



INSTALLATION, OPERATION, AND MAINTENANCE MANUAL
WELKER HEATED INSTRUMENT REGULATOR

MODEL

HR

DRAWING NUMBER

ADHR002

PATENT

U.S. PATENT 7,471,882

MANUAL NUMBER

IOM-158

REVISION

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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 Heated Instrument Regulator, HR. For comprehensive instructions, please refer to the IOM Manuals for each individual component. A list of relevant component IOM Manuals is provided in Appendix A of 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 Heated Instrument Regulator is of a mechanical and electrical 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 Heated Instrument Regulator, please contact a Welker representative immediately.

Phone: 281.491.2331

Address: 13839 West Bellfort Street
Sugar Land, TX 77498

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 may have additional requirements and specifications that are not listed in this manual.*

1.2 Product Description

The Welker *HR* Heated Instrument Regulator provides a conditioned gas sample stream at the required temperature and pressure for the instrumentation.

The HR heats product prior to decreasing the pressure to help compensate for the natural temperature drop that occurs during regulation. In order to set the desired output pressure, an adjusting screw on the device is turned clockwise. The design of the HR allows for the sample stream to flow through at a consistent rate of pressure and temperature.

The enclosure for the electrical parts of the equipment consists of one (1) of two (2) certified flameproof enclosures with either two (2) or three (3) $\frac{3}{4}$ " FNPT entries and a threaded cover. The certified enclosure houses a terminal block and a heater controller for regulation of the heater cartridge.

Welker may custom design the HR to suit the particular application and specifications of each customer.

1.3 Important Certification Information

1. Ensure that the field technician installing the HR is trained in the protection practices required to maintain the area classification for electrical equipment in ATEX and IECEx hazardous locations.
2. Before connecting power to the HR, the technician shall ensure that cabling components supplied by the end-user are certified for explosion protection flameproof enclosure "d".
3. The cable entry points may reach 179.24 °F (81.8 °C). Appropriate selection of cabling components shall be made by the end-user to ensure that the installation of the HR maintains its certifications.
4. The phase conductors should have a minimum cross-sectional area no less than 0.8325 mm² (18 AWG). The protective earth conductors should have the same or larger cross-sectional area as the phase conductors. All external equipotential bonding connections shall provide an effective connection of a conductor with a minimum cross-sectional area of 4 mm².
5. Do not open the certified enclosure until the surface temperature and any stored electrical energy have decayed to the point that the certified enclosure can no longer be a potential ignition source.
6. Ensure that the HR is isolated from all incoming and outgoing connections (including neutral conductors) prior to opening the certified enclosure.
7. When removing the HR to perform maintenance, ensure that the exposed conductors are correctly terminated in an appropriate enclosure, are insulated and isolated from all power sources, or are properly grounded and isolated from all power sources.
8. When reassembling the certified enclosure, all joints should be thoroughly cleaned and may be lightly lubricated with suitable grease, such as Crouse-Hinds STL or HTL Thread Lubricant, to prevent corrosion and assist in weatherproofing. Use only non-metallic scrapers and non-corrosive cleaning fluids to clean flanges. Keep blind bolt holes clear of grease.

1.4 Specific Conditions of Use

1. Some external parts of the equipment are non-conducting and may generate an ignition-capable level of electrostatic charge under certain extreme conditions. The end-user should ensure that the equipment is not installed in a location where it may be subjected to external conditions (such as high pressure steam), which might cause a build-up of electrostatic charges on non-conducting surfaces. Additionally, cleaning of the equipment should be done with a damp cloth.
2. The equipment shall be operated within an inlet process temperature range of -76 °F to 140 °F (-60 °C to +60 °C).

1.5 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 may vary depending on the customization of your equipment.**

