INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

WELKER® INSTRUMENT REGULATORS

**MODEL**
IR-1, IR-2, IR-4, IR-6

**DRAWING NUMBER**
AD015BO.V
AD024BO.2
AD030BO.1
AD031BO.3.D

**MANUAL NUMBER**
IOM-025

**REVISION**
Rev. E, 02/14/2024

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# IMPORTANT SAFETY INFORMATION
# READ ALL INSTRUCTIONS

Notes emphasize information and/or provide additional information to assist the user.

Caution messages appear before procedures that could result in damage to equipment if not observed.


Warning messages appear before procedures that could result in personal injury if not observed.

*This manual is intended to be used as a basic installation and operation guide for the Welker® Instrument Regulator, IR-1, IR-2, IR-4, and IR-6. For comprehensive instructions, please refer to the IOM Manuals for each individual component. A list of relevant component IOM Manuals is provided in the Appendix to this manual.*

*The information in this manual has been carefully checked for accuracy and is intended to be used as a guide for the installation, operation, and maintenance of the Welker® equipment described in this manual. Correct installation and operation, however, are the responsibility of the end user. Welker® reserves the right to make changes to this manual and all products in order to improve performance and reliability.*

## BEFORE YOU BEGIN

Read these instructions completely and carefully.

**IMPORTANT** – Save these instructions for local inspector's use.

**IMPORTANT** – Observe all governing codes and ordinances.

**Note to Installer** – Leave these instructions with the end user.

**Note to End User** – Keep these instructions for future reference.

Installation of this Instrument Regulator is of a mechanical nature.

Proper installation is the responsibility of the installer. Product failure due to improper installation is not covered under the warranty.

If you received a damaged Instrument Regulator, please contact a Welker® representative immediately.

**Phone:** 281.491.2331
**Address:** 13839 West Bellfort Street
Sugar Land, TX 77498

# SECTION 1: PRODUCT INFORMATION

## 1.1 Introduction

We appreciate your business and your choice of Welker® products. The installation, operation, and maintenance liability for this equipment becomes that of the purchaser at the time of receipt. Reading the applicable *Installation, Operation, and Maintenance* (IOM) *Manuals* prior to installation and operation of this equipment is required for a full understanding of its application and performance prior to use.*

If you have any questions, please call Welker® at 1.281.491.2331.

**The following procedures have been written for use with standard Welker® parts and equipment. Assemblies that have been modified might have additional requirements and specifications that are not listed in this manual.*

## 1.2 Product Description

The Welker® *IR-1, IR-2, IR-4, and IR-6* Instrument Regulators are mechanical, spring-balanced, non-pilot instrument pressure-reducing regulators. They are designed to provide a reduced pressure for devices that are unable to sustain high pressures. They are designed to balance a force between the adjustable spring tension and the desired output pressure.

In addition to the inlet port, the instrument regulator has three common ports on the body: the gauge, relief, and outlet. All ports are marked on the device accordingly. The IR-1, IR-2, and IR-6 series regulators are piston-operated, while the IR-4 is diaphragm-operated (see *Figure 1* and *Figure 2*). If the regulator is bolted together, it has a piston assembly.

Model IR-1T is the exception. It is diaphragm-operated and is bolted together.

*Welker® might custom design the IR-1, IR-2, IR-4, and IR-6 to suit the particular application and specifications of each customer.*

