



INSTALLATION, OPERATION, AND MAINTENANCE MANUAL
WELKER® BELLOWS INJECTION PUMP



MODELS

BIP-1
BIP-2
BIP-3
BIP-4

DRAWING NUMBERS

AD788BC
AD788BE
AD788BV
AD788BW

MANUAL NUMBER

IOM-010

REVISION

Rev. F, 08/14/2024

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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, if not observed, could result in damage to equipment.



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

This manual is intended to be used as a basic installation and operation guide for the Welker® OdorEyes® Bellows Injection Pumps, BIP-1, BIP-2, BIP-3, and BIP-4. 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 section 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® OdorEyes® 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 Bellows Injection Pump 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 Bellows Injection Pump, 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 product becomes that of the purchaser at the time of receipt. Reading the applicable *Installation, Operation, and Maintenance (IOM) Manual* 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® OdorEyes® 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® OdorEyes® *BIP-1, BIP-2, BIP-3, and BIP-4* Bellows Injection Pumps are positive displacement pumps designed to inject a liquid chemical into a pressurized pipeline.

The inlet and outlet check valves trap the chemical in the injection chamber, where it is isolated from the operational side of the pump by the Teflon® bellows. The bellows protects the piston and seals from the potentially harsh liquid chemical that might flow through the BIP, extending seal life and preventing corrosion of metal parts.

The BIP may be used as a stand-alone pump or incorporated into a system.

Welker® might custom design the BIP-1, BIP-2, BIP-3, and BIP-4 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. However, please note that the specifications might vary depending on the customization of your product.

Table 1: BIP Specifications

Application	Injection of Liquid Chemicals, Such As Acid, Inhibitor, Methanol, and Odorant				
Materials of Construction	303 Stainless Steel, 316/316L Stainless Steel, Anodized Aluminum, Buna, Kalrez®, Polyurethane, PTFE, and Teflon® Others Available				
Maximum Allowable Operating Pressure	BIP-1 and -3: 2160 psig @ -20 °F to 100 °F (148 barg @ -28 °C to 37 °C) BIP-2: 2000 psig @ -20 °F to 100 °F (137 barg @ -28 °C to 37 °C) BIP-4: 1440 psig @ -20 °F to 100 °F (99 barg @ -28 °C to 37 °C)				
Actuation Pressure Limits	BIP-1, -2, and -4: 100 psig (6.8 barg) BIP-3: 150 psig (10 barg)				
Inlet and Outlet Connections	BIP-1, -2, and -3: ¼" FNPT BIP-4: ½" FNPT				
Pneumatic Supply Connection	BIP-1, -3, and -4: ¼" FNPT BIP-2: ⅛" FNPT				
Utility Requirements	Pneumatic Supply Timer				
Air Consumption		90 psig @ 60 °F (6.2 barg @ 15 °C)	100 psig @ 60 °F (6.8 barg @ 15 °C)	120 psig @ 60 °F (8 barg @ 15 °C)	150 psig @ 60 °F (10 barg @ 15 °C)
	BIP-1	0.040 scf/Stroke	0.044 scf/Stroke	–	–
	BIP-2	0.012 scf/Stroke	0.013 scf/Stroke	–	–
	BIP-3	0.048 scf/Stroke	–	0.062 scf/Stroke	0.076 scf/Stroke
	BIP-4	0.262 scf/Stroke	0.288 scf/Stroke	–	–
Injection Volume	BIP-1: 0.5-3.00 cc BIP-2: 0.1-0.75 cc BIP-3: 1.0-9.0 cc BIP-4: 10-50 cc				
Operation	Piston-Operated BIP-1: ½" Piston BIP-2: ¼" Piston BIP-3: ¾" Piston BIP-4: 1½" Piston				
Feature	Volume Indicator Rod				
Options	Designed for Atmospheric Pressure Flexlines on Inlet and Outlet				

