

July 2010

# Type 289RC Exhaust Booster

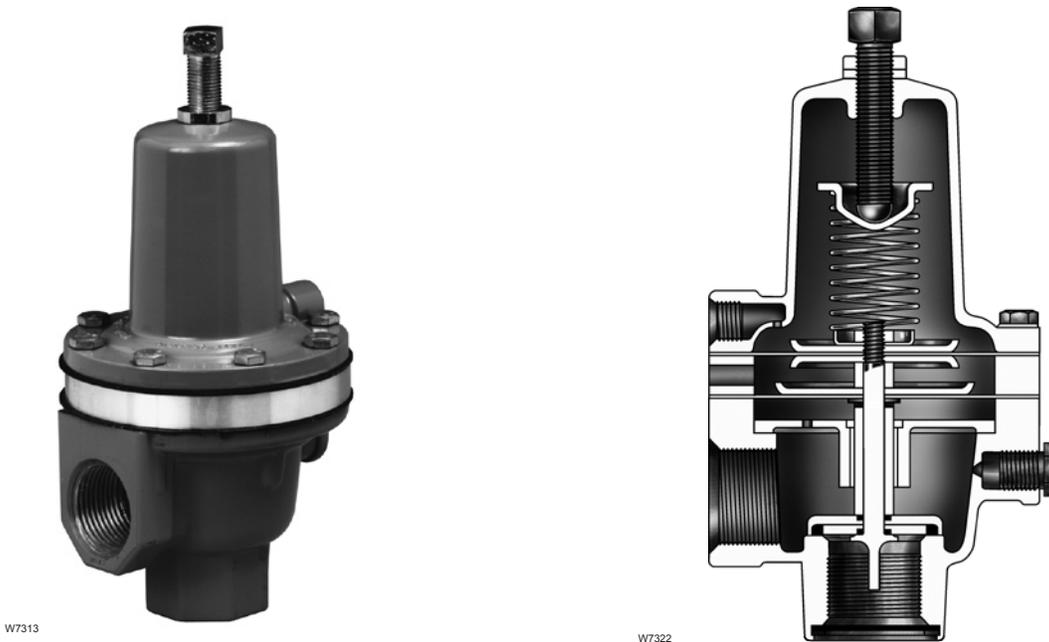


Figure 1. Type 289RC Exhaust Booster

## Introduction

### Scope of the Manual

This manual describes the principles of operation and provides installation instructions and a parts list for the Type 289RC exhaust booster.

### Product Description

The Type 289RC high-capacity exhaust booster provides “release control (RC)” control pressure to actuators, other pneumatic devices, and related systems that require rapid response, such as surge valves or recycle valves on compressors. This exhaust booster is normally used on control valve actuators to speed up the proportional operation of a

control valve in response to sudden pressure changes from pneumatic output devices, such as solenoid valves or pneumatic instruments. By carefully matching the instrument and actuator performance with the bypass valve adjustment, the Type 289RC reduces overshoot and related problems while allowing very fast positioning response to system requirements (i.e., compressor surge control). The one-way throttling action offers superior control with exceptional stability and the specially designed boosting system provides high flow rates with minimum buildup.

### Specifications

Specifications for the Type 289RC exhaust booster are listed on page 2. Specifications for a given exhaust booster as it originally comes from the factory are stamped on the nameplate.



# Type 289RC

## Specifications

### Body Size<sup>(1)</sup>

1 NPT

### Inlet and Outlet Connections

**Inlet:** Connect to the outlet via a bypass valve, adjustable from 0 to 0.3  $C_v$ . (Piping is normally configured by the customer.) See Figure 3.

**Signal:** 1/8 NPT (standard)

**Outlet:** 1 NPT

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

125 psig (8,6 bar)

### Input to Output Pressure Ratio

Fixed at 1 to 1

### Dead Band

0.5 psid (0,034 bar d) pressure across the bypass valve

### Maximum Exhaust Flow Capacity

$C_v = 22$ . System capacity limited by the smallest restriction between the exhaust valve and pressure source (actuator).

