

# Fail-safe System

## GENERAL INFORMATION

This bulletin covers features unique to valves equipped with fail-safe systems, and must be used in conjunction with the appropriate Valtek® installation, operation, maintenance instructions for the basic automatic control valves installed with fail-safe systems.

Where service conditions exceed the capabilities of the standard fail-safe spring to drive the valve to its failure position, and where specially designed, extra-strong failure springs may be both mechanically and economically unfeasible, air spring fail-safe systems on Valtek control valves provide the thrust necessary to drive the plug to its failure position. An air spring provides a pressurized volume of air to drive the actuator piston in the failure direction. The volume of air is sometimes provided within the actuator itself, or where the cylinder volume is insufficient, a separate external volume tank is provided.

Air spring systems are used primarily to close valves upon air failure. And sometimes they must open valves upon air failure. A fail-closed Valtek valve is customarily operated with the flow direction over the plug. Thus, with the plug on the seat, the upstream pressure acts to hold the valve closed.

Fail-open Valtek valves customarily operate with the flow direction under the plug. Thus, when a general system failure occurs, the upstream pressure will keep the plug off the seat and the valve open.

Air springs on Valtek valves are practical because the locked-up air is used only at the instant of air failure to drive the valve to the fail position. Line pressure will insure that the valve stays either closed or open.

Occasionally, service conditions require that the valve remain in the last operating position upon loss of air supply. For such applications, Valtek valves can be equipped with a fail-in-place lock-up system. If air failure occurs, the system activates two pilot-operated lock-up valves that trip and lock the existing cylinder pressures on both sides of the piston, thus maintaining the last throttling position.

## TROUBLESHOOTING

If the fail-safe system does not function properly upon air failure, or does not remain in the failure position:

1. Verify proper pressure setting on airset (if used).
2. Inspect all tubing and connections for air leaks.
3. Inspect the check valve (if used) to insure that air is not leaking back through it.
4. Inspect the volume tank (if used) for air leaks.
5. Check the three-way lock-up valves for sticking.
6. Check three-way switching valves for proper operation. Check port "C" for obstructions in the bleed hole. Check preset pressure switching level.
7. Check actuator for leaks, in some rare cases, the piston O-rings could be leaking air across the piston. Refer to the proper actuator bulletin to disassemble the actuator and replace the O-rings.
8. Replace or repair faulty or damaged items.

## AIR SPRINGS USING CYLINDER VOLUME

### Normal Operation

The fail-safe system consists of a three-way switching valve and airset. The valve positioner operates as a three-way positioner and supplies air to one side of the piston only. A constant air pressure is maintained on the other side of the piston by the airset. Supply pressure is sensed by the three-way switching valve. If supply pressure drops below a preset value, the three-way switching valve locks the air on the constant pressure side of the piston to drive the valve plug to its failure position. When supply air pressure returns to normal, the three-way switching valve trips to permit normal throttling of the control valve. (Figure 1 shows the cylinder volume air spring schematic for a fail-closed control valve.)

**NOTE:** *The pressure setting of the airset is critical for operation. The factory setting furnished is high enough*



## Reversing the Failure Action

1. If a mechanical spring is used in the actuator, reassemble the actuator with the spring on the appropriate side of the piston by following the directions in the proper actuator installation, operation, maintenance instructions.
2. Reverse the positioner's air-action by following the directions in the proper installation, operation, maintenance instructions for the positioner.
3. For fail-open operation, connect the tubing from the lock-up valve mounted to "output 2" port of the positioner to the lower cylinder port. Connect the tubing from the lock-up valve mounted in "output 1" port of the positioner to the upper cylinder port. For fail-closed operation, connect the tubing from the lock-up valve mounted to "output 2" port of the positioner to the upper cylinder port. Connect the tubing from the lock-up valve mounted to "output 1" port of the positioner to the lower cylinder port. Leave connected the tubing from the volume tank to the "in" port of the lock-up valve mounted in "output 2" port of the positioner. Tubing schematics for fail-closed and fail-open operations are shown in figures 3 and 4, respectively.