1.4 Equipment Diagrams

Figure 1: BIP Models

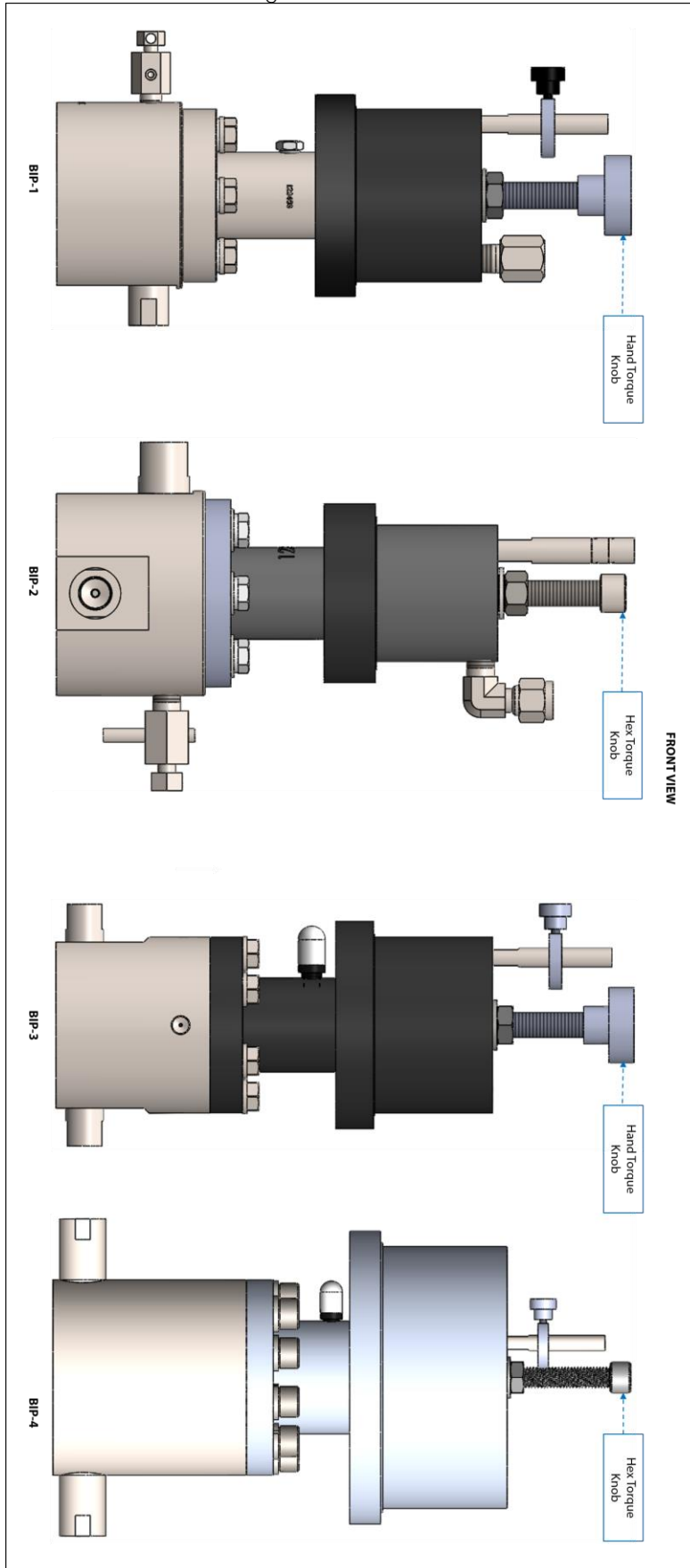


Figure 2: BIP Models – Angled

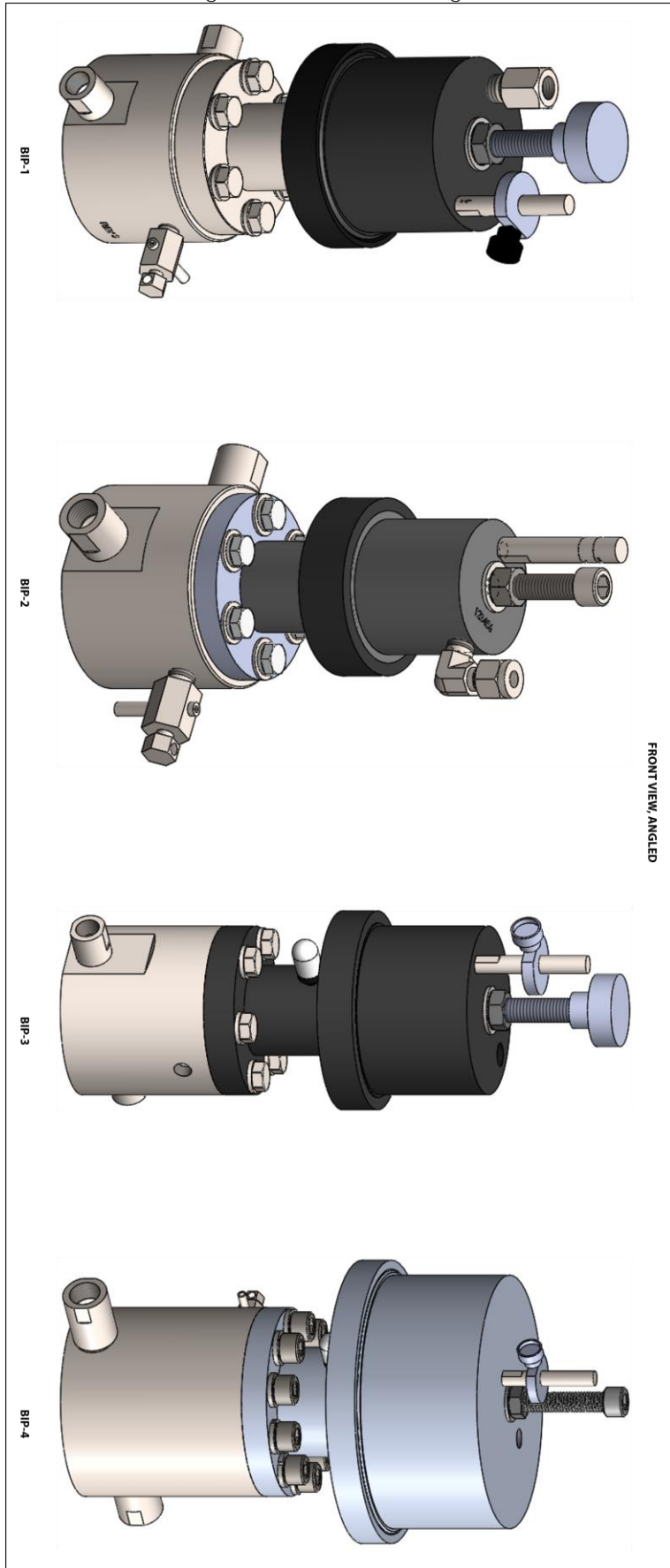