### Temperature Capabilities<sup>(1)</sup>

-20° to 180°F (-29° to 82°C)

### Approximate Weight

4 pounds (2 kg)

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

## Principle of Operation

The Type 289RC 1 NPT outlet port is connected directly to a spring return actuator and the 1/8 NPT inlet connection on the spring case is connected to the controlling instrument (I/P transducer, controller, positioner, etc.). The assembly of the Type 289RC to a control valve requires the inlet and outlet chambers be connected via a bypass valve. The bypass valve should be installed between the two 1/8 NPT connections on the Type 289RC or any other convenient location per the customer's preference. The Type 289RC exhaust booster has a factory set opening threshold of 0.5 psid (0,03 bar d). The adjustment screw in the booster body is not field adjustable. The bypass valve is adjusted on the control valve system to account for differences in various instrument and actuator performance characteristics. Once adjusted, the control valve action is as described in the following paragraph.

As the output pressure of the instrument increases the actuator moves the valve normally since the exhaust booster cannot be actuated with an increasing signal. When the output pressure of the instrument decreases the actuator will move the valve until the rate of change of the output pressure develops 0.5 psid (0,034 bar d) across the bypass valve. When this occurs, the pressure differential in the Type 289RC causes the exhaust booster valve to begin opening and begin reducing the pressure in the actuator. The greater the differential pressure develops across the bypass valve, the further the exhaust booster will

open. The booster exhaust valve closes as the pressure difference between the instrument and actuator decreases.

## Installation

The schematic on page 3 (Figure 2) shows the typical Type 289RC installation. Connect the instrument supply to the 1/8 NPT spring case inlet and the actuator to the 1 NPT side port outlet. The inlet and outlet must be connected via an adjustable bypass valve. Flow through the exhaust valve must be in the same direction as the flow arrow on the body.