Table 1: HR Specifications

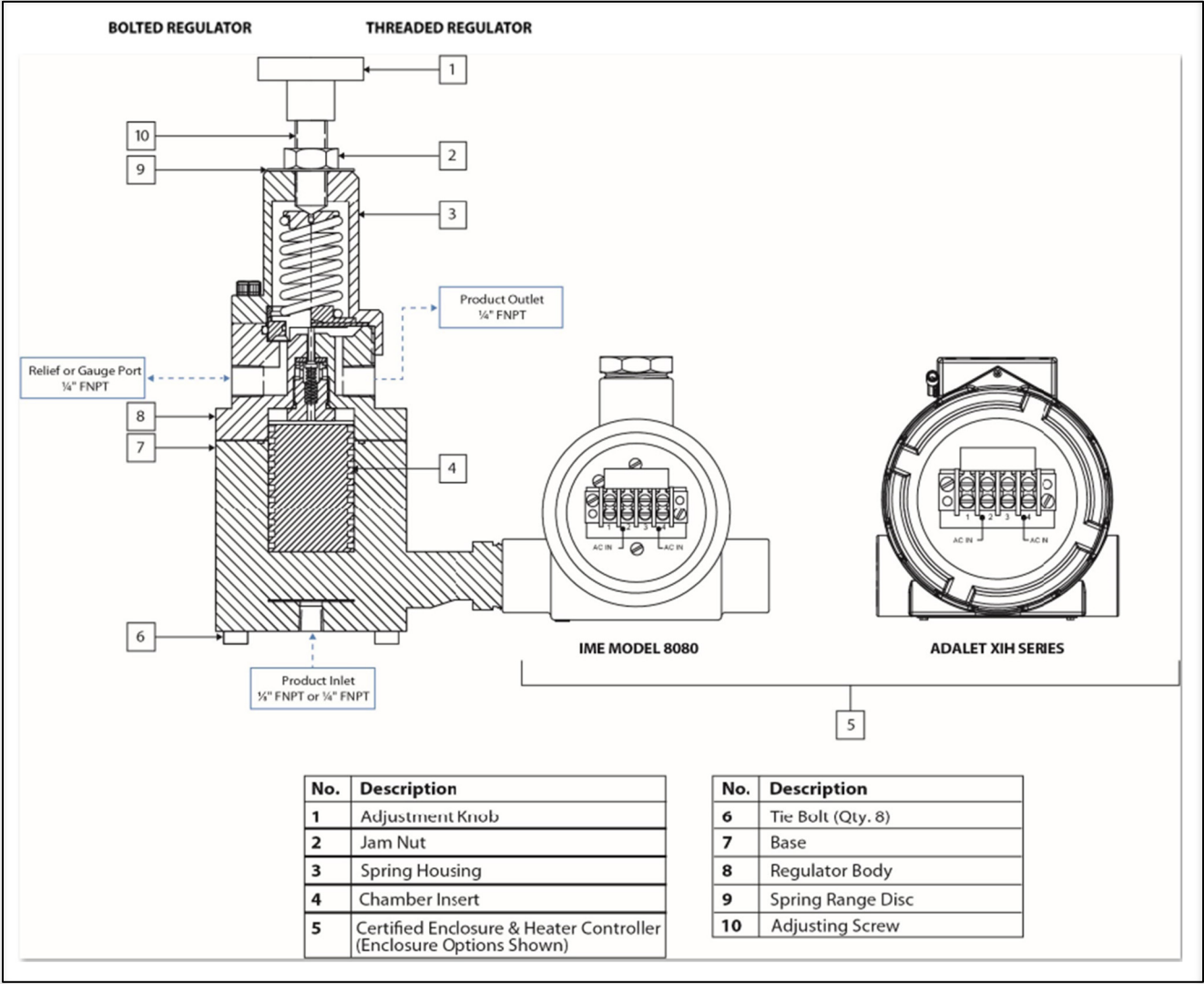
Products	Natural Gas and Natural Gas Liquids Compatible With the Materials of Construction
Materials of Construction	<p>Regulator Base & Body: 6 Moly Stainless Steel, 17-4 PH Stainless Steel, 304/304L Stainless Steel, 316/316L Stainless Steel, 317/317L Stainless Steel, 321/321H Stainless Steel, 347/347H Stainless Steel, Duplex Stainless Steel, HASTELLOY® C276 Alloy, Inconel Alloy 625, Monel® Alloy 400, and Super Duplex Stainless Steel</p> <p>Seals: Varies Based on Customer Specifications and the MAOP and MAOT of the Unit</p>
Maximum Allowable Operating Pressure	<p>Bolted: 6000 psig @ -76 °F to 140 °F (413 barg @ -60 °C to +60 °C)</p> <p>Threaded: 3600 psig @ -76 °F to 140 °F (248 barg @ -60 °C to +60 °C)</p>
Process Temperature Range	-76 °F to 140 °F (-60 °C to +60 °C)
Connections	<p>Product Inlet: 1/8" FNPT (Standard) or 1/4" FNPT</p> <p>Product Outlet: 1/4" FNPT</p>
Electrical Connections	3/4" MNPT
Output Range	<p>0–25 psig (0–1.7 barg)</p> <p>0–50 psig (0–3.4 barg)</p> <p>20–100 psig (1.3–6.8 barg)</p> <p>75–200 psig (5.1–13.7 barg)</p>
Operation	Diaphragm- or Piston-Operated Regulator
Features	<p>Explosion-Proof Certified Enclosure</p> <p>Heating Element With Adjustable Temperature Range</p> <p>(See Table 2 for Options)</p>
Product Certifications	
Patent	U.S. Patent 7,471,882
Options	<p>Bracket for Mounting</p> <p>Regulator Subassembly</p> <p>Relief Valve With Pressure Gauge</p>

Table 2: Heating Element Options

Electrical Connection	Power	Temperature Range	Current	Resistance
AC 110/220 V	150 W	68 °F to 210 °F (20 °C to 98 °C)	1.25 A	196 Ω
	200 W	180 °F to 380 °F (82 °C to 193 °C)	1.67 A	75 Ω
AC 220/240 V	100 W	68 °F to 210 °F (20 °C to 98 °C)	0.417 A	576 Ω
	200 W	180 °F to 380 °F (82 °C to 193 °C)	0.833 A	288 Ω

1.4 Equipment Diagram

Figure 1: Welker Heated Instrument Regulator Diagram



SECTION 2: INSTALLATION & OPERATION

2.1 Before You Begin



After unpacking the unit, check the equipment for compliance and any damage that may 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.