Figure 3: BIP Models–Cross Sections

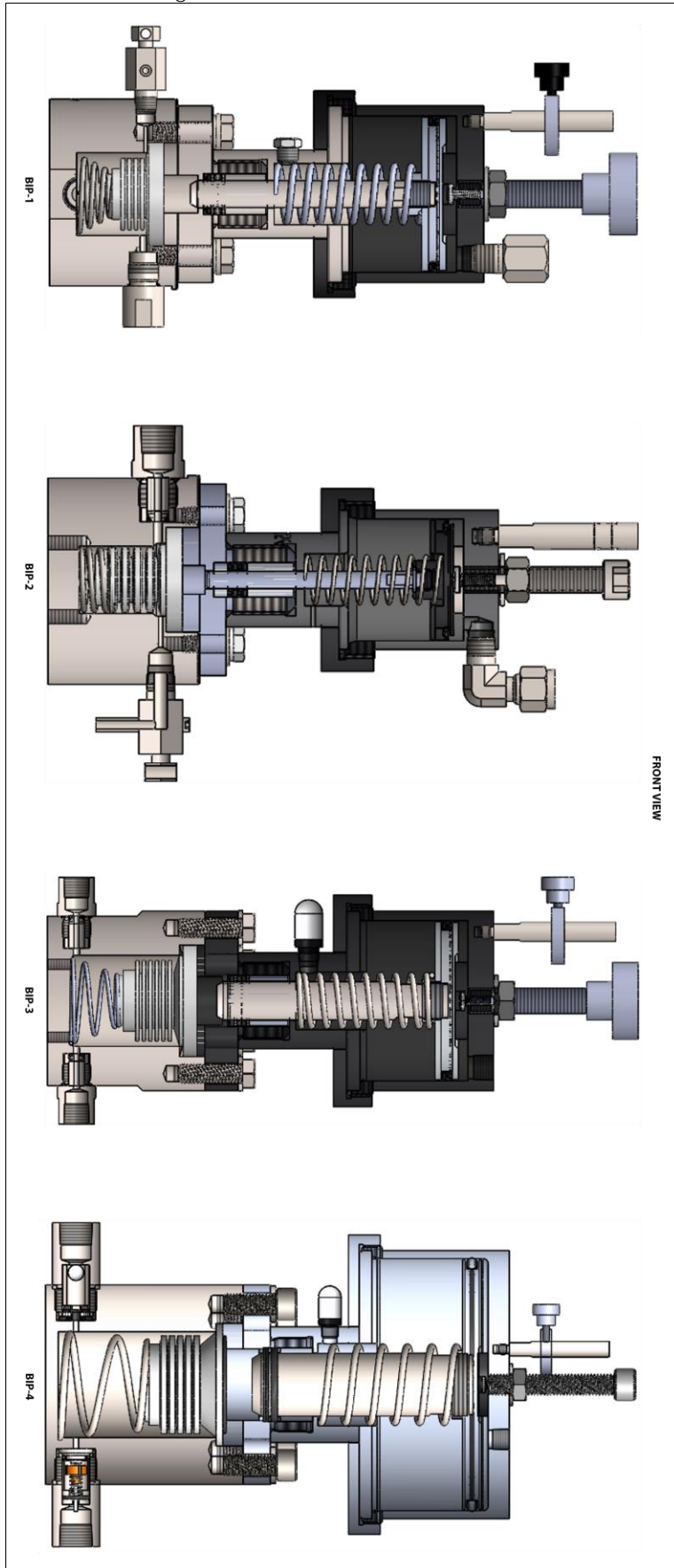


Figure 4: BIP Connection Diagram

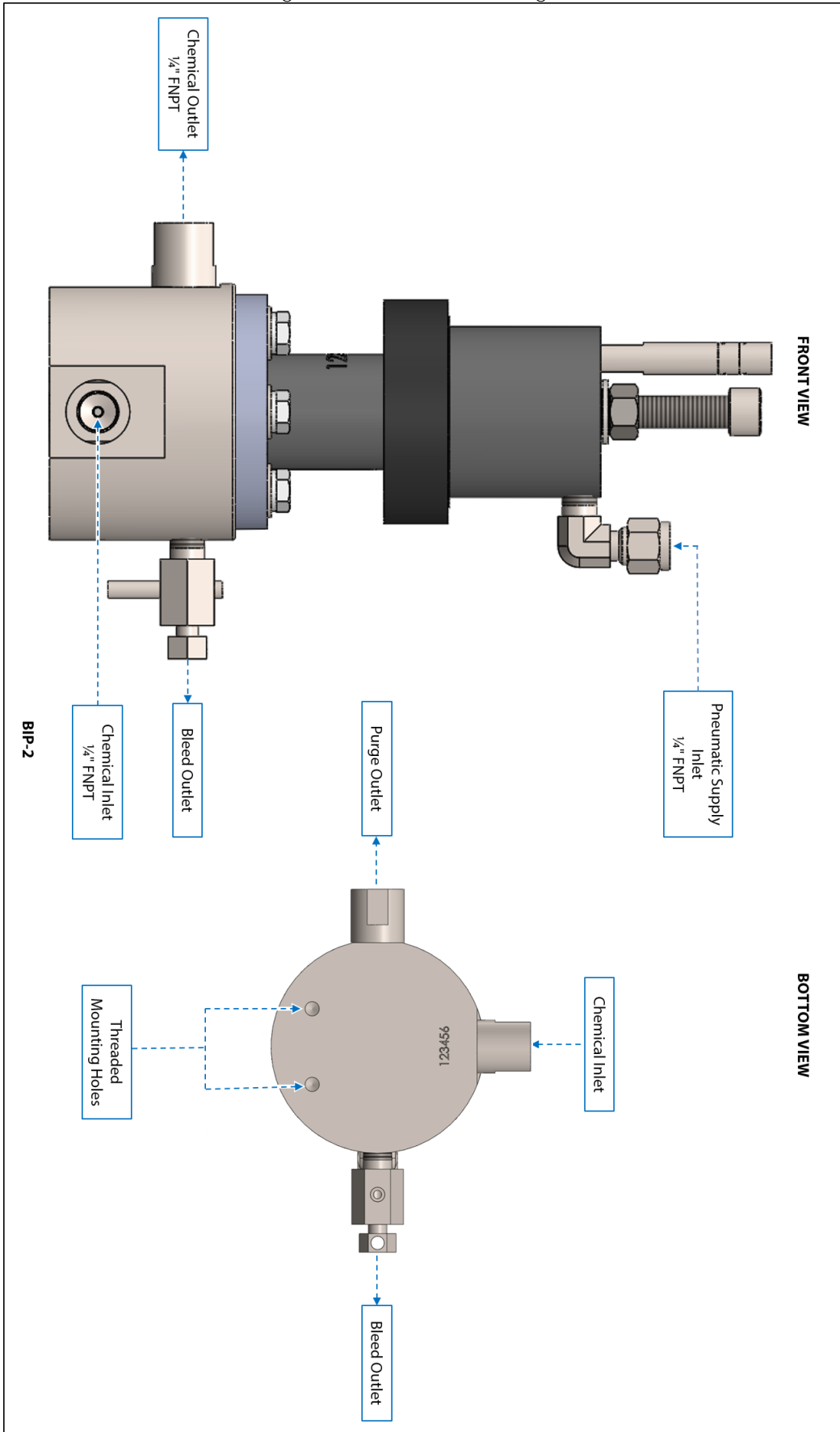
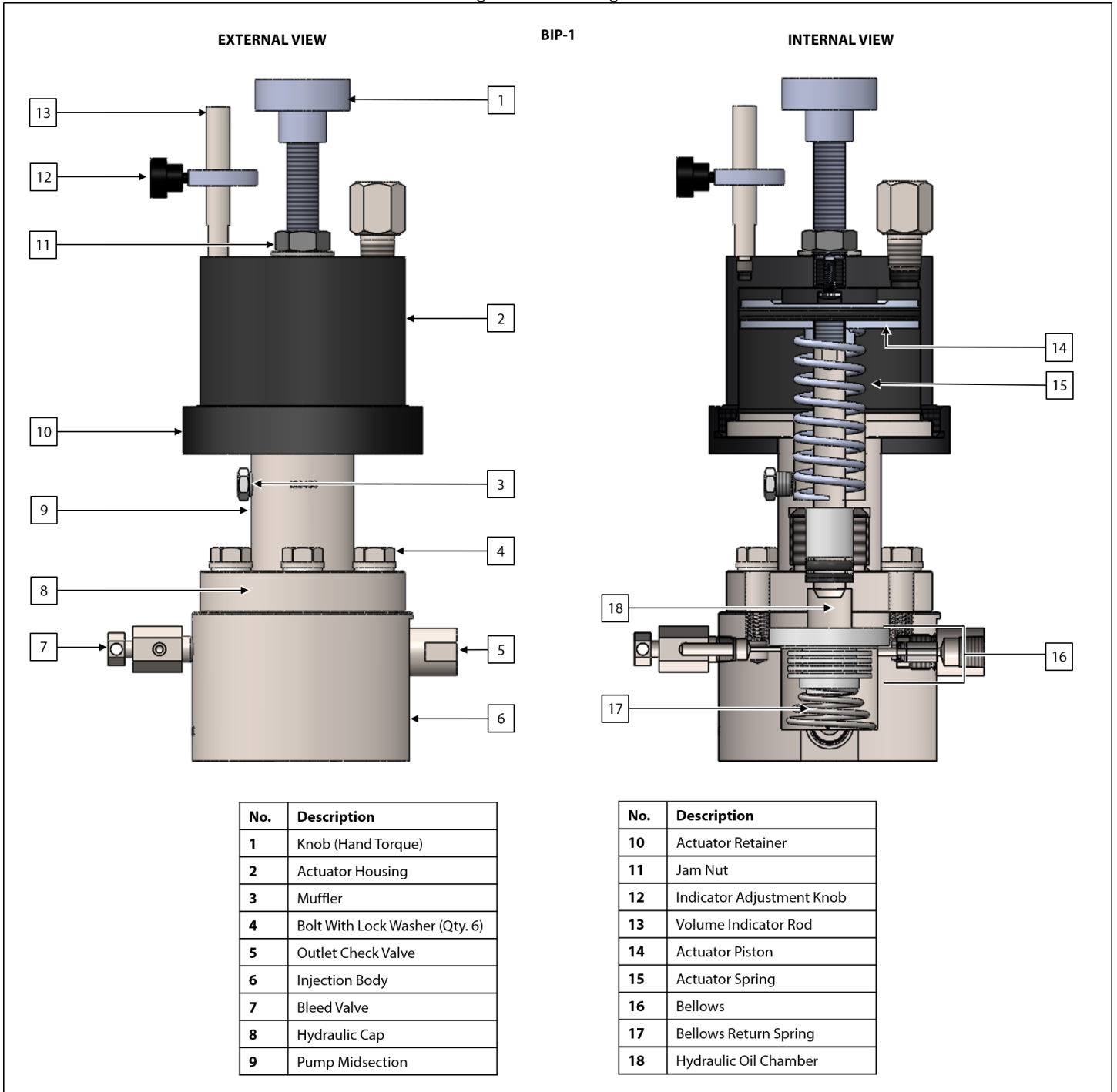


