

November 2021

# Spence™ Air-Operated Switchover Station



## WARNING

Failure to follow these instructions or to properly install and maintain this equipment could result property damage and personal injury or death.

Air-operated switchover station must be installed, operated and maintained in accordance with federal, state and local codes, rules and regulations and Emerson Process Management Regulator Technologies, Inc. (Emerson) instructions.

If the valve vents gas or a leak develops in the system, service to the unit may be required. Failure to correct issue could result in a hazardous condition.

Installation, operation and maintenance procedures performed by unqualified personnel may result in improper adjustment and unsafe operation. Either condition may result in equipment damage or personal injury. Only a qualified person shall install or service the air-operated switchover station.

## Introduction

### Scope of the Manual

This manual provides installation, operation and maintenance instructions for an air-operated switchover station using pneumatic control valves. Reference VCIMD-14934 for installation, operation, maintenance troubleshooting and parts ordering for Type J control valve.



Figure 1. Type J Control Valve



Figure 2. Type P60 Proportional Integral Controller

# Air-Operated Switchover Station

## Specifications

This section lists the specifications for the air-operated switchover station. Factory specifications are stamped on the nameplate fastened on the control valves and controller at the factory.

### Type J Control Valves

#### Control Valve Types

**Type J1:** Cast Iron  
**Type J3:** Stainless steel

#### Valve Sizes

NPS 1/2, 3/4, 1, 1-1/2 and 2 / DN 15, 20, 25, 40 and 50

#### Pressure and Temperature Chart<sup>(1)</sup>

See Figure 3

#### End Connection Styles

NPT, CL150, CL300 and CL600

#### Flow Coefficient, C<sub>v</sub>

**NPS 1/2 / DN 15:** 5.1  
**NPS 3/4 / DN 20:** 10.3  
**NPS 1 / DN 25:** 18.2  
**NPS 1-1/2 / DN 40:** 37  
**NPS 2 / DN 50:** 67

#### Construction Materials

**Body:** Stainless steel or Cast iron  
**Seat Ring:** Stainless steel  
**Packing:** PTFE V ring, PTFE/Graphite or Graphite  
**Plug and Stem Assembly:** Stainless steel  
**Yoke:** Ductile iron  
**Diaphragm:** Nitrile/Polyester  
**Piston:** Stainless steel  
**Spring:** Steel wire  
**Actuator Housing:** Steel

#### Options

36 or 60 sq. in. / 0.02 or 0.04 sqm actuators  
Soft Seats- 450°F / 232°C  
Moore, PMV, Eckardt Positioner Accessories

#### Approximate Weight

See Table 1

#### Seat Leakage Classifications

**Metal Seats:** ANSI/ISA 70-2 Class IV  
**Teflon Soft Seats:** Class VI

### Type P60 P.I. Controller

#### Typical Configurations:

**EAP60:** Pressure and Temperature  
**CAP60:** Pressure and Temperature

#### Pressure Rating<sup>(1)</sup>

See Table 2

#### Control Ranges<sup>(1)</sup>

0 to 15 psig / 0 to 1.03 bar  
0 to 30 psig / 0 to 2.07 bar  
0 to 60 psig / 0 to 4.14 bar  
0 to 100 psig / 0 to 6.89 bar