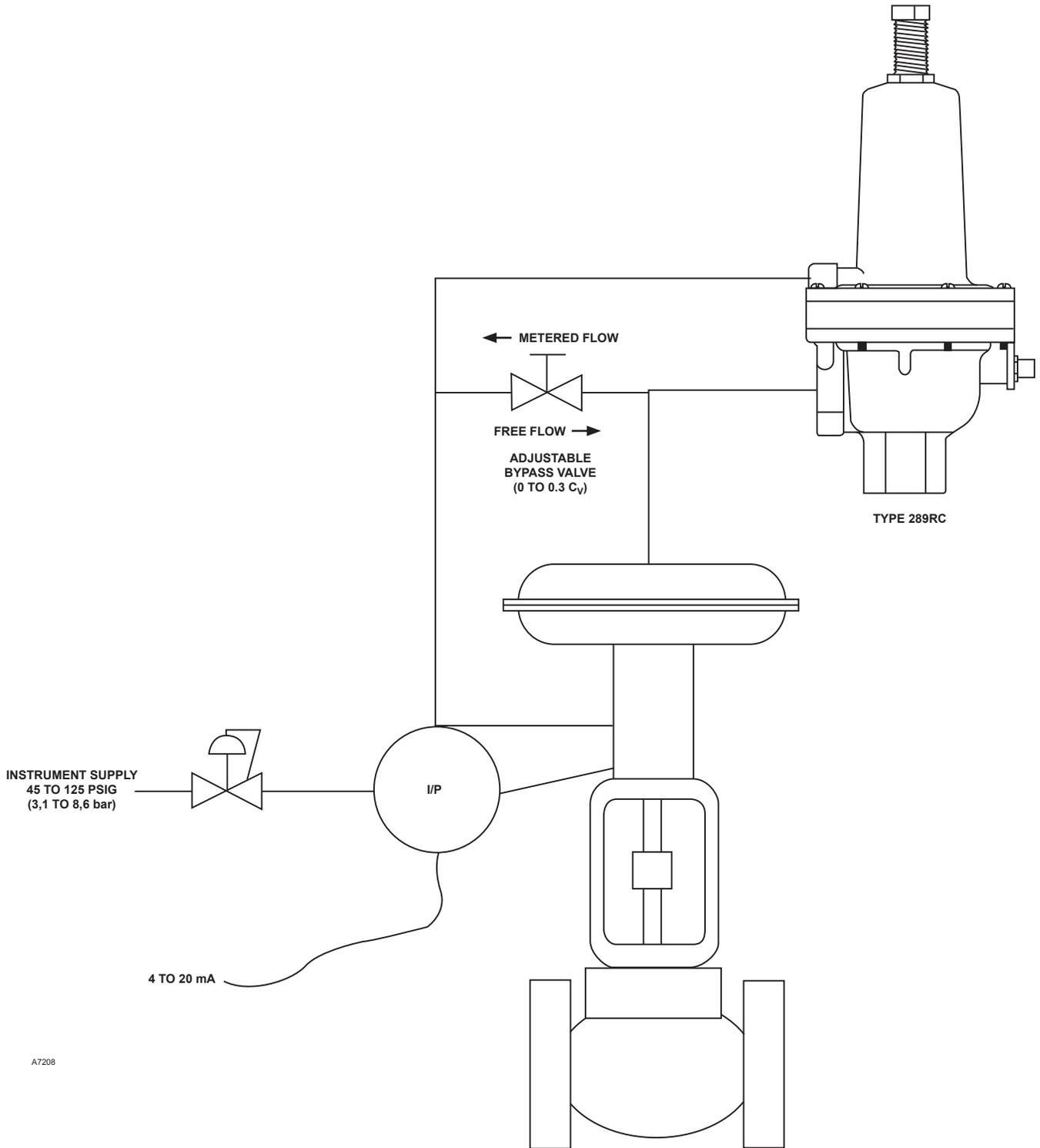
### Note

**Mounting is recommended with the outlet exhaust connection pointing down. If it is necessary to pipe this outlet away from the area, remove the outlet screen.**



## CAUTION

**Protect the outlet exhaust connection against the entrance of rain, snow, insects, or any other foreign material that may block the outlet or affect the opening and closing of the valve.**



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**Figure 2.** Typical Type 289RC Exhaust Booster and Control Valve Installation

# Type 289RC

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## Operating Information



### WARNING

**Never operate this system with the bypass valve closed.**

#### Note

**The Type 289RC requires no adjustment. The adjusting screw (key 6) is factory set and must not be changed.**

In the operating configuration (Figure 2) the bypass valve may require adjustment for optimum actuator response. Always begin with the bypass valve open. If opened enough, the instrument signal will drive the actuator and the system will respond as if the exhaust booster was not installed. As the bypass valve is closed the actuator response will be faster only in the exhaust mode. Response in the filling direction will remain unchanged. If the control valve tends to overshoot the desired position, the bypass valve has been closed too far.

## Calibration

The exhaust booster's calibration is factory set. This unit should not require calibration unless the adjusting screw has been loosened or the spring has been changed. Use the following procedure to calibrate a Type 289RC exhaust booster:

1. Connect the assembled Type 289RC to two independent pressure sources ( $P_1$  and  $P_L$ ) with pressure gauges as shown in Figure 3.
2. Place a plug in the 1/8 NPT body connection.
3. Set  $P_1$  and  $P_L$  at 6 psig (0,41 bar).
4. Screw the adjusting screw in all the way.
5. Adjust  $P_L$  to 5.3 psig (0,37 bar).

4. Turn the unit upside down and put just enough water into the exhaust port to cover the sealing surface. Turn the adjusting screw out until the first bubble appears at the exhaust port.
5. Lock adjusting screw in place.

## Maintenance

Type 289RC exhaust boosters are subject to normal wear and should be inspected periodically. The inspection frequency and replacement of parts depends on the severity of the service conditions.