Figure 5: BIP Diagram



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 Principles of Operation

1. The customer connects from a pressurized chemical supply to the inlet check valve and from the outlet check valve to the pipeline.
2. When chemical is supplied to the BIP, it flows through the inlet check valve and is then trapped in the injection chamber.
3. Supply pressure is applied to the actuator piston, pushing the actuator piston down into the hydraulic oil.
4. The pressure on the hydraulic oil causes the bellows to expand, which forces the chemical trapped in the injection chamber through the outlet check valve into the pipeline.
5. As supply pressure is relieved, the actuator spring returns the actuator piston to the top of the actuator housing.
6. The reduced pressure on the hydraulic oil allows the bellows to contract, creating space in the injection chamber for the chemical to enter.
7. Chemical injection continues according to the timer settings.

2.3 Installation

1. Mount the BIP in an upright, vertical position in a location convenient for chemical injection.



This orientation allows all air trapped in the injection chamber to be bled off as chemical is supplied to the BIP during start-up.

2. Connect from the pressurized chemical supply to the chemical inlet (*Figure 4*).



Welker® recommends installing a filter and isolation valve between the pressurized chemical supply and the BIP.

3. Connect from the chemical outlet to the pipeline (*Figure 4*).
4. Connect the pneumatic supply to the pneumatic supply inlet in the actuator housing (*Figure 4*).



If necessary, the actuator housing may be repositioned so that the pneumatic supply inlet is more easily accessed. Turn the actuator retainer counterclockwise, and then reposition the actuator housing. Once the desired position has been achieved, hand-tighten the actuator retainer against the actuator housing.

2.4 Start-Up Procedures

1. Open the valve from the pipeline connection to allow line pressure to the outlet check valve.
2. Apply a blanket of pressure to the pressurized chemical supply to start the flow of liquid chemical to the inlet check valve. The chemical will flow through the inlet check valve into the injection chamber.
3. Using a wrench, slowly loosen the cap on the bleed valve to purge the injection chamber of any trapped air (*Figure 4* and *Figure 5*).



Take the necessary precautions and wear appropriate personal protective equipment (PPE) to protect from potential harm caused by exposure to the injection chemical.



If desired, a small hose may be connected to the bleed valve to collect any chemical that might appear at the purge outlet.

4. Once all air has been purged from the injection chamber, tighten the bleed valve cap.
5. As necessary, adjust the injection volume.



Loosen the jam nut on the adjustment knob.
To increase the injection volume, turn the adjustment knob counterclockwise.
To decrease the injection volume, turn the adjustment knob clockwise.
Once the desired volume has been reached, tighten the jam nut.



NOTE: The adjustment knob on BIP-1 and BIP-3 requires hand torque.
NOTE: The adjustment knob on BIP-2 and BIP-4 requires hex torque.
See *Figure 1*.

6. The BIP is now ready to be put into service.

2.5 Halting Pump Operation

1. Turn OFF all electrical power to the unit.
2. Turn OFF the pneumatic supply.
3. Decrease hydraulic pressure on the bellows by loosening the jam nut on the adjustment knob and turning the adjustment knob counterclockwise (see Note above and *Figure 1* for correct torquing) until the maximum volume limit is reached (*Figure 5*).
4. Using a wrench, slowly loosen the cap on the bleed valve to purge the injection chamber of any trapped air (*Figure 4* and *Figure 5*).



Take the necessary precautions and wear appropriate personal protective equipment (PPE) to protect from potential harm caused by exposure to the injection chemical.



If desired, a small hose may be connected to the bleed valve to collect any chemical that might appear at the purge outlet.

5. Once all air has been purged from the injection chamber, tighten the bleed valve cap.
6. The BIP is now ready to be removed for maintenance or to be relocated.

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 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.

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. Adjustable Wrench
 - b. Small Pointed Instrument

3.2 Maintenance



Prior to performing maintenance on the BIP, operations must be halted. See *Section 2.5, Halting Pump Operation*, for instructions.

1. Disconnect the pressurized chemical supply from the chemical inlet (*Figure 4*).
2. Disconnect the BIP from the pipeline at the chemical outlet (*Figure 4*).
3. Remove the BIP from its mounted location.

Disassembly



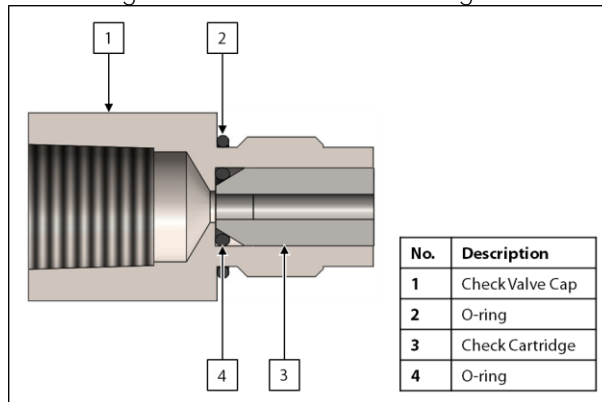
Welker® recommends that the BIP remain upright and vertical during disassembly to prevent the hydraulic oil from draining from the bellows.

4. Unscrew the actuator housing from the actuator retainer (*Figure 5*).
5. Carefully remove the actuator housing from the pump midsection (*Figure 5*).
6. Remove the actuator piston from the pump midsection (*Figure 5*).
7. Remove the actuator spring from the pump midsection (*Figure 5*).
8. Unscrew the pump midsection from the hydraulic cap (*Figure 5*). Note that the actuator retainer will also be removed at this time.
9. Drain the hydraulic oil from the bellows (*Figure 5*).
10. Unscrew the bolts from the hydraulic cap, and then remove the hydraulic cap from the injection body (*Figure 5*).
11. Remove the bellows and bellows return spring from the injection body (*Figure 5*).
12. Unscrew the inlet and outlet check valves from the injection body (*Figure 5*).