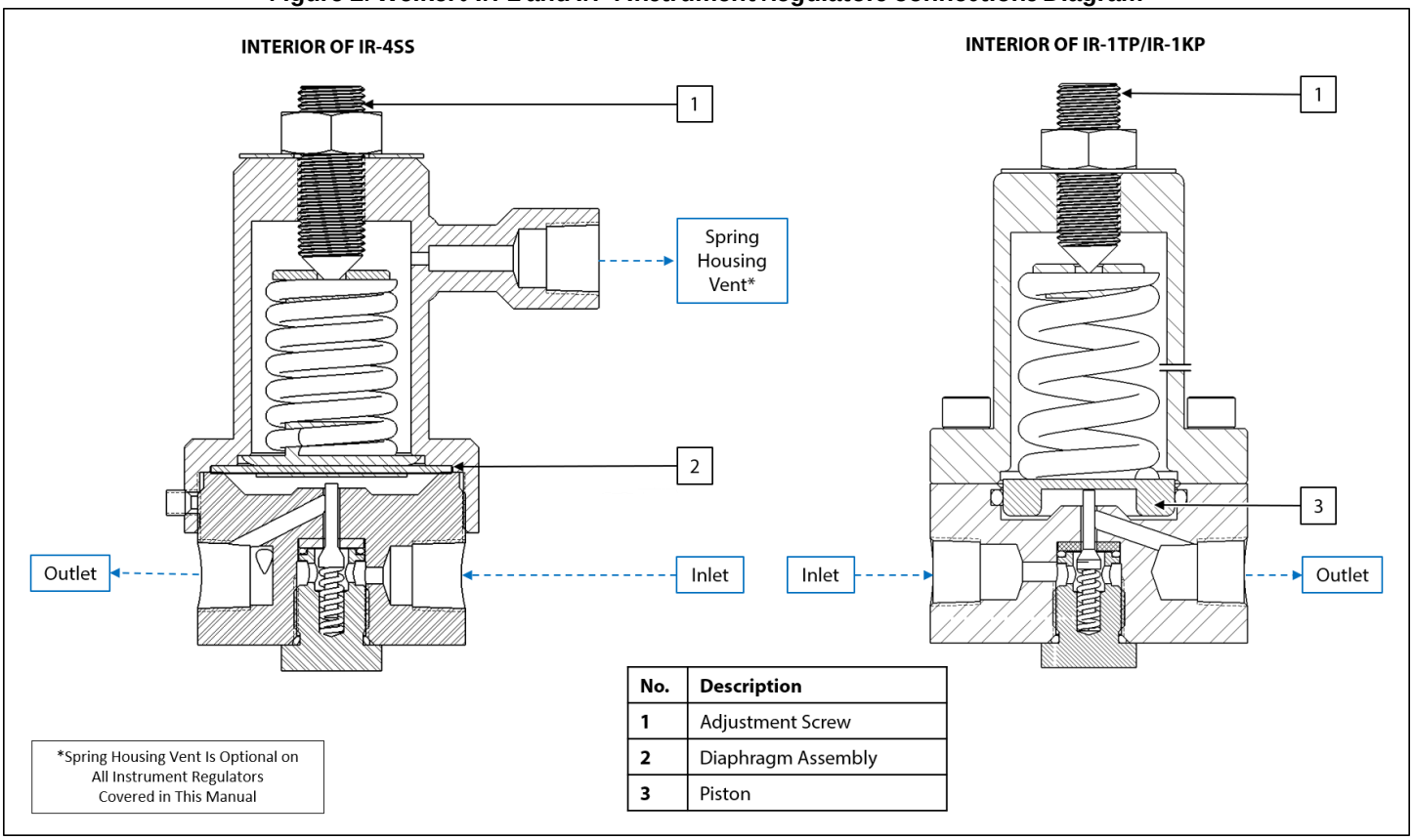
## 1.3 Specifications

The specifications listed in this section are generalized for this equipment. Welker® can modify the equipment according to your company's needs. **Please note that the specifications might vary depending on the customization of your equipment.**

| Table 1: Welker® IR-1, IR-2, IR-4, IR-6 Instrument Regulator Specifications | |
|---|---|
| **Products Sampled** | Gaseous Fluids or Liquids Compatible With the Materials of Construction |
| **Materials of Construction** | 316/316L Stainless Steel |
| **Maximum Inlet Pressure** | **IR-1:** 2000 psig (*137.9 barg*) (PTFE), 5000 psig (*344.7 barg*) (PCTFE)<br>**IR-2:** 5000 psig (*344.7 barg*)<br>**IR-4:** 3600 psig (*248.2 barg*)<br>**IR-6:** 5000 psig (*344.7 barg*)<br>Bolts Must Have a Minimum Tensile Strength of 180,000 lbs |
| **Temperature Range** | -20 °F to 120 °F (*-29 °C to 48 °C*) |
| **Connections** | **Sample Inlet:** ¼" FNPT<br>**Sample Outlet:** ¼" FNPT |
| **Output Ranges** | **IR-1:** 0–25 psig, 0–50 psig, 20–100 psig, 75–200 psig<br>**IR-2:** 200–500 psig<br>**IR-4:** 0–25 psig, 0–50 psig, 20–100 psig, 75–200 psig<br>**IR-6:** 200–1500 psig |
| **Operation** | **IR-1:** Piston-Operated or Diaphragm-Operated<br>**IR-2:** Piston-Operated<br>**IR-4:** Diaphragm-Operated<br>**IR-6:** Piston-Operated |
| **Approximate Weight** | **IR-1:** 3 lbs<br>**IR-2:** 2 lbs<br>**IR-4:** 2 lbs<br>**IR-6:** 3.25 lbs |
| **Approximate Dimensions** | **IR-1:** 4½" x 2½" x 2½" (Length x Width x Height)<br>**IR-2:** 4½" x 2½" x 3" (Length x Width x Height)<br>**IR-4:** 4⅜" x 2¼" x 3" (Length x Width x Height)<br>**IR-6:** 2½" x 2½" x 5" (Length x Width x Height) |
| **Features** | Connections for Relief Valve and Pressure Gauge<br>Welker® Recommends Connecting a Relief Valve and a Pressure Gauge to the Instrument Regulator |
| **Option** | Spring Housing Vent (See *Figure 1* for Example) |