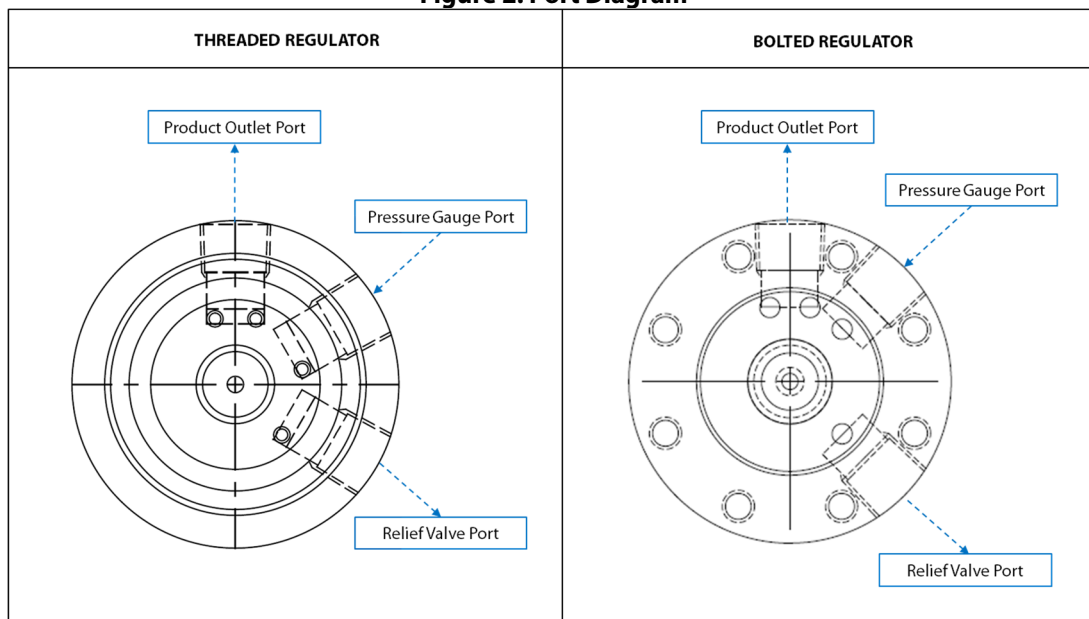
2.2 Installing the HR



Ensure that the field technician installing the HR is trained in performing installations as well as the protection practices required to maintain the area classification of the electrical equipment in ATEX and IECEx hazardous locations.

1. As necessary, install a pressure gauge to the pressure gauge port (*Figure 2*).

Figure 2: Port Diagram



Welker can install a relief valve and pressure gauge if requested at the time of order.

2. As necessary, use a safe auxiliary gas supply to set the relief valve to the proper pressure. Refer to the *Installation, Operation, and Maintenance (IOM) Manual* for the relief valve for instructions on setting the relief.



If a Welker relief valve is used, Welker can set the relief valve prior to shipment if requested at the time of order.

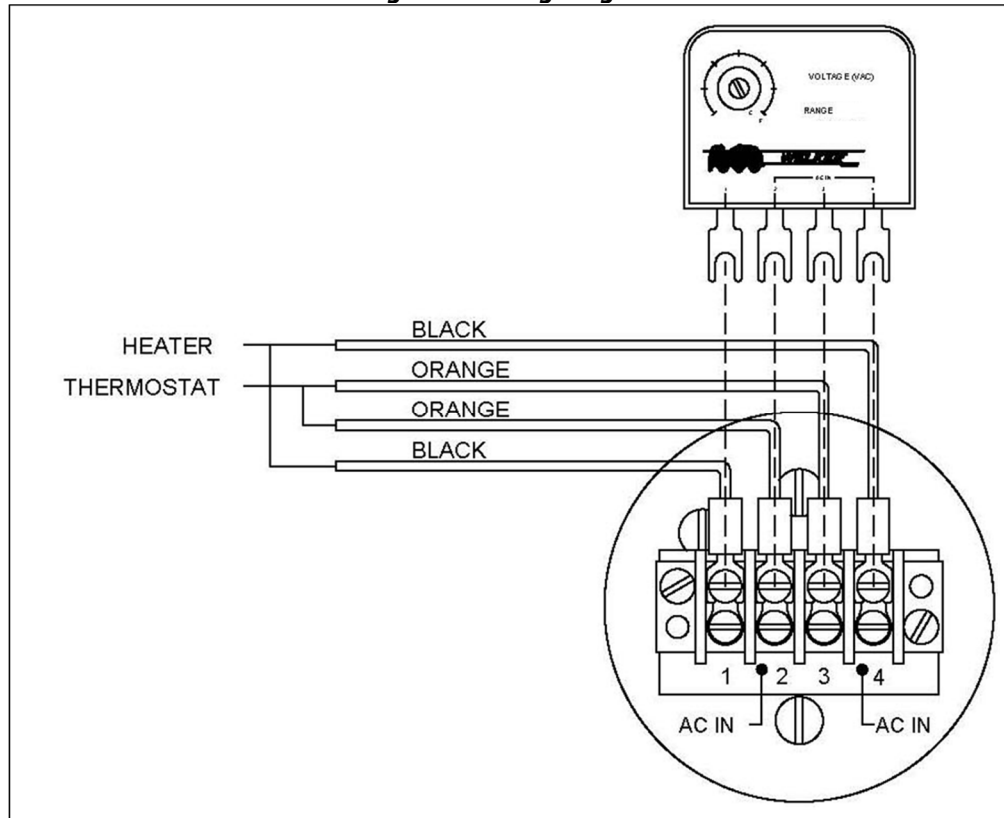
3. As necessary, install the set relief valve to the relief valve port (*Figure 2*).

4. With the customer-supplied electrical power turned OFF, connect the appropriate leads to terminals 2 and 4 in the provided certified enclosure (*Figure 3*).



See *Section 1.3, Important Certification Information*, for information on selecting appropriate cabling components for the HR to ensure it maintains its certifications.

Figure 3: Wiring Diagram



5. Conductors used to supply power to the certified enclosure are required to use adequate barrier glands or conduit seals and an appropriate sealing compound to maintain flameproof "d" rating.



For systems used in hazardous locations, sealing compound is required to seal all fittings to restrict the passage of gases, vapors, or flames.