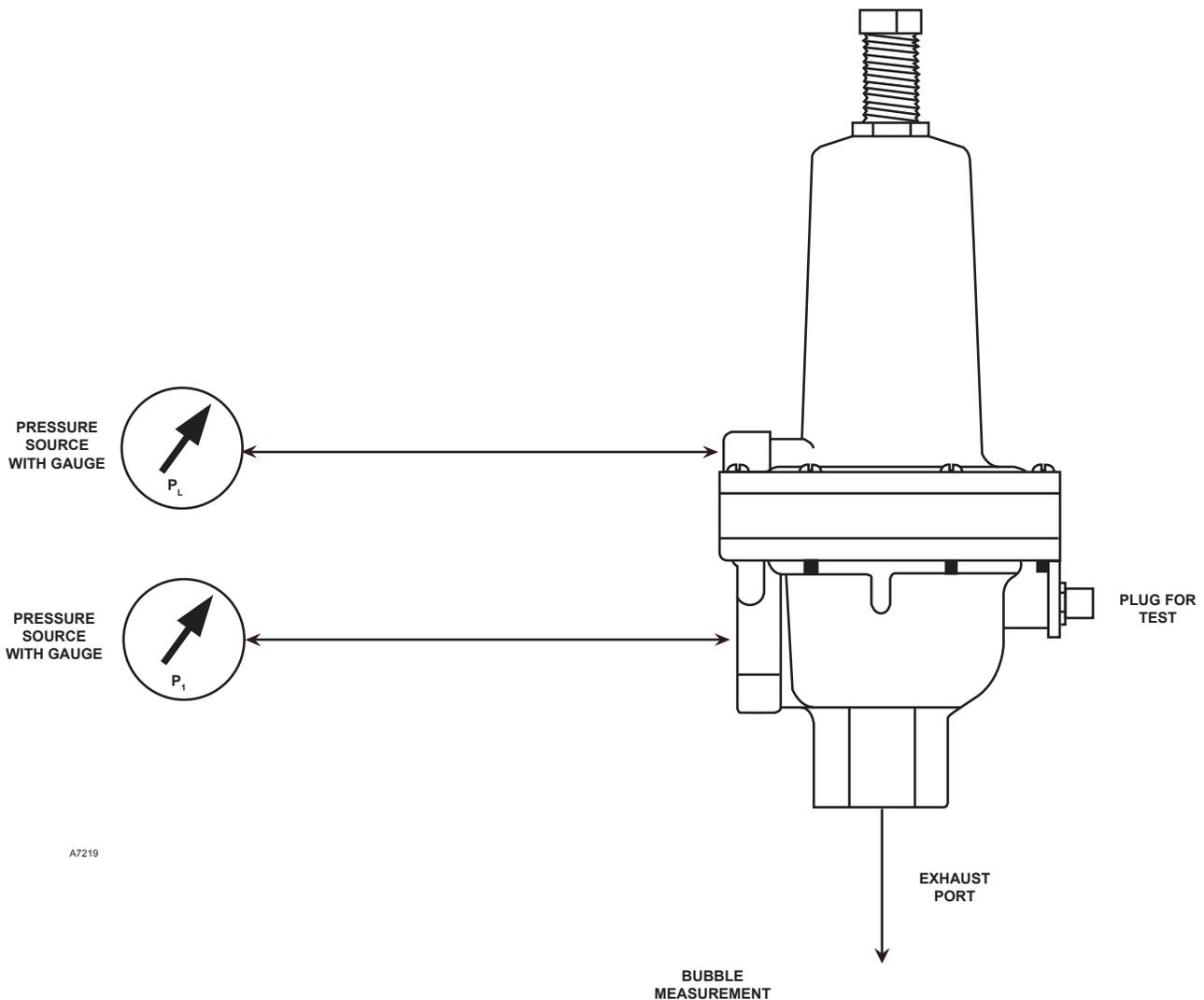
### CAUTION

**Maintenance requires taking the exhaust booster out of service. To avoid personal injury or equipment damage, release or bypass any pressure in the exhaust booster before beginning required maintenance.**

## Elastomer Replacement

Key numbers refer to Figure 5.

1. Loosen the adjusting screw (key 6) and remove the eight machine screws (key 8) from the spring case (key 2).
2. Remove the spring case (key 2).
3. Remove the spring (key 7) and upper spring seat (key 4).
4. Remove the spacer ring (key 42). The diaphragms may stick to the spacer.
5. Remove the two machine screws (key 29) and lift out the diaphragm/valve assembly. Lift up the valve assembly for more screwdriver clearance.

