test Switch Trip Pressure
- 5.2) Disassembly, inspect and lubricate
- 5.3) Replace all seals

### MAINTENANCE

- Every 30 days
- Yearly or as required
- Every two years or as required

## 6.0 TROUBLESHOOTING

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 (Item 8) ports.	Disassemble switch as per procedure in Section 3.0 and clean switch body. Clean instrument system filters.
	C) Spring (Item 2) malfunction.	Remove the spring cap (Item 1) and inspect spring (Item 2) for damage. Replace if necessary.
	D) Debris plugging the base sense port or the piston (Item 17).	Remove base and piston as per procedure in Section 3.0 and clean. Begin cleaning on a regular basis.
	E) Spool seals (Item 7) and/or piston seal (Item 16) swollen.	Disassemble as per procedure 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.	A) Damaged spool o-ring (Item 7).	Disassemble and repair as per procedures in Section 3.0 and 4.0.
3) Gas or liquid leaking from small hole above switch base.	A) Damaged spool o-ring or guide sleeve seal (Item 9).	Disassemble and repair as per procedure in Section 3.0 and 4.0
4) Deadband and set point repeatability are larger than switch specifications.	A) Switch o-rings dry.	Follow procedures in Section 3.0 and 4.0 to disassemble the switch, lubricate all seals and re-assemble.
	B) Cause E for problem #1.	Same as problem #1.