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

6. Set the heater controller dial to the desired temperature.



Note that the temperature scale on the heater controller is for reference only.

7. Secure the cover to the certified enclosure and fasten the set screw.
8. Using customer-supplied 1/4" tubing, connect from the product supply outlet to the product inlet of the HR (*Figure 1*).
9. Install customer-supplied tubing or other fittings to the product outlet port of the HR (*Figure 1* or *Figure 2*).



Welker recommends that this tubing be insulated and heat-traced so that the sample maintains its temperature increase prior to reaching the analyzer.

10. Loosen the jam nut on the adjusting screw (*Figure 1*).
11. Screw the adjusting screw clockwise to adjust the outlet pressure. Tighten the jam nut to secure the adjusting screw at the desired outlet pressure (*Figure 1*).
12. Turn ON the electrical power to begin operation. Allow at least thirty (30) minutes for the HR to warm up.



Welker recommends that the unit be enclosed or insulated to maximize the heating effect of the HR.

SECTION 3: MAINTENANCE

3.1 Before You Begin

1. **Welker recommends that the unit have standard yearly maintenance.** Based on the operating conditions and/or site requirements, adjustments to the maintenance schedule may be necessary.
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 may 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.

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 may vary by model.
 - a. 6" and 10" Channel Lock Pliers
 - b. 10" Adjustable Wrench
 - c. Gloves
 - d. Hex Key Set
 - e. Non-autoranging Multimeter
 - f. Seal Pick
 - g. Tubing Crimp and Accessories

3.2 Maintenance



When removing the HR to perform maintenance, ensure that the exposed conductors are correctly terminated in an appropriate enclosure and are properly grounded and isolated from all energy sources.

1. Turn OFF all electrical power to the unit and isolate it from all applicable energy sources.

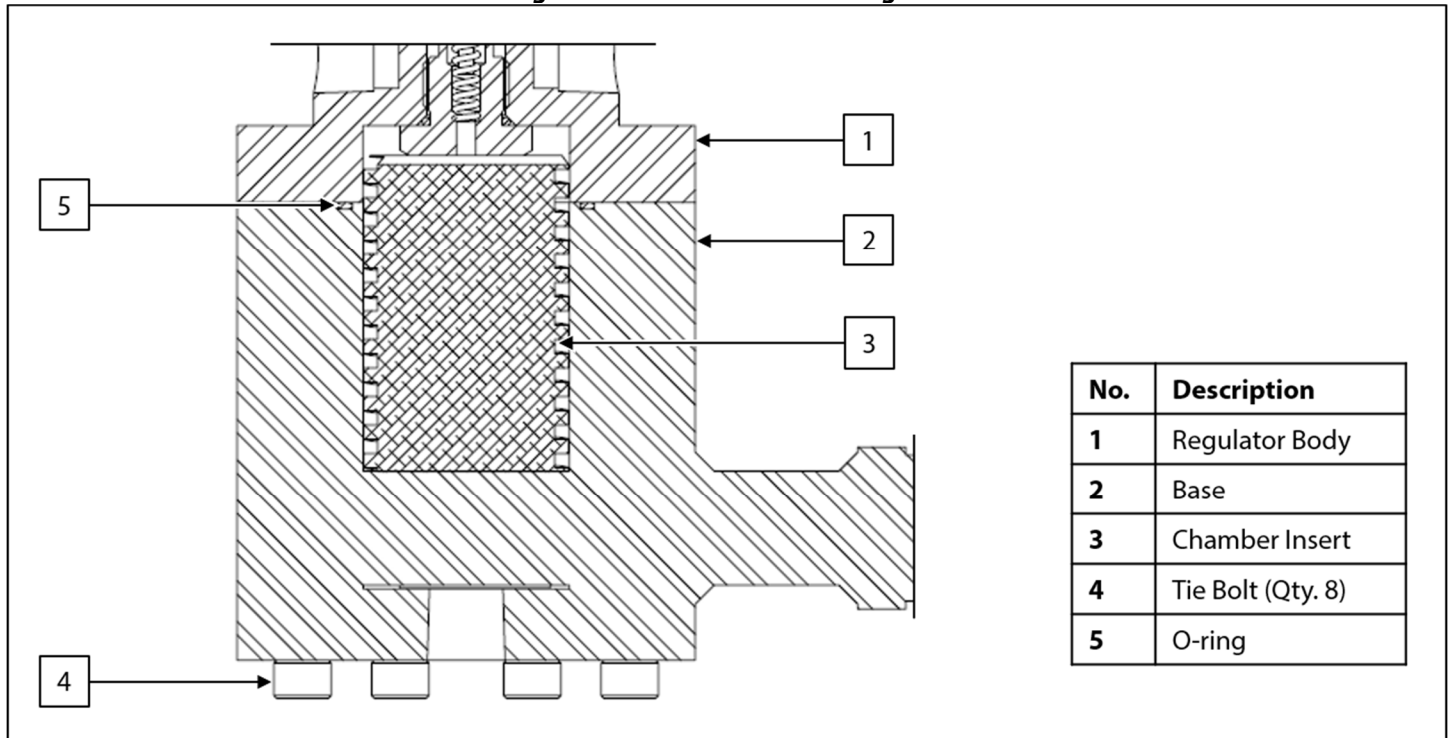


The HR will be HOT after use. Allow an appropriate amount of time for the regulator to cool down prior to performing maintenance.