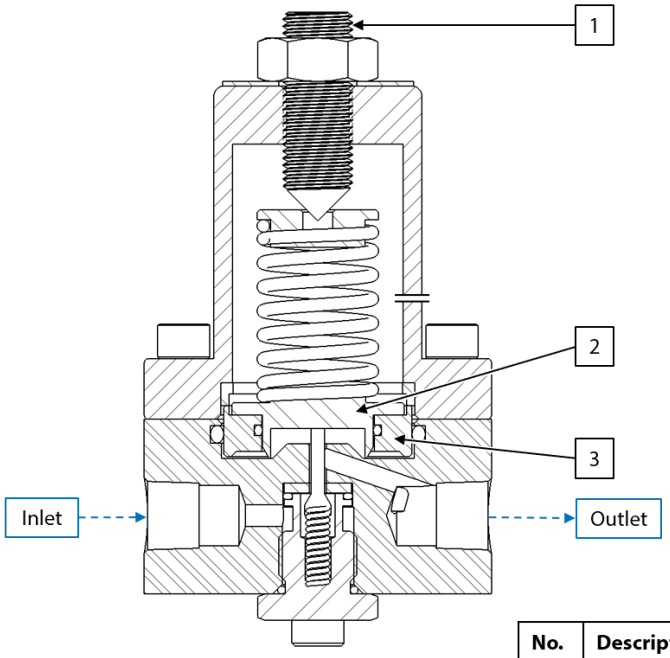
## 1.4 Equipment Diagrams

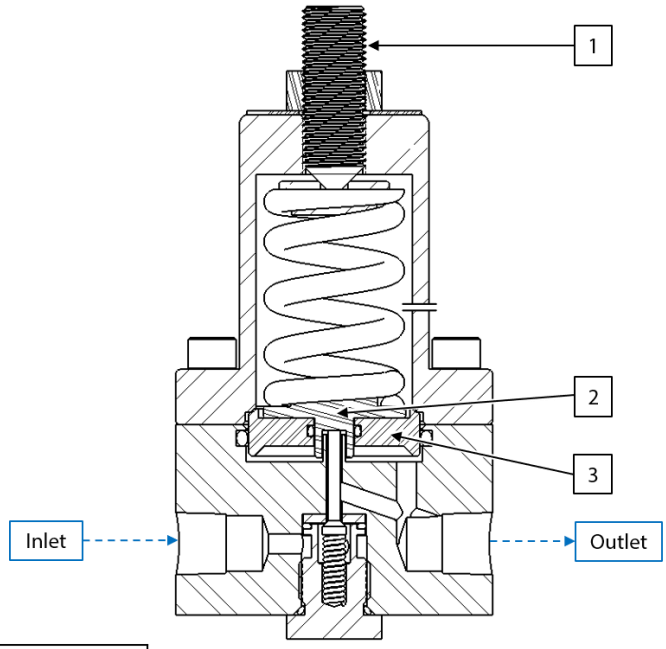
**Figure 1: Welker® IR-1 and IR-4 Instrument Regulators Connections Diagram**




| No. | Description |
|---|---|
| 1 | Adjustment Screw |
| 2 | Diaphragm Assembly |
| 3 | Piston |

**Figure 2: Welker® Instrument Regulator IR-2 and IR-6 Connections Diagram**




| No. | Description |
|---|---|
| **1** | Adjustment Screw |
| **2** | Piston |
| **3** | Adapter |

# SECTION 2: INSTALLATION & OPERATION

## 2.1 Before You Begin

After unpacking the unit, check the equipment for compliance and any damage that might have occurred during shipment. Immediately contact a Welker® representative if you received damaged equipment.