Maintenance: Check Valves

Inlet Check Valve

Figure 6: Inlet Check Valve Diagram



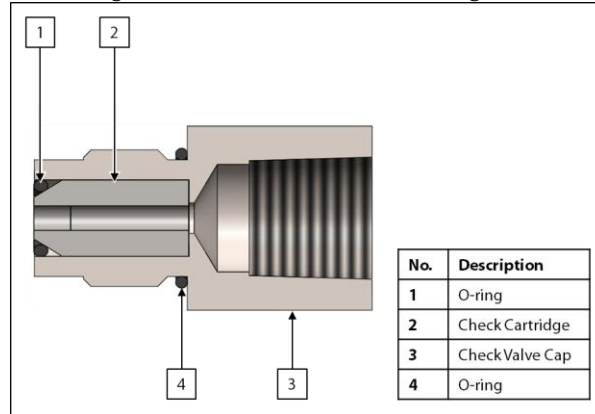
13. Remove the check cartridge and O-rings from the inlet check valve.
14. Clean the check valve cap with solvent.
15. Replace the O-ring on the check valve cap.
16. Replace the O-ring in the check valve cap.
17. Install the replacement check cartridge conical end first to the check valve cap.



Ensure that the flow arrow on the check valve cartridge points to the BIP when installed. Incorrect installation of the check valves or check cartridges will prevent the BIP from operating correctly.

Outlet Check Valve

Figure 7: Outlet Check Valve Diagram



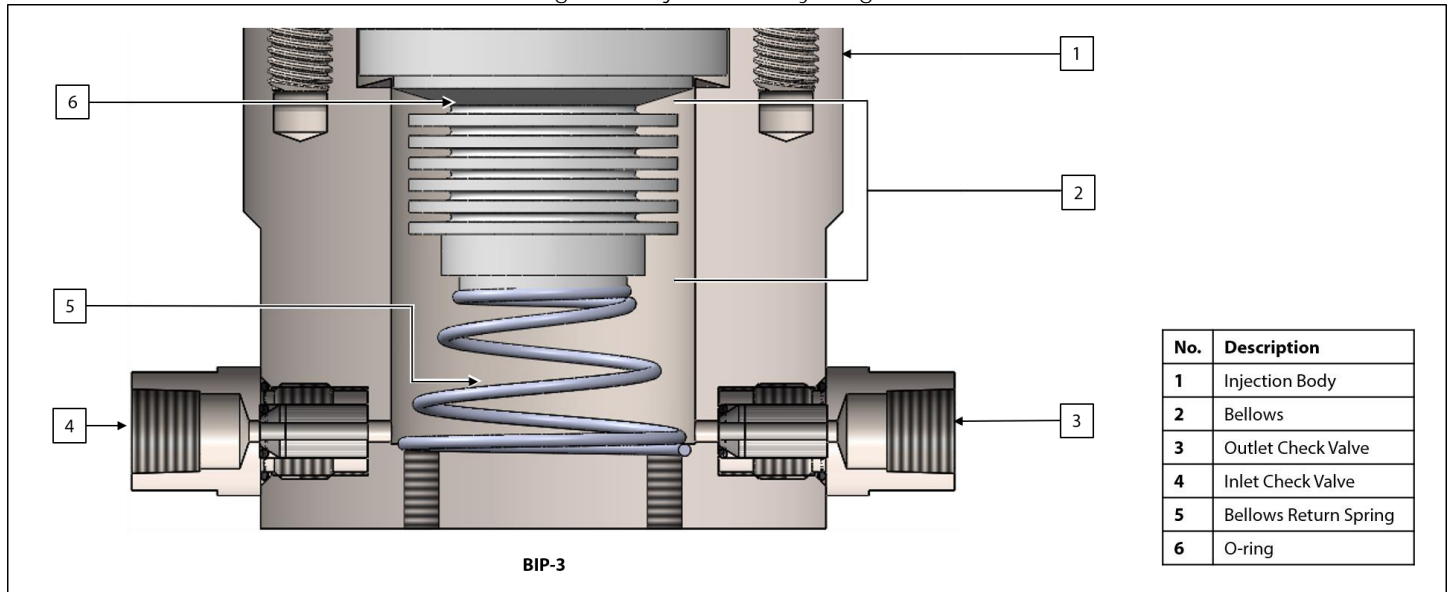
18. Remove the check cartridge and O-rings from the outlet check valve.
19. Clean the check valve cap with solvent.
20. Replace the O-ring on the check valve cap.
21. Install the replacement check cartridge large end first to the check valve cap.



Ensure that the flow arrow on the check valve cartridge points away from the BIP when installed. Incorrect installation of the check valves or check cartridges will prevent the BIP from operating correctly.

22. Replace the O-ring on the conical end of the check cartridge.

Figure 8: Injection Body Diagram



23. Clean the injection body with solvent.
24. Install the inlet and outlet check valves to the injection body.



NOTE: Placement of BIP-3 and BIP-4 inlet and outlet valves is on the front left and right.
 NOTE: Placement of BIP-1 and BIP-2 inlet and outlet valves is on one side of the front and in the front middle.
 See Figure 2.



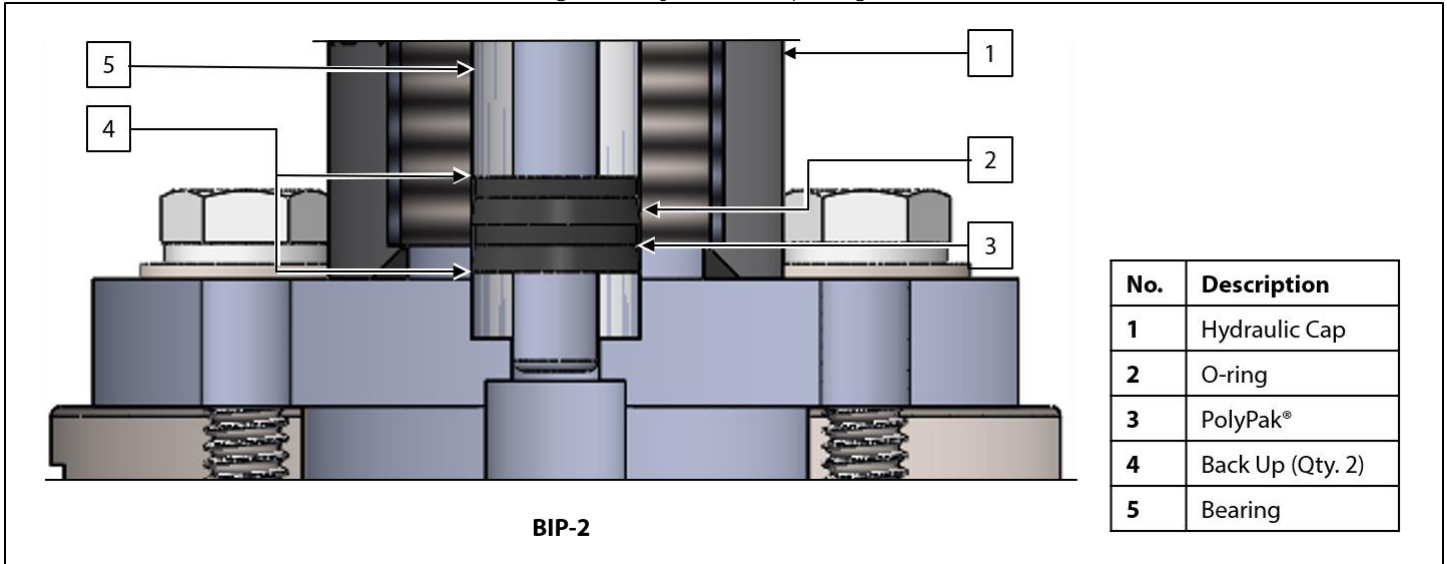
Ensure that the check valves are installed correctly, because incorrect installation of the check valves or check cartridges will prevent the BIP from operating correctly.