2. Disconnect the electrical wiring and ensure that it cannot become live while maintenance is performed (*Figure 3*).
3. Turn OFF the product supply to the unit to depressurize the HR.
4. Disconnect the customer-supplied tubing, fittings, or instrument attached to the HR.
5. Remove the tie bolts from the bottom of the base and separate the regulator subassembly from the base (*Figure 4*).

Base Maintenance

Figure 4: Base Maintenance Diagram



6. Replace the O-ring in the top of the base (*Figure 4*).
7. Remove the chamber insert and inspect it for any dents that would impede the flow of gas (*Figure 4*). Replace as necessary.
8. Return the chamber insert to the base, and then set the base aside.

Regulator Upper Housing Maintenance



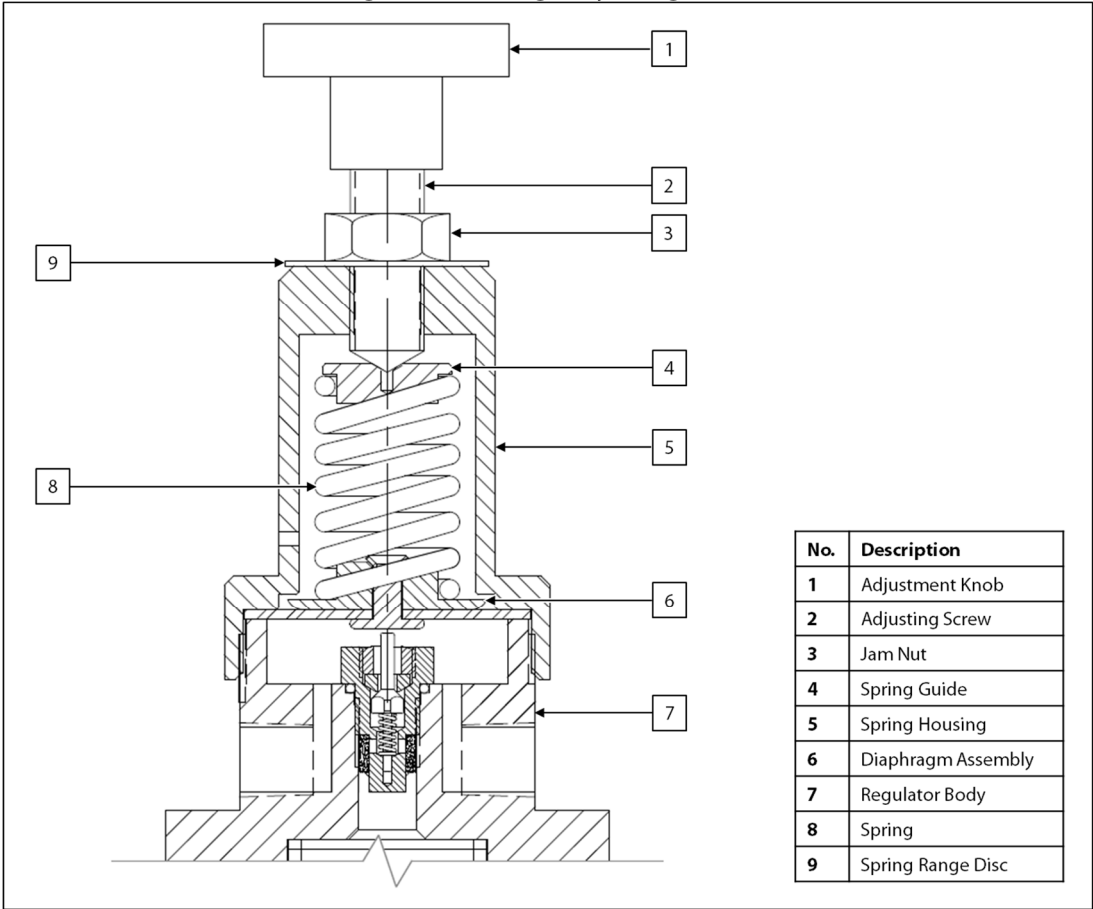
Maintenance should not be performed on the regulator until the regulator has been isolated from all pressure.

9. Loosen the jam nut on the adjusting screw (*Figure 1*).
10. In a counterclockwise direction, back off the adjusting screw to relieve tension on the spring (*Figure 1*).
11. As necessary, perform maintenance on the relief valve. Refer to the *Installation, Operation, and Maintenance (IOM) Manual* for the relief valve for maintenance instructions.
12. Separate the spring housing from the regulator body (*Figure 1*).



To perform maintenance on a cartridge-style regulator, continue to step 13.
To perform maintenance on a diaphragm-style regulator, proceed to step 20.
To perform maintenance on a piston-style regulator, proceed to step 28.

Figure 5: Cartridge-Style Regulator



- 13. Remove the diaphragm assembly, spring, and spring guide (Figure 5).
- 14. Inspect the diaphragm for wear. If the diaphragm shows signs of wear, the diaphragm assembly must be replaced.



The diaphragm assembly must be replaced at least every five (5) years.