When sealing fittings with PTFE tape, refer to the proper sealing instructions for the brand used.

## 2.2 Installing the Regulator

1. Connect a gauge with the appropriate pressure range to the gauge port on the regulator (see *Figure 3 inset* for an example).
2. Connect a relief valve with the appropriate pressure limit to the relief valve port on the regulator (see *Figure 3 inset* for an example).
3. Use tubing to connect the inlet supply to the inlet port on the regulator (see *Figure 1* or *Figure 2*).

Do not turn on the inlet supply at this time. Turning on the inlet supply before the relief valve is set could result in overpressurizing the regulator.

Welker® recommends installing an upstream filter if the product has solid particles. The filter should be installed on the connection to the regulator inlet.

4. Use tubing to connect from the outlet port on the regulator to the inlet of the instrument.

## 2.3 Setting the Regulator

1. Loosen the adjustment screw until there is no tension on the spring.
2. Turn on the inlet supply to pressurize the regulator inlet.

If you choose to use the regulator to set the relief, do not exceed the output pressure range of the device.

If requested, the manufacturer can preset the relief prior to shipment.

3. Tighten the adjustment screw until the gauge reads the desired pressure of the outlet.
4. Tighten the nut on the adjustment screw to secure the screw into place.
5. Adjust the relief. Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the relief valve (listed in the *Appendix* to this manual).
6. The Instrument Regulator is now in operation.

# SECTION 3: MAINTENANCE

## 3.1 Before You Begin

1. **Welker® recommends that the unit have standard yearly maintenance under normal operating conditions.** In cases of severe service, dirty conditions, excessive cycling usage, or other unique applications that might lead to excess wear on the unit, a more frequent maintenance schedule might be appropriate.
2. Prior to maintenance or disassembly of the unit, it is advisable to have a repair kit available for repairs of the system in case of unexpected wear or faulty seals.

New seals supplied in spare parts kits should be lightly lubricated before being installed to ease the installation of the seals and reduce the risk of damage when positioning them on parts. Wipe excess lubricant from the seals, as it might adversely affect analytical instrument results.

For sample-exposed seals, Welker® recommends non-hydrocarbon-based lubricants, such as Krytox®.
For non-sample-exposed seals, Welker® recommends either non-hydrocarbon-based lubricants or silicone-based lubricants, such as Molykote® 111.

After the seals are installed, the outer diameter of shafts and inner diameter of cylinders may be lubricated to allow smooth transition of parts.

Maintenance on the Instrument Regulator should not be performed until the regulator has been isolated from ALL pressure.

3. All maintenance and cleaning of the unit should be performed on a smooth, clean surface.
4. Welker® recommends having the following tools available for maintenance. Please note that the exact tools required might vary by model.
   a. $^{3}/_{16}$" Allen Wrench
   b. $^{1}/_{4}$" Allen Wrench
   c. 6" Adjustable Wrench
   d. Small Screwdriver
   e. Seal Pick (or Small, Pointed Instrument)