25. Inspect the bellows for holes, tears, and any other potential leak points. Replace as necessary.
26. Replace the O-ring in the bellows.
27. Center the bellows in the bellows return spring, and then return the bellows assembly to the injection body.



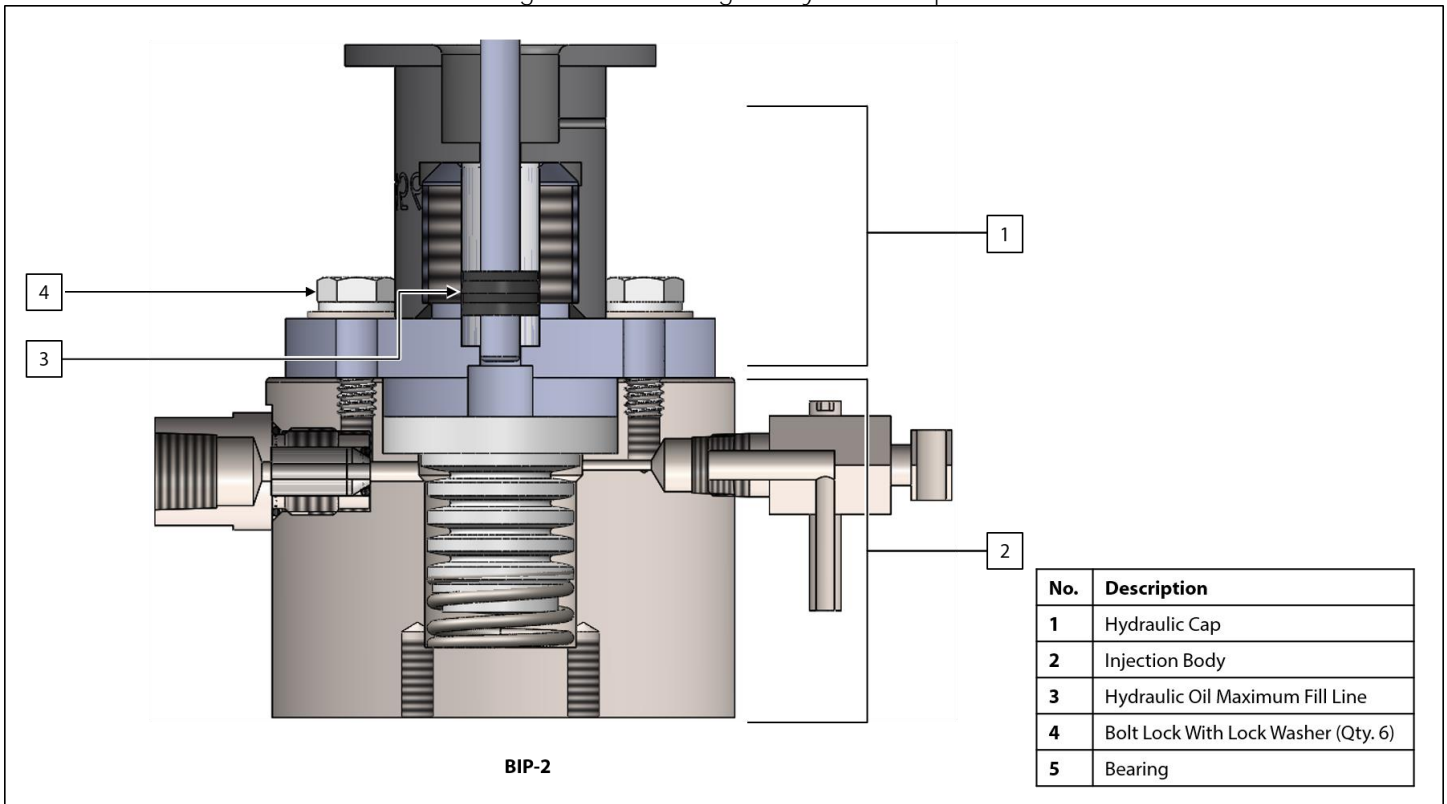
The bellows must be centered in the bellows return spring so that chemical can be fully evacuated from the injection body when the BIP is actuated.

Figure 9: Hydraulic Cap Diagram



28. Remove the bearing and seals from the hydraulic cap.
29. Clean the hydraulic cap with solvent.
30. Replace the PolyPak® back ups, O-ring, and bearing in the hydraulic cap.
31. Return the hydraulic cap to the injection body (*Figure 9*).

Figure 10: Installing the Hydraulic Cap



32. Following a cross-bolting sequence, install the bolts with lock washers to the hydraulic cap (*Figure 11* or *Figure 12*).



NOTE: While BIP-1, BIP-2, and BIP-3 are equipped with 6 bolts with lock washers, BIP-4 is equipped with 10 bolts with lock washers.