#### Ambient Temperature Limits<sup>(1)</sup>

-40 to 180°F / -40 to 82°C

#### Air Connections

1/4 in. FNPT

#### Maximum Air Consumption

**Maximum:** 0.2 SCFM / 0.34 SCM  
**Normal:** 0.1 SCFM / 0.17 SCM

#### Proportional Band

Adjustable, 2 - 200%

#### Control Action

Adjustable, Reverse or Direct

#### Control Mode

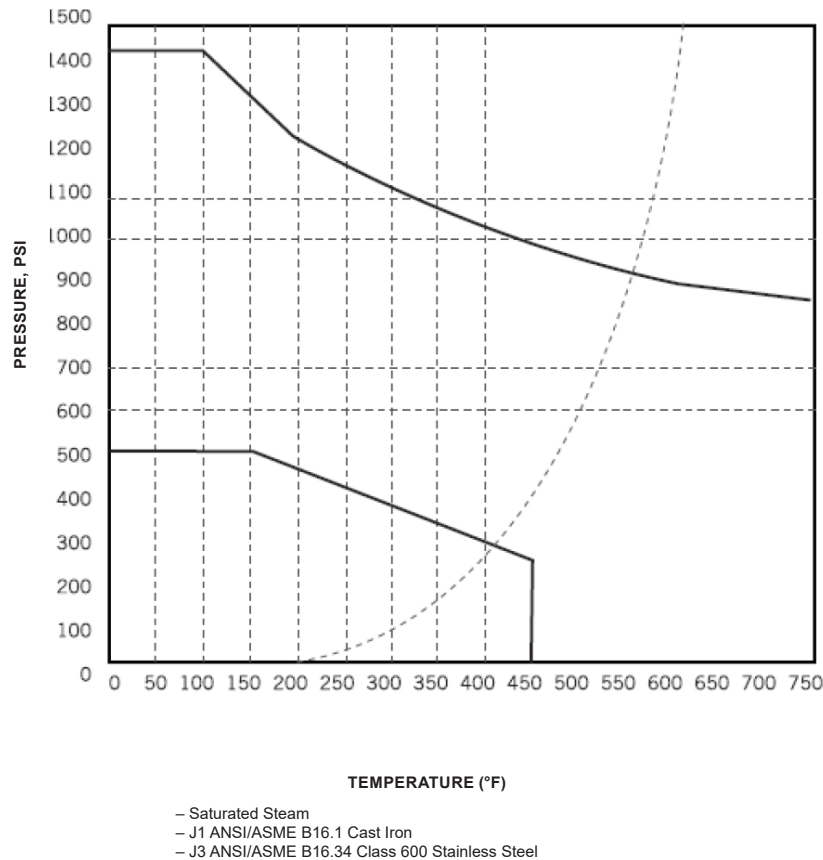
**Standard:** Proportional + Reset (PI)  
**Optional:** P, PD or PID

#### Weight

8-1/2 lbs. / 19 kg

1. The pressure/temperature limits in this Instruction Manual and any applicable standard or code limitation should not be exceeded.

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**Figure 3.** Type J Pressure and Temperature Chart

## Product Description

Air-Operated Switchover Stations are designed for use when the system rangeability exceeds 10:1. This system permits the larger of two parallel valves to operate from one quarter to full valve capacity.

The station consists of two Type J control valves with positioners installed in parallel. The smaller control valve is sized for some fraction of the design

load (typically once quarter or one third). The larger control valve is sized for some fraction of the design load. Both valves are controlled by a single Type P60 Proportional Integral (P.I.) Controller. An interlocking system of pneumatic relays provide the logic to sequence the operation of the system.

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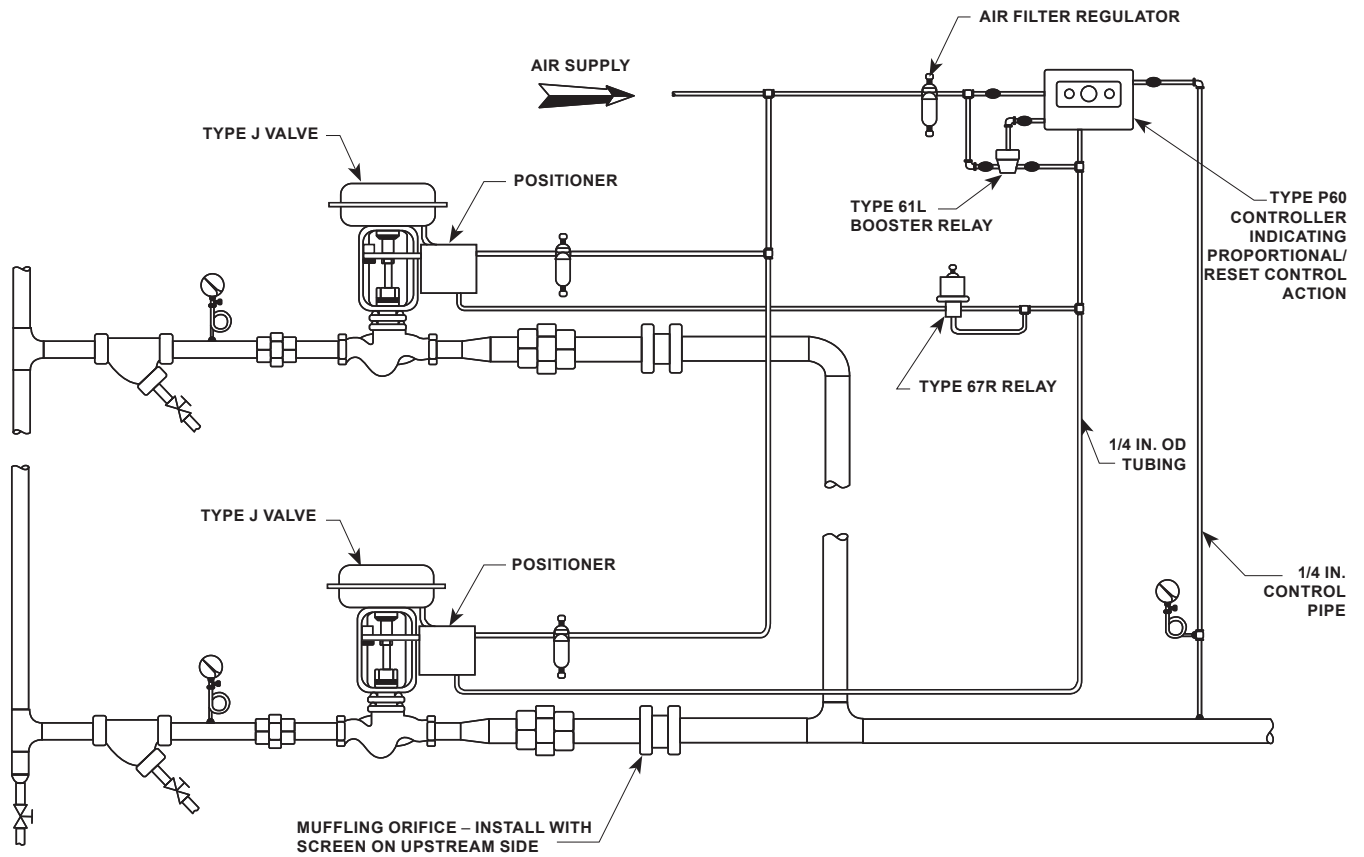