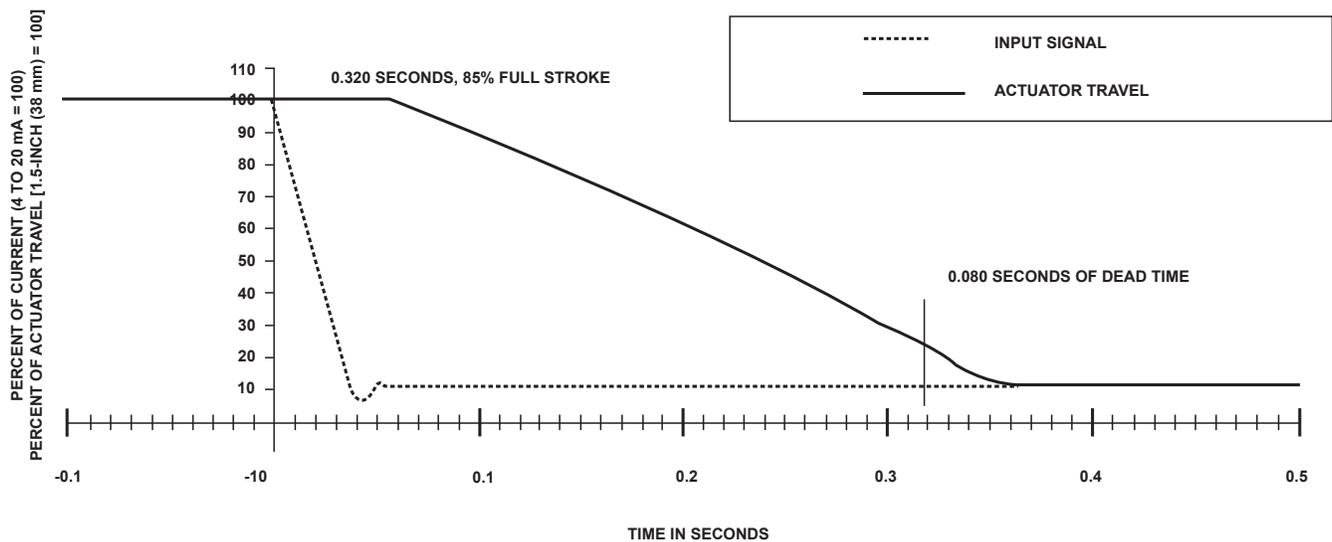


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**Figure 3.** Type 289RC Exhaust Booster Calibration Connection

6. Use a 7/16-inch (11 mm) wrench to remove the hex nut (key 24). Then remove the parts in order: spring guide (key 17), first diaphragm head (key 43) with curved side facing the diaphragm, diaphragm (key 5), second diaphragm head (key 43) with curved side facing the diaphragm, spacer (key 41), third diaphragm head (key 43) with curved side facing the diaphragm, second diaphragm (key 5), stem guide (key 31), spacer (key 23), O-ring (key 30), O-ring holder (key 21), O-ring (key 20), O-ring holder (key 22), and O-ring (key 30).
7. Remove and discard all non-metallic parts.
8. Position the stem (key 18) to accept all parts. Replace all non-metallic parts with new parts. Then place parts on the stem (key 18) in reverse order of step 6. Make sure to:
  - a. Lubricate all O-rings with a light coating of silicone grease.
  - b. Assemble both diaphragms so the spring sides (marked on diaphragm) face toward the spring.