Figure 11: Cross-Bolting Sequence – 6 Bolts

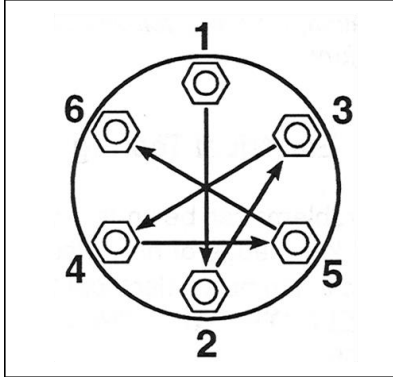
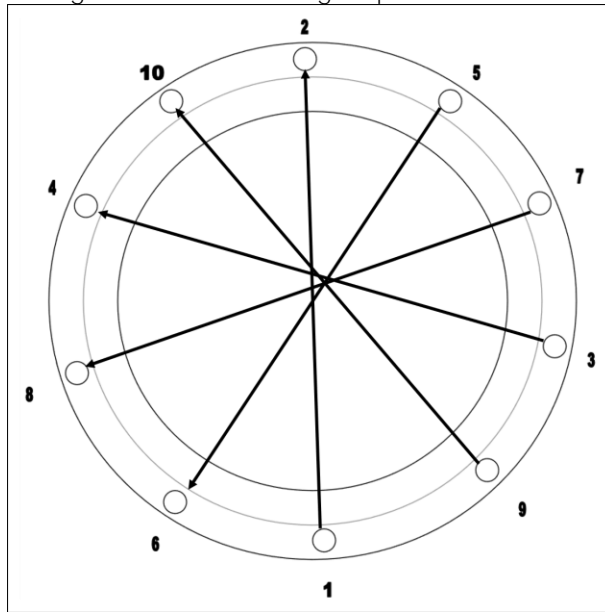


Figure 12: Cross-Bolting Sequence – 10 Bolts



33. Hand-tighten the bolts until there is no more thread engagement.



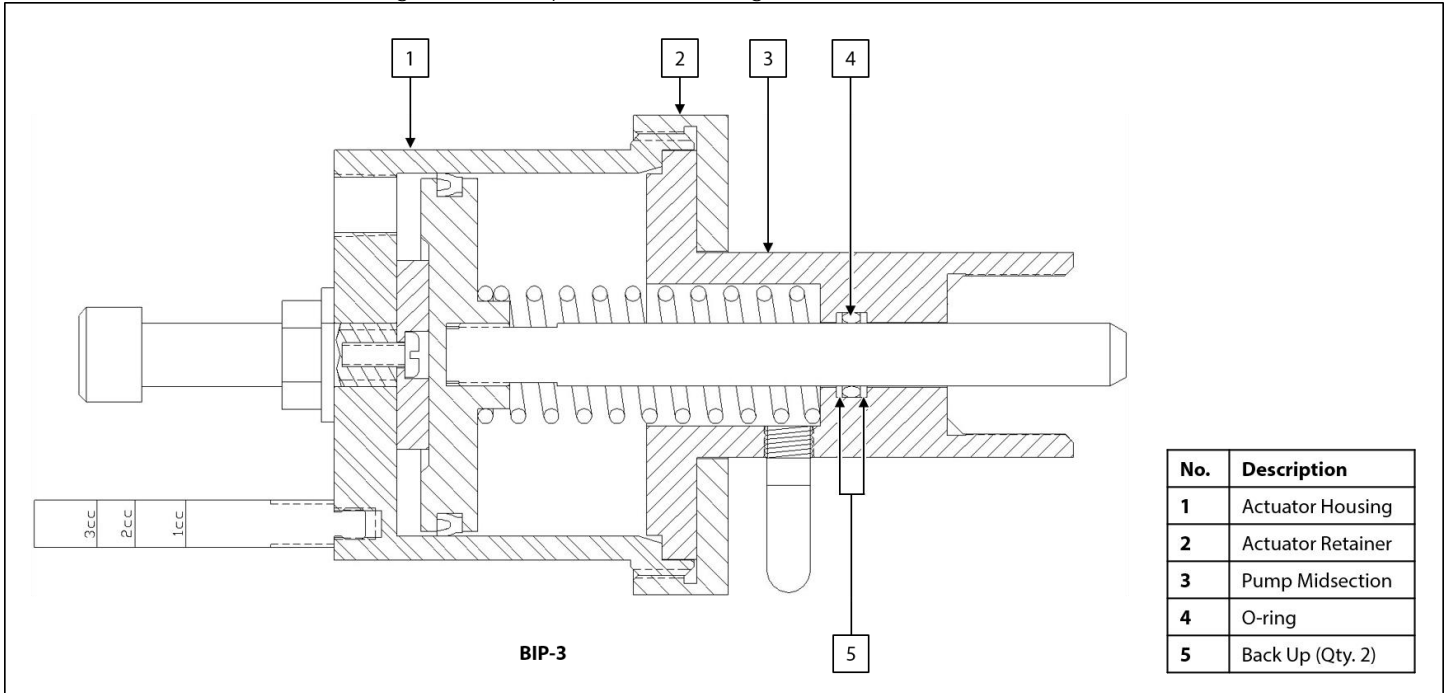
Bolts must be fully tightened to prevent leakage across the bellows.

34. Fill the bellows with hydraulic oil up to the hydraulic oil maximum fill line (*Figure 10*).



Welker® recommends SAE 30 hydraulic oil for use with this unit.

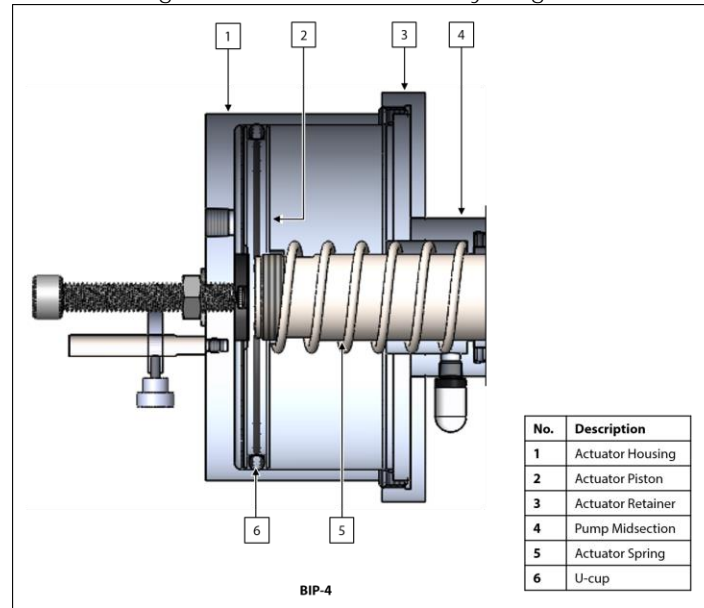
Figure 13: Pump Midsection Diagram for BIP With Dual Seal



35. If the pump midsection is equipped with dual seals, remove the seals (*Figure 13*).
36. Clean the pump midsection and actuator retainer with solvent.
37. As necessary, replace the back ups and O-ring in the pump midsection (*Figure 13*).
38. Insert the pump midsection through the actuator retainer (*Figure 13* or *14*).
39. Screw the pump midsection onto the hydraulic cap (*Figure 13* or *14*).

Maintenance: Actuator Piston

Figure 14: Actuator Assembly Diagram



40. Remove the actuator spring from the actuator piston.
41. Remove the U-cup from the actuator piston.
42. Clean the actuator piston and actuator spring with solvent.
43. Inspect the surface of the actuator piston for scratches or other damage. If scratches or other damage is present, the actuator piston might need to be replaced. Contact Welker® for service options.
44. Inspect the surface of the actuator spring for cracks or other damage. If cracks or other damage is present, the actuator spring might need to be replaced. Contact Welker® for service options.
45. Replace the U-cup on the actuator piston. The U-cup should be installed so that the “U” is open to the pneumatic supply inlet when installed.
46. Return the adapter spring to the pump midsection.
47. Lightly lubricate the actuator piston with silicon grease.