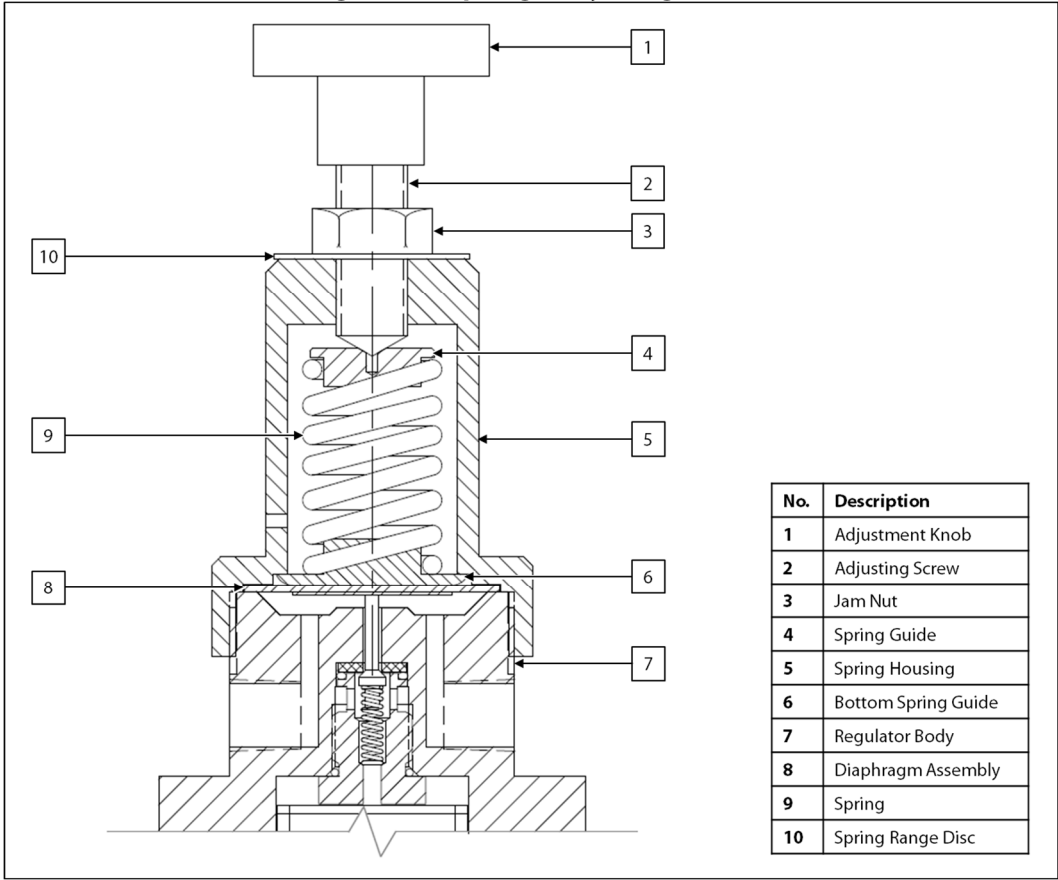
- 15. Place the diaphragm assembly on the top of the regulator body with the bottom spring guide facing up (Figure 5).
- 16. Place the spring on the diaphragm assembly (Figure 5). Ensure that the spring is sitting on the bottom spring guide.
- 17. Return the spring guide to the top of the spring (Figure 5).
- 18. Install the spring housing to the regulator body (Figure 5).



When reassembling the upper housing, HAND TIGHTEN ONLY.

- 19. Proceed to step 38 for instructions on maintaining the regulator body.

Figure 6: Diaphragm-Style Regulator



- 20. Remove the spring guides and spring (Figure 6).
- 21. Remove the diaphragm assembly (Figure 6).
- 22. Inspect the diaphragm for wear. Replace as necessary.



The diaphragm assembly must be replaced at least every five (5) years.

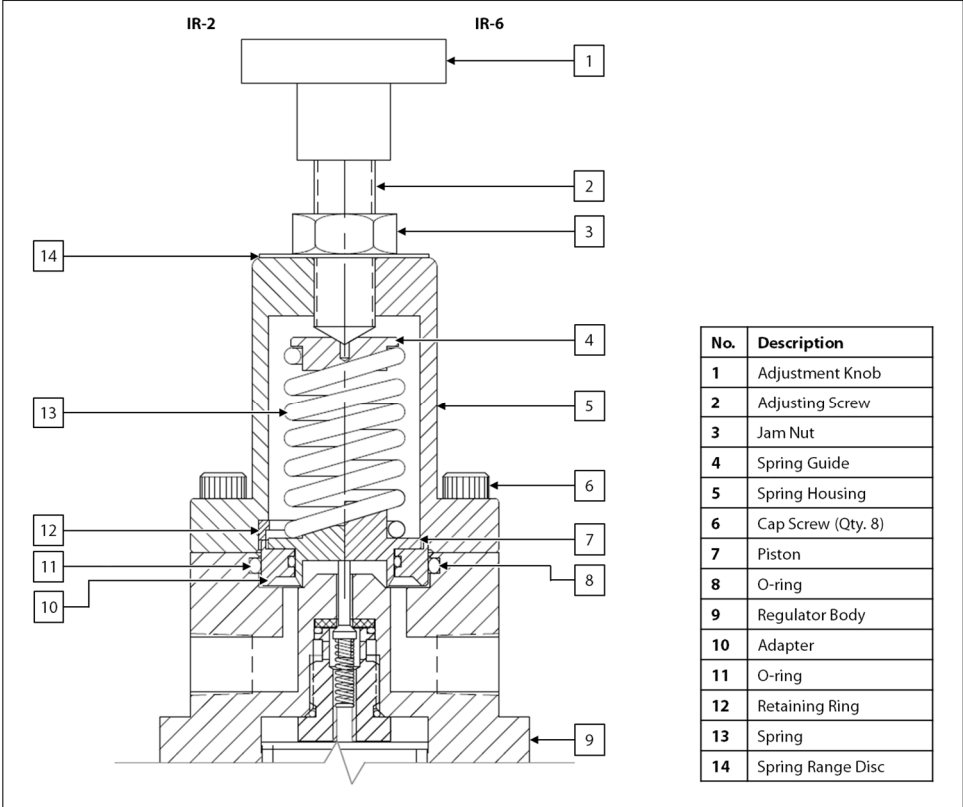
- 23. Place the diaphragm assembly on top of the regulator body with the bottom spring guide facing up (Figure 6).
- 24. Place the spring on the diaphragm assembly (Figure 6). Ensure that the spring is sitting on the bottom spring guide.
- 25. Return the spring guide to the top of the spring (Figure 6).
- 26. Install the spring housing to the regulator body (Figure 6).