Figure 4. Recommended Installation

Table 1. Type J Control Valve Approximate Weight

VALVE SIZE		SCREWED				FLANGED			
		36 in. sq / 0.02 sqm		60 in. sq / 0.04 sqm		36 in. sq / 0.02 sqm		60 in. sq / 0.04 sqm	
NPS	DN	lbs	kg	lbs	kg	lbs	kg	lbs	kg
1/2	15	20.5	9.3	36.5	16.6	23.5	10.7	39.5	17.9
3/4	20	20.5	9.3	36.5	16.6	25.75	11.7	41.75	18.9
1	25	22.5	10.2	38.75	17.6	29.0	13.2	45.25	20.5
1-1/2	40	29.25	13.3	45.5	20.6	40.25	18.3	57.5	26.1
2	50	38.25	17.3	54.25	24.6	50.25	22.8	68.25	31.0

**Table 2. Pressure Ratings at Maximum Inlet Conditions**

SUPPLY PRESSURE		OUTPUT RANGE	
psig	bar	psig	bar
20	1.38	3 to 15	0.21 to 1.03
35	2.41	3 to 27	0.21 to 1.86
35	2.41	6 to 30	0.41 to 2.07
65	4.48	12 to 60	0.83 to 4.14

## Principle of Operation

Under low flow conditions, the smaller valve gradually opens until it reaches its full open position. Upon further increase in demand, the larger valve opens and simultaneously, the small valve shuts in a "bumpless" load transfer. The larger valve now carries the load. Should demand drop, this sequence reverses and control flow is transferred back to the smaller valve.

The Type J valve with a pneumatic positioner fully opens with an input signal of 6 psi / 0.41 bar (3 to 9 psig / 0.21 to 0.62 bar ) (9 to 15 psig / 0.62 to 1.03 bar). The Type P60 controller has a standard output of 3 to 15 psig / 0.21 to 1.03 bar. Sequencing of control is obtained by splitting the Type P60 output signal into two 6 psig / 0.41 bar span portions; 3 to 9 psig / 0.21 to 0.62 bar and 9 to 15 psig / 0.62 to 1.03 bar. The output signal from the Type P60 controller is directed to a Type 61L relay and a Type 67R relay to sequence the valve's opening.

The larger valve is isolated from the low flow conditions by its setting and/or its pneumatic positioner. The small valve is isolated from the low flow conditions by a reversing relay. The relay passes the 3 to 9 psi / 0.21 to 0.62 bar controller signal to the small valve and, at 9 psig / 0.62 bar, starts to close the small valve while the large valve is opening.