Welker® recommends Molykote® 111 or an equivalent lubricant for use with this unit.

48. Slowly guide the actuator piston down through the pump midsection to the PolyPak® in the hydraulic cap (*Figure 9*).

Maintenance: Actuator Housing

49. Clean the actuator housing with solvent.
50. Inspect the inner diameter of the actuator housing for scratches or other damage. If scratches or other damage are present, the actuator housing might need to be replaced. Contact Welker® for service options.
51. Lightly lubricate the actuator housing.



Welker® recommends Molykote® 111 or an equivalent lubricant for use with this unit.

52. Carefully slide the actuator housing over the actuator piston down to the pump midsection.
53. Tighten the actuator retainer against the actuator housing to secure the actuator housing to the pump midsection.
54. The BIP is now ready to be installed. See *Section 2.3, Installation*, and *Section 2.4, Start-Up Procedures*, for instructions on installing the unit and returning it to operation.

3.3 Troubleshooting Guidelines

Table 2: BIP Troubleshooting Guidelines

Issues	Possible Causes	Solutions
The BIP has low to no output.	Pipeline pressure at the site of chemical injection has increased.	Verify that the pressure level of the pneumatic supply is adequate for the increased pipeline pressure. Allow the BIP to build enough pressure to overcome the increased pipeline pressure. It might take several strokes for the BIP to build pressure adequate to overcome the increase. As necessary, adjust the pneumatic supply pressure.
	Pipeline pressure at the site of chemical injection changes frequently or by a significant amount.	Add a regulator suitable for the injection chemical after the outlet check valve on the BIP. Set the regulator slightly higher than the anticipated maximum pipeline pressure to ensure that the BIP will stroke against the same pressure.
	The outlet check valve on the BIP is blocked.	Relieve pressure. Beginning at the injection point in the pipeline, work backward to the BIP, checking the tubing and any attached instruments until the blockage is found.
	Pressure from the pressurized chemical supply is too low.	Verify that the liquid chemical filter is not clogged. Increase the blanket pressure on the pressurized chemical supply or remount the BIP.
	The injection chamber is not filling with chemical.	Verify that the outlet from the pressurized chemical supply is open to the BIP. Bleed any trapped air from the injection body.
	The chemical being injected contains vapors.	Install a vapor trap, such as the Welker® Vapor Eliminator, immediately before the inlet check valve so that only liquid chemical passes through the inlet check valve.
	The stroke and exhaust times are too short.	Ensure that the pump cycle is no faster than every 4 seconds.

Table 2: BIP Troubleshooting Guidelines (Continued)

Issues	Possible Causes	Solutions
<p>The BIP has low to no output. (Continued)</p>	<p>The pneumatic supply is not reaching the BIP.</p>	<p>Clear any blockages in the pneumatic supply line. As necessary, replace the device directing the pneumatic supply to the BIP.</p>
	<p>The pneumatic supply pressure is too low to actuate the BIP.</p>	<p>Adjust the pneumatic supply pressure to a level appropriate for the pipeline pressure.</p>
	<p>The pneumatic supply is not exhausting after stroking the BIP.</p>	<p>Clear any blockages in the pneumatic exhaust line. As necessary, replace the device directing the pneumatic supply from the BIP.</p>
	<p>The actuator spring is broken.</p>	<p>Replace the actuator spring. Inspect the actuator piston for any scratches caused by the broken spring. Deep scratches could prevent a seal from forming around the actuator piston and allow the hydraulic oil to leak. If the actuator piston must be replaced, contact Welker® for service options.</p>
	<p>The actuator has failed.</p>	<p>Inspect the actuator piston for scratches or other damage. Deep scratches could prevent a seal from forming around the actuator piston and allow the hydraulic oil to leak. As necessary, replace the U-cup on the actuator piston. If the actuator piston must be replaced, contact Welker® for service options.</p>
	<p>The hydraulic oil level is low.</p>	<p>Fill the bellows with hydraulic oil up to the top of the hydraulic oil maximum fill line (<i>Figure 7</i>).</p>
	<p>The check valves have failed.</p>	<p>Remove the check valves from the injection body. Blow instrument air into one end of each check valve and then into the other end. If instrument air blows through both ways, the check valve needs to be replaced.</p>
	<p>The bellows might have ruptured and the chemical being injected can be smelled and/or is leaking from the muffler.</p>	<p>Replace the bellows. Contact Welker® for service options.</p>

Table 2: BIP Troubleshooting Guidelines (Continued)

Issues	Possible Causes	Solutions
The BIP has low to no output. (Continued)	The bellows return spring is broken.	Replace the bellows return spring. Contact Welker® for service options.
Chemical is free flowing through the BIP.	Pipeline pressure at the site of chemical injection is too low.	Verify that the pressure level of the pneumatic supply is adequate for the decreased pipeline pressure. As necessary, adjust the pneumatic supply pressure. If chemical continues to free flow after the pressure level of the pneumatic supply has been reduced, add a regulator suitable for the injection chemical after the outlet check valve on the BIP. Set the regulator slightly higher than the anticipated maximum pipeline pressure to ensure that the BIP will stroke against the same pressure.
	Pipeline pressure at the site of chemical injection changes frequently or by a significant amount.	Add a regulator suitable for the injection chemical after the outlet check valve on the BIP. Set the regulator slightly higher than the anticipated maximum pipeline pressure to ensure that the BIP will stroke against the same pressure.
	Pressure from the pressurized chemical supply is too high.	If possible, decrease the blanket pressure on the pressurized chemical supply or remount the BIP. If the blanket pressure cannot be decreased, add a regulator suitable for the injection chemical after the outlet check valve on the BIP. Set the regulator slightly higher than the anticipated maximum pipeline pressure to ensure that the BIP will stroke against the same pressure.
Trapped air will not purge from the bleed valve.	There is a blockage in the chemical inlet line.	Clear any blockages in the chemical inlet line. Beginning at the inlet check valve, work backward to the pressurized chemical supply, checking the tubing and any attached instruments until the blockage is found.
	Pressure from the pressurized chemical supply is too low.	As necessary, increase the blanket pressure of the pressurized chemical supply to ensure that it is high enough to overcome the cracking pressure of the inlet check valve.

APPENDIX: REFERENCED DOCUMENTS

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

- None

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

- Kepner Products Company Kepsel Cartridge Insert Valves (Welker® IOM-V078)
- Swagelok® Bleed Valves and Purge Valves (Welker® IOM-V208)
- Swagelok® Hose Assemblies, Bulk Hose, Flexible Tubing, and End Connections (Welker® IOM-V176)

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

- Assembly Drawing: AD788BV (BIP-1)
- Assembly Drawing: AD788BW (BIP-2)
- Assembly Drawing: AD788BC (BIP-3)
- Assembly Drawing: AD788BE (BIP-4)

NOTES



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