When reassembling the upper housing, HAND TIGHTEN ONLY.

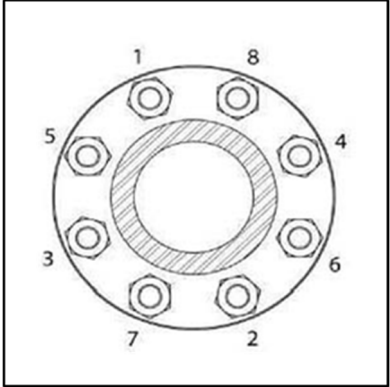
- 27. Proceed to step 38 for instructions on maintaining the regulator body.

Figure 7: Piston-Style Regulator



- 28. Remove the piston, adapter, spring, and spring guide (Figure 7).
- 29. Replace the O-ring in the regulator body and in the adapter (Figure 7).
- 30. As necessary, remove the retaining ring from the spring housing and inspect the retaining ring for scratches or damage (Figure 7). Replace as necessary.
- 31. Inspect the sealing surfaces of the piston for scratches (Figure 7). Replace as necessary.
- 32. Install the piston to the adapter, and then install this subassembly to the regulator body with the piston facing up.
- 33. Place the spring on the piston assembly. Ensure that the spring is sitting on the piston.
- 34. Return the spring guide to the top of the spring.
- 35. As necessary, return the retaining ring to the spring housing.
- 36. Following a cross-bolting sequence, install the cap screws to the spring housing, and then tighten to secure the spring housing to the regulator body (Figure 8).

Figure 8: Cross-Bolting Sequence



- 37. Continue to step 38 for instructions on maintaining the regulator body.

Regulator Body Maintenance

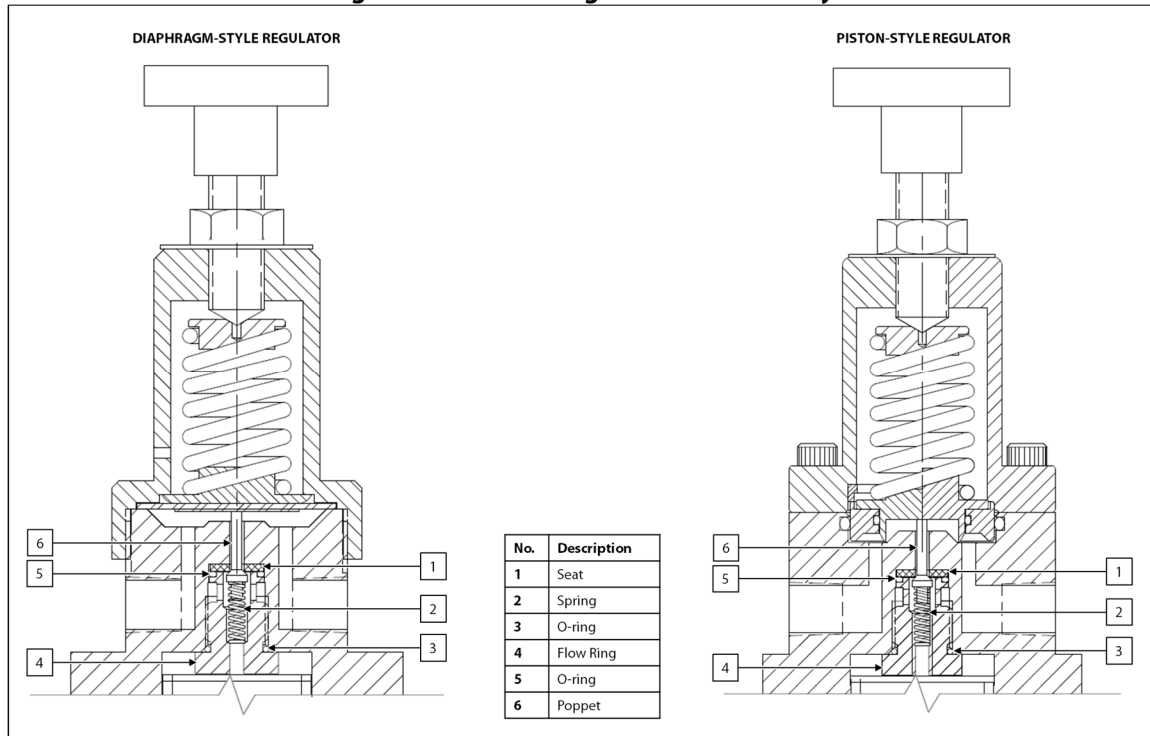
38. Ensure that the regulator subassembly is separated from the base.



To perform maintenance on a standard regulator subassembly, continue to step 39.
To perform maintenance on a cartridge-style regulator subassembly, proceed to step 50.

Regulator Subassembly: Standard

Figure 9: Standard Regulator Subassembly



39. Use a socket wrench to loosen the flow ring (Figure 9).
40. Remove the flow ring, spring, and poppet (Figure 9).
41. Examine the seating face of the poppet for scratches or damage. Replace as necessary.