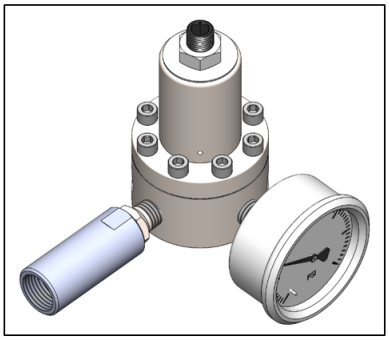
## 3.2 Maintenance

1. Turn off the inlet supply pressure to the regulator inlet.

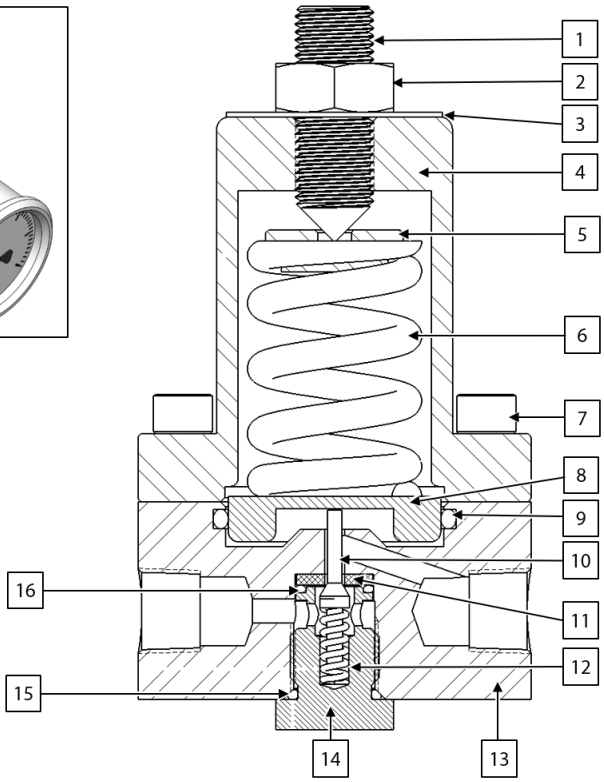
Check valves for leaks and repair as necessary during reinstallation.

2. Disconnect the inlet supply from the regulator inlet port.
3. Disconnect the instrument from the regulator outlet port.
4. Loosen the nut on the adjustment screw (see *Figure 3* and *Figure 4*).
5. Loosen the adjustment screw to relieve tension on the spring.

**Figure 3: Welker® IR-1 Instrument Regulator Maintenance Diagram**



**EXTERIOR OF IR-1 SHOWN WITH RELIEF & GAUGE**




**INTERIOR OF IR-1 INSTRUMENT REGULATOR - PISTON-OPERATED -**

| No. | Description |
|---|---|
| 1 | Adjustment Screw |
| 2 | Jam Nut |
| 3 | Spring Range Disc |
| 4 | Spring Housing |
| 5 | Spring Guide |
| 6 | Spring |
| 7 | Hex Cap Screw (Qty = 8) |
| 8 | Piston |
| 9 | O-Ring |
| 10 | Poppet |
| 11 | Seat |
| 12 | Spring |
| 13 | Instrument Regulator Body |
| 14 | Flow Ring |
| 15 | O-Ring |
| 16 | O-Ring |

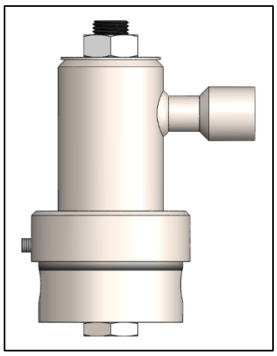
6. Disassemble the piston assembly (see *Figure 3*; if you have an Instrument Regulator with a diaphragm, please continue to step 7):

> If the Instrument Regulator is bolted together, it has a piston assembly. Model IR-1T is the exception. It is diaphragm-operated and is bolted together.

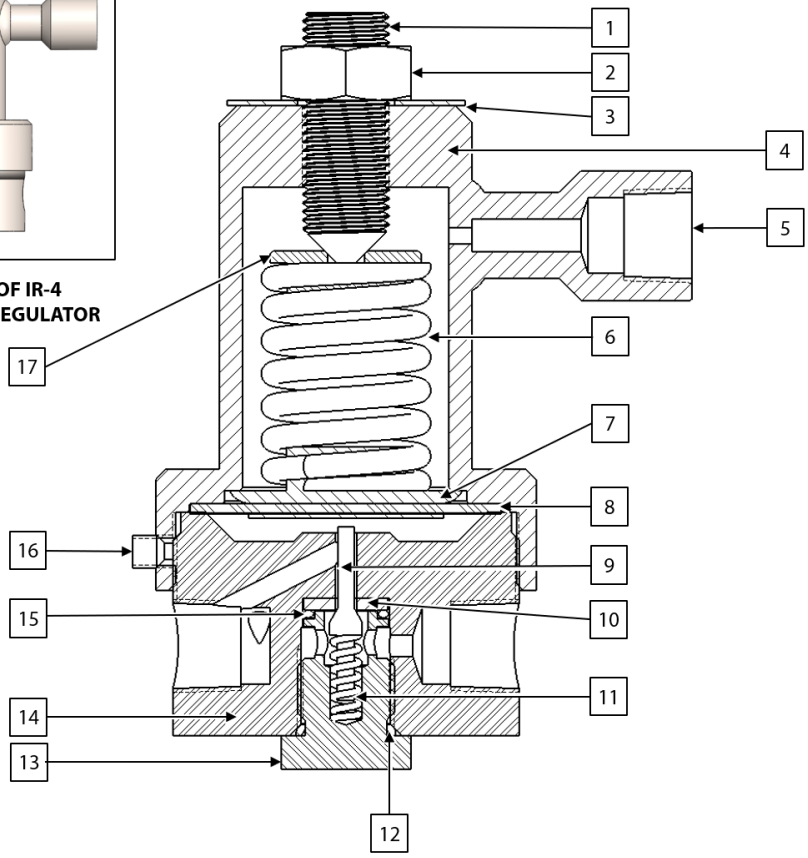
   a. Remove the eight (8) socket head screws and remove the spring housing.
   b. Remove the spring guide and the spring.
   c. Carefully remove the piston—without scratching it.
   d. Replace both O-rings in the piston body.
   e. Inspect the sealing surfaces of the piston for scratches. Replace the piston if necessary.
   f. Push the piston back into place. Continue to step 8.