## Installation



**Personal injury or system damage may result if this station is installed, without appropriate overpressure protection, where service conditions could exceed the limits given in the Specifications section and/or regulator nameplate.**

**Additionally, physical damage to the station may result in personal injury or property damage due to escaping of accumulated gas. To avoid such injury and damage, install the station in a safe location.**

**Under enclosed conditions or indoors, escaping gas may accumulate and be an explosion hazard. In this case, the vent should be piped outdoors.**

## Planning

1. Locate each control valve in a straight run of horizontal pipe. Provide a three-valve bypass to facilitate inspection without interrupting service.
2. Install adequate traps before and after the control valves and before a secondary control valve, if used. This will prevent water hammer and erratic operation from entrained condensate.

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3. Install a strainer ahead of each control valve to avoid damage from pipeline scale and debris.
4. Enlarge the downstream piping to maintain reasonable flow velocities. A tapered expansion is recommended. Avoid a sharp turn close to the control valve outlet.
5. Install inlet and outlet pressure gages to indicate control valve performance. If the pressure rating of any downstream component is less than the initial pressure, provide a properly sized safety valve.

## Type P60 Pilot Installation

1. Mount the Type P60 pilot vertically on a panel or wall where it is reasonably free from vibration and wide temperature fluctuations.
2. Confirm that Type P60 is set for reverse action (nozzle in up position and green pointer in the correct zone. Refer to SD4121.
3. Use e1/4 in. pipe, hand valve and pigtail syphon to connect the Type P60 "process" connection to the desired point of pressure control.
4. This sensing pipe should be located at a point of minimum turbulence. The sensing point should be a minimum of 4 pipe diameters beyond the downstream pipe expansion. Never locate the sensing line immediately downstream of a control valve outlet or a turn.
5. Connect instrument air supply to an air filter regulator and to supply connection on Type P60.
6. Connect Type P60's output to Type 61L relay's input.
7. Connect Type 61L relay's output to Type 67R relay's input and to the large Type J valve positioner's input.
8. Connect the output of the Type 67R relay to the small Type J valve positioner's input.
9. Connect an instrument air supply of 60 psig / 4.14 bar maximum to the positioner.

## Start-up and Adjustment



**The station may be handling hazardous fluids. Only qualified personnel, who are familiar with the installation, should be permitted to install, readjust, inspect or maintain the switchover station.**

1. Confirm that the Type P60 pilot is adjusted for reverse action. Set the proportional band at approximately 50% and the reset at 0.5 repeats per minute. See SD4121.
2. Adjust the air filter regulator to provide 20 psig / 1.38 bar supply air to the Type P60 pilot. Move the setpoint indicator (red pointer) to obtain 9 psig / 0.62 bar on its output gauge.
3. Adjust the positioner on the small valve so that it starts to open the valve at 3 psig / 0.21 bar and is fully open at 9 psig / 0.62 bar. Adjust the Type 67R relay so that it vents the actuator on large valve so the valve starts to open at 8 psig / 0.55. (See instruction for positioner adjustment.)
4. Use an air filter regulator to shut off the supply air to the Type P60. Move the setpoint indicator to the desired delivery pressure setpoint.
5. Warm up the downstream piping by cracking the bypass valve. The gradually open the bypass until the delivery pressure is just below the desired setpoint.
6. Crack open the inlet stop valves of both control valves. *Blow down the strainers.* Then open both inlet and outlet valves wide.
7. Gradually provide supply air to the Type P60 pilot until the station comes on the line and brings the delivered pressure to the desired setpoint. Note that the smaller control valve will open first. Depending on demand, the larger control valve may or may not open.

8. Gradually close down the bypass and increase the Type P60 supply pressure to 20 psig / 1.38 bar.
9. The station is now under the control of the Type P60 pilot. Observe the delivery pressure for proper control. If the station cycles or is sluggish, the Type P60 controller must be turned to the process. Refer to Instruction SD4121.

## Maintenance



### WARNING

To avoid personal injury, property damage or equipment damage caused by sudden release of pressure or explosion of accumulated gas, do not attempt any maintenance or disassembly without first isolating the control valve from system pressure and relieving all internal pressure from the control valve.

Control valves that have been disassembled for repair must be tested for proper operation before being returned to service. Only parts manufactured by Emerson should be used for repairing this control valve.

Due to normal wear or damage that may occur from external sources, this control valve should be inspected and maintained periodically. The frequency of inspection and replacement of parts depends upon the severity of service conditions or the requirement of local, state and federal rules and regulations.

## Parts Ordering

When corresponding with your local Sales Office about this equipment, always reference the service and serial number.

## Parts List

Refer to VCIMD-14934 for complete parts list of Type J control valve.

Refer to SD4121 for Type P60 P.I. Controller.

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