## FAIL-IN-PLACE LOCK-UP SYSTEM

### Normal Operation

A three-way switching valve and two pilot-operated three-way lock-up valves are used in the fail-in-place lock-up system. In this system, the positioner operates

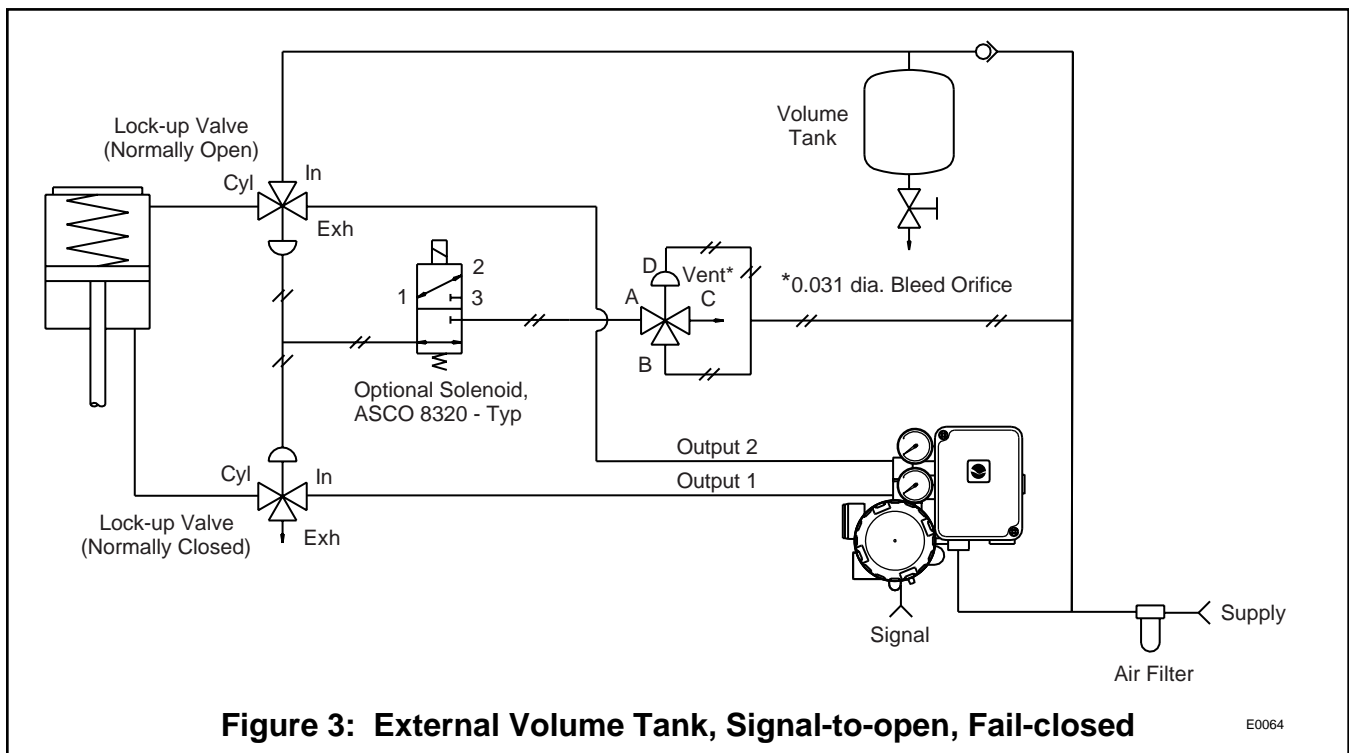
as a four-way positioner, supplying air to both sides of the actuator piston. The three-way switching valve senses supply line pressure. If supply pressure drops below a preset level, pilot pressure from the three-way switching valve to the lock-up valves is released, causing the lock-up valves to trip and lock the existing air pressure on both sides of the piston. Exhaust ports on the lock-up valves should be plugged. (Figure 5 shows a schematic depicting a fail-in-place lock-up system.)