7. Disassemble the diaphragm assembly (see *Figure 4*):
   a. Unscrew the spring housing and remove.
   b. Remove the top spring guide and the spring.
   c. Remove the bottom spring guide.
   d. Remove the diaphragm. Inspect for wear and replace if necessary.
   e. Set the diaphragm back into place.
   f. Set the bottom spring guide back into place on top of the diaphragm. Continue to step 8.
8. Set the spring back into place.
9. Set the top spring guide back into place on top of the spring.
10. Reattach the spring housing securely. For the IR-4 series Instrument Regulators, hand-tighten the housing. For the IR-1, IR-2, and IR-6 series Instrument Regulators, cross-bolt the eight (8) socket head screws.

**Figure 4: Welker® IR-4 Instrument Regulator Maintenance Diagram**



EXTERIOR OF IR-4
INSTRUMENT REGULATOR




INTERIOR OF IR-4
INSTRUMENT REGULATOR
- DIAPHRAGM-OPERATED -

| No. | Description |
|---|---|
| 1 | Adjustment Screw |
| 2 | Jam Nut |
| 3 | Spring Range Disc |
| 4 | Spring Housing |
| 5 | Spring Housing Vent* |
| 6 | Spring |
| 7 | Bottom Spring Guide |
| 8 | Diaphragm Assembly |
| 9 | Poppet |
| 10 | Welker® Standard Seat |
| 11 | Spring |
| 12 | O-Ring |
| 13 | Flow Ring |
| 14 | Body |
| 15 | O-Ring |
| 16 | Hex Set Screw |
| 17 | Spring Guide |

*Spring Housing Vent Is Optional on
All Instrument Regulators
Covered in This Manual

## 3.3 Lower Housing Maintenance

1. Unscrew the flow ring from the regulator body (see *Figure 3* and *Figure 4*).
2. Replace the seal (O-ring) on the flow ring.
3. Remove the poppet spring and the poppet (see *Figure 3* and *Figure 4*).
4. Examine the poppet and poppet spring. Replace if necessary.
5. Use a seal pick or pointed instrument to carefully pick the seat out of the body.
6. Examine the seat and replace if necessary.
7. Set the seat back into place.

Debris or scratches on either the poppet or seat will prevent positive shut off of the regulator.

8. Guide the poppet into the seat.
9. Reattach the poppet spring and flow ring.
10. Tighten the flow ring securely.
11. The unit is now ready for reinstallation.

# APPENDIX: REFERENCED OR ATTACHED DOCUMENTS

Welker® *Installation, Operation, and Maintenance* (IOM) *Manuals* suggested for reference or for use with this unit:

- IOM-033: Welker® RV-1, RV-1CP, RV-2, RV-2CP, and RV-3 Relief Valves

Other *Installation, Operation, and Maintenance* (IOM) *Manuals* suggested for reference or for use with this unit:

- None

Welker® drawings and schematics suggested for reference or for use with this unit:

- Assembly Drawing: AD015BO.V (Instrument Regulator IR-4SS With Spring Housing Vent)
- Assembly Drawing: AD024BO.2 (Instrument Regulator IR-1TP / IR-1KP)
- Assembly Drawing: AD030BO.1 (Instrument Regulator IR-2KP)
- Assembly Drawing: AD031BO.3.D (Instrument Regulator IR-6KP)

## NOTES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