# Type 289RC



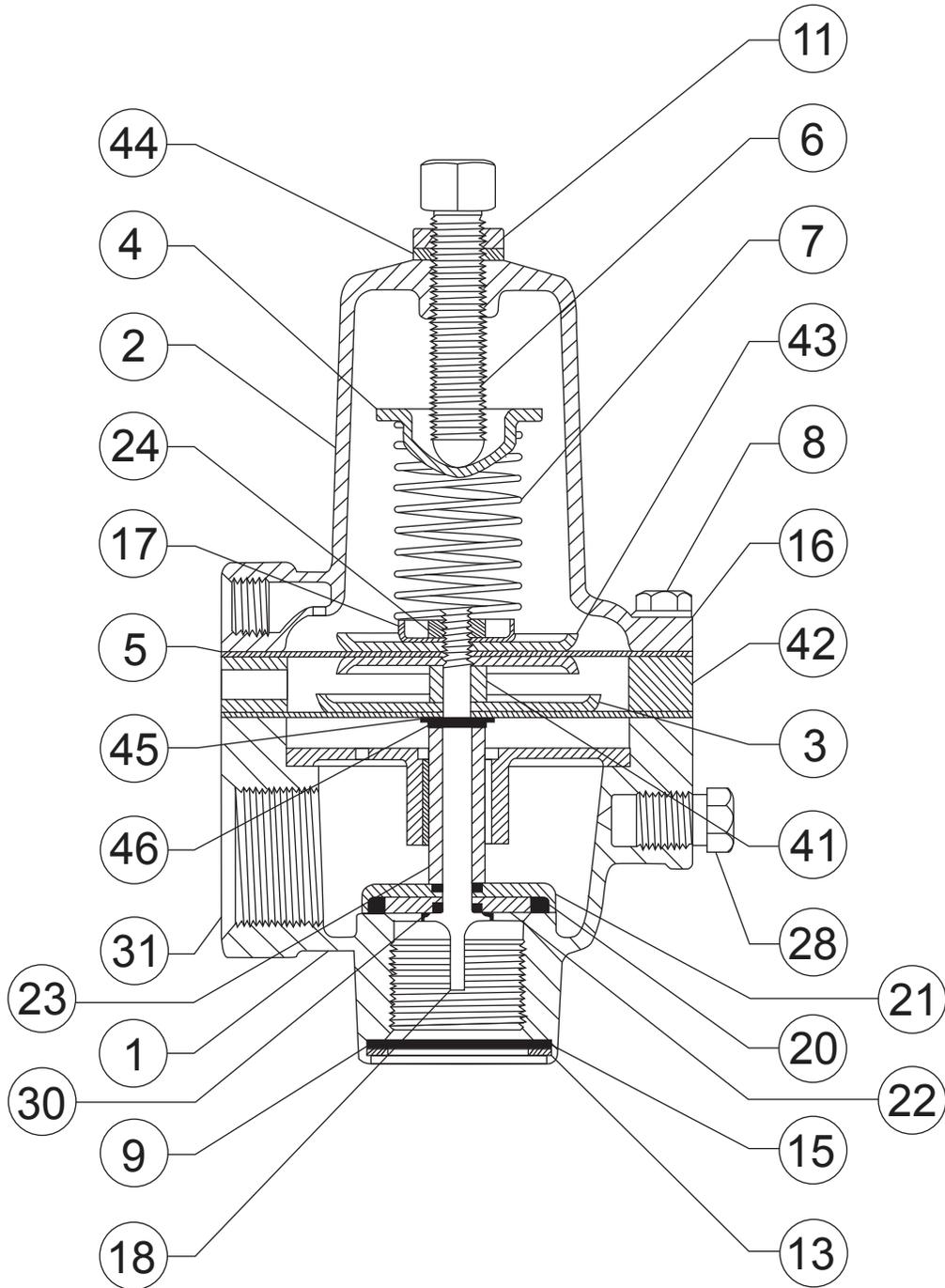
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**Figure 4.** Typical Response Curve for Type 657 Size 45 Actuator with Type 289RC Exhaust Booster [Using a Type 546 I/P Transducer with 4 to 20 mA input signal, 6 to 30 psig (0,41 to 2,1 bar) output, and 35 psig (2,4 bar) supply pressure; a Type 657 or 645 Valve Actuator with 10 to 26 psig (0,69 to 1,8 bar) setting and 0 to 1.5-inches (0 to 38 mm) of travel; and a Type 289RC Exhaust Booster with a bypass valve.]

- c. Assemble the valve seat holder and O-ring assembly (keys 20, 21, and 22) by hand prior to placing it on the stem.
- d. Do not tighten the hex nut (24) until step 11.
9. Place the machine screws (key 29) in the stem guide assembly (key 31), position the diaphragm/valve assembly in the valve body (key 1), and tighten screws (key 29) to 15 to 20 inch-pounds (1,7 to 2,3 N•m).
10. Position the spacer ring (key 42) between the diaphragms and align all holes with at least three machine screws (key 8) turned partially into the body.
11. While holding the stem (key 18) through the exhaust port in the bottom of the body, tighten the hex nut (key 24) to 30 to 35 inch-pounds (3,4 to 3,9 N•m). Hold the diaphragm head (key 43) while tightening the hex nut to be sure it does not turn or move.
12. Remove the aligning machine screws (key 8).
13. Place the spring (key 7) firmly around the lower spring guide (key 17) and install the upper spring seat (key 4).
14. Orient the spring case (key 2) as required while carefully positioning over the spring and seat.
15. Insert and tighten the machine screws (key 8) to 40 to 45 inch-pounds (4,5 to 5,1 N•m) using a cross tightening process.
16. Recalibrate unit using Calibration procedure on page 4.