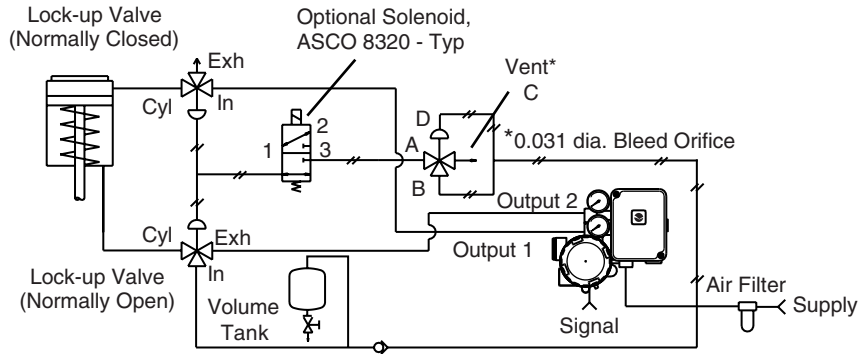
**NOTE:** The setting of the three-way switching valve is factory set at a level close to the supply pressure, yet low enough to avoid being tripped on normal supply pressure swings. Changing the setting could create a simulated loss of supply pressure during normal fluctuations in air supply pressure, or prevent the valve from tripping upon loss of supply pressure.

### Reversing the Air Action

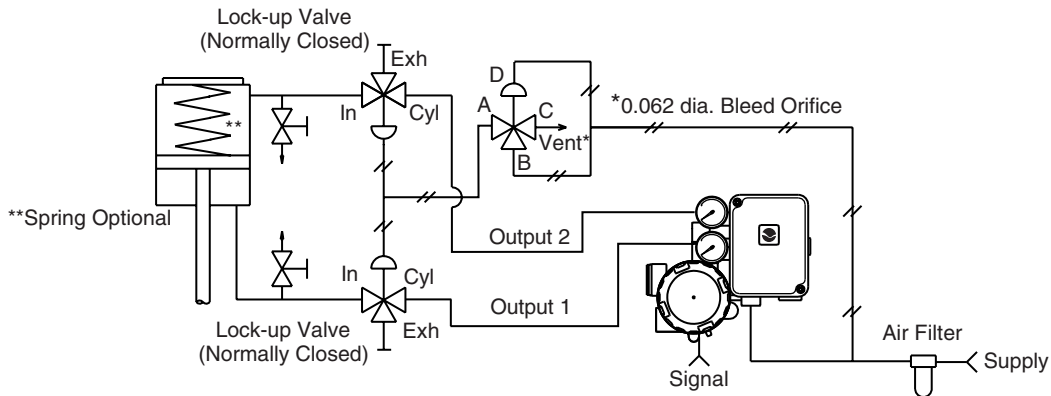
1. If a mechanical spring is used in the actuator, reassemble the actuator with the spring on the appropriate side of the piston by following the directions in Valtek Maintenance Instructions 2.
2. Relocate the positioner on the mounting bracket by following the directions in the proper maintenance instructions for the positioner.
3. For signal-to-close valves, connect the tubing from the lock-up valve connected to the "output 2" port on the positioner to the lower cylinder port. Connect the tubing from "output 1" port of the lock-up valve to the upper cylinder port.

For signal-to-open valves, connect the tubing as shown in figure 5.

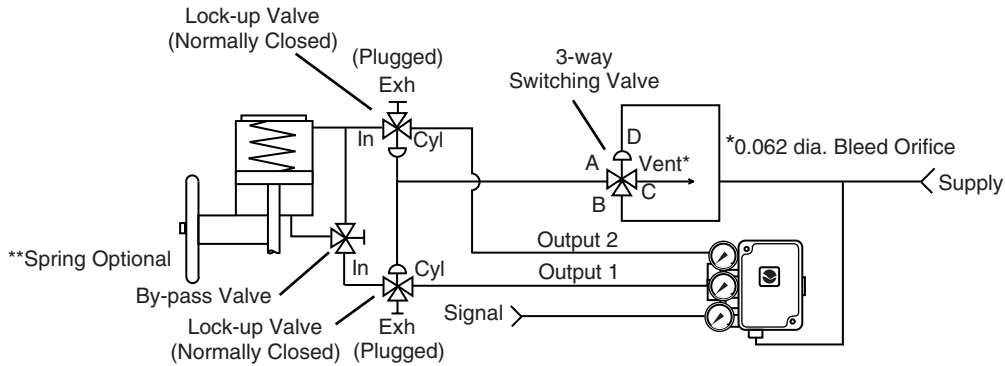




**Figure 4: External Volume Tank, Signal-to-close, Fail-open**



**Figure 5: Fail-in-place Lock-up System, Signal-to-open**



**Figure 6: Fail-in-place Lock-up System, Signal-to-open with handwheel**

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