Debris or scratches on the poppet will prevent positive shutoff of the regulator.

42. Use a small, pointed instrument to carefully remove the seat from the regulator body (Figure 9).
43. Inspect the seat for debris or scratches. Replace as necessary.

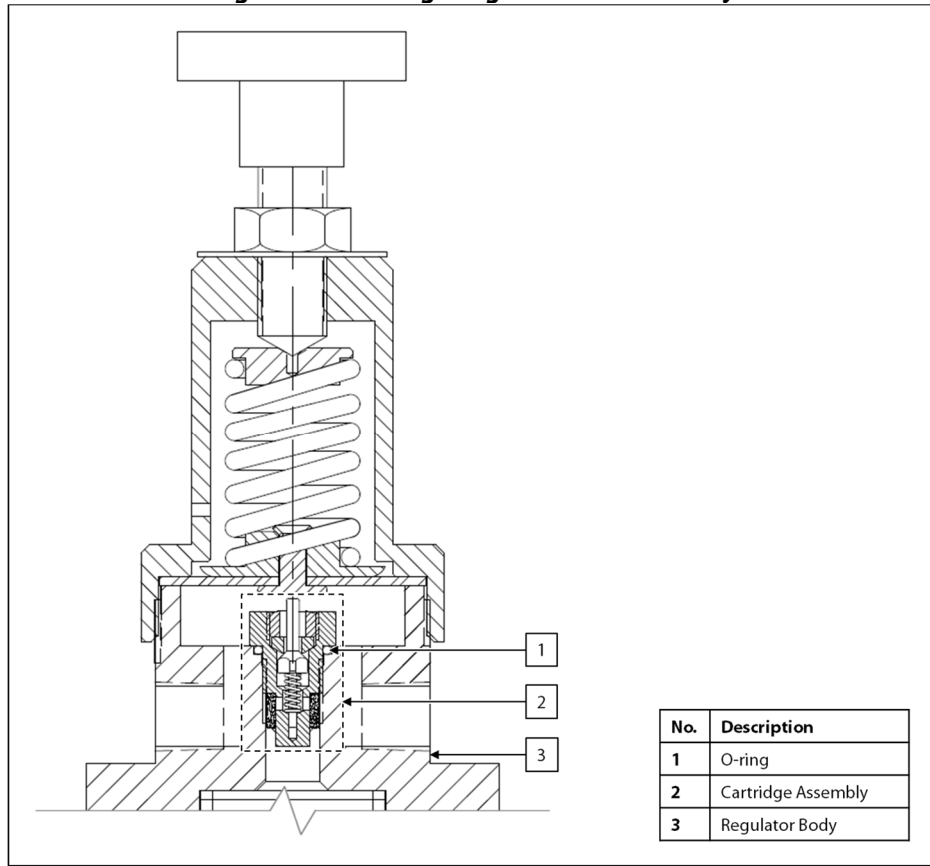


Debris or scratches on the seat will prevent positive shutoff of the regulator.

44. Replace the O-ring on the flow ring (Figure 9).
45. Install the seat to the regulator body.
46. Guide the poppet into the seat.
47. Return the spring to the poppet.
48. Return the flow ring to the regulator body and tighten firmly using a socket wrench.
49. Proceed to step 54 for reassembly instructions.

Regulator Subassembly: Cartridge

Figure 10: Cartridge Regulator Subassembly



50. Remove the cartridge assembly from the regulator body (*Figure 10*).
51. Replace the O-ring in the regulator body (*Figure 10*).
52. Install a replacement cartridge assembly to the regulator body.
53. Install the spring housing to the regulator body and hand tighten only.

Reassembly

54. Return the regulator subassembly to the top of the base.
55. Following a cross-bolting sequence, insert the tie bolts through the base to the regulator body, and then tighten firmly (*Figure 9*).
56. The HR is now ready for installation. See *Section 2.2, Installing the HR*, for instructions on correctly installing the unit.

3.3 Heater Failure



Neither the controller nor the heating element is prone to fail; however, failure is possible in instances of misuse and extreme malfunction of the electrical system.



If the thermostat controller or heating element do not produce heat, replacement is required. The heated regulator must be returned to Welker. This is necessary to ensure the unit maintains its certifications.

Returning Unit to Welker

1. Turn OFF all electrical power to the unit and isolate it from all applicable energy sources.



DO NOT open the certified enclosure until it can no longer be a potential ignition source.



Ensure that the HR is isolated from all incoming and outgoing connections (including neutral conductors) prior to opening the certified enclosure.

2. Unfasten the set screw, and then remove the cover from the certified enclosure.
3. Disconnect the two (2) power supply leads from the terminal block.
4. Return the cover to the certified enclosure and refasten the set screw.
5. As necessary, disconnect the customer-supplied tubing, fittings, or instrument attached to the unit.
6. Send unit back to Welker.

APPENDIX A: REFERENCED OR ATTACHED DOCUMENTS

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

- IOM-033: Welker RV-1, RV-2, RV-2CP, and RV-3 Relief Valves
- IOM-234: Welker RV-110A and RV-110V Relief Valves

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

- Adalet Explosionproof Instrument Housing XIH Series Single Ended Housing (Welker IOM-V236)
- International Metal Engineering Pte. Ltd. Model 8080 Explosion Proof Instrument Enclosure (Welker IOM-V237)

Welker drawings and schematics suggested for use with this unit:

- Assembly Drawing: ADHRO02

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