## Parts Ordering

When corresponding with your local Sales Office about this equipment, always reference the equipment serial number stamped on the spring case (key 2). When ordering replacement parts, specify the complete 11-character part number of each required part as found in the following parts list.



PART NOT SHOWN  
MACHINE SCREW (KEY 29)

BYPASS VALVE, TUBING, AND FITTINGS  
NOT SUPPLIED WITH THE TYPE 289RC EXHAUST BOOSTER

Figure 5. Type 289RC Exhaust Booster

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# Type 289RC

## Parts List

Key	Description	Part Number	Key	Description	Part Number
1	Valve Body, Aluminum	14B9956X012	21	O-Ring Holder, Aluminum	1F826409012
2	Spring Case, Aluminum	2P901508012	22	O-Ring Washer, Aluminum	1F826509012
3	Diaphragm Head, Zinc-plated carbon steel	1D666428982	23	Spacer	17B7490X012
4	Spring Seat, Zinc-plated carbon steel	1D667125072	24	Hex Nut	1A499724122
5*	Diaphragm, Nitrile (NBR) on nylon (2 required)	24B5622X012	28	Pipe Plug	T13718T0012
6	Adjusting Screw	1D995448702	29	Machine Screw (2 required)	1H526928982
7	Spring, 302 Stainless steel	17B9737X012	30	O-Ring, Nitrile (NBR) (2 required)	1D687506992
8	Machine Screw (8 required)	1C856228992	31	Stem Guide Assembly, Zinc/Brass	18B0253X012
9	Screen	1E564843122	41	Spacer, Aluminum	17B3185X012
11	Hex Nut	1D667728982	42	Spacer Ring, Aluminum	27B3187X012
13	Snap Ring	13A9938X012	43	Diaphragm Head, Zinc-plated Carbon steel (2 required)	1P901425062
15*	Gasket, Nitrile (NBR)	13A9929X012	44*	Screw Seal	1V205699012
16	Nameplate	-----	45	Washer	1F826709012
17	Lower Spring Guide, Zinc-plated carbon steel	1D666625072	46*	Gasket	1F826804022
18	Pitot Tube or Stem, Aluminum	17B3186X012			
20*	O-Ring, Nitrile (NBR)	1F269206992			

\*Recommended spare part.

### Industrial Regulators

#### Emerson Process Management Regulator Technologies, Inc.

USA - Headquarters  
McKinney, Texas 75069-1872 USA  
Tel: 1-800-558-5853  
Outside U.S. 1-972-548-3574

Asia-Pacific  
Shanghai, China 201206  
Tel: +86 21 2892 9000

Europe  
Bologna, Italy 40013  
Tel: +39 051 4190611

Middle East and Africa  
Dubai, United Arab Emirates  
Tel: +971 4811 8100

### Natural Gas Technologies

#### Emerson Process Management Regulator Technologies, Inc.

USA - Headquarters  
McKinney, Texas 75069-1872 USA  
Tel: 1-800-558-5853  
Outside U.S. 1-972-548-3574

Asia-Pacific  
Singapore, Singapore 128461  
Tel: +65 6777 8211

Europe  
Bologna, Italy 40013  
Tel: +39 051 4190611  
Gallardon, France 28320  
Tel: +33 (0)2 37 33 47 00

### TESCOM

#### Emerson Process Management Tescom Corporation

USA - Headquarters  
Elk River, Minnesota 55330-2445 USA  
Tel: 1-763-241-3238

Europe  
Selmsdorf, Germany 23923  
Tel: +49 (0) 38823 31 0

For further information visit [www.fisherregulators.com](http://www.fisherregulators.com)

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