



INSTALLATION, OPERATION, AND MAINTENANCE MANUAL
WELKER INFLOW™ CRUDE OIL SAMPLER
WITH AI CONTROL™

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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 inFlow™ Crude Oil Sampler. 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 inFlow™ Crude Oil Sampler 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 inFlow™ Crude Oil Sampler, 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 *inFlow*™ Crude Oil Sampler is an isokinetic probe sampler designed to extract a representative sample of liquid product from the flowing stream. When used with a pipeline isolation valve, the *inFlow*™ with AI Control™ can be safely inserted and retracted without interfering with or venting pipeline pressure.

The operator controls the insertion and retraction of the probe by manipulating valves and applying process or auxiliary pressure. The *inFlow*™ features an adjustable insertion length to accommodate different pipeline sizes. Sampling may be hydraulically or pneumatically operated but is electronically controlled from a Programmable Logic Controller (PLC) or other signal control system. Sampling may be timed or proportional to flow.

When ordered with the optional internal and external sand reliefs, this sampler is capable of sampling product containing sand or debris. If equipped with the optional purge tube, the *inFlow*™ can be fully evacuated of internal sample volume, thus preparing the sampler for the next sample batch.



For this manual, the term "PLC," or Programmable Logic Controller, will be used to refer to the PLC, DCS, or other signal control system used by the customer to activate and operate the solenoid.

*Welker may custom design the *inFlow*™ to suit the particular application and specifications of each customer.*

1.3 Important Information

1. The lubrication port should remain open and protected from insects and dirt at all times except when performing maintenance on a sampler that has been isolated from pipeline pressure and/or removed from the pipeline.



A customer-supplied muffler or needle valve must be installed to the lubrication port for insect and dirt protection. If a needle valve is installed, it must remain open at all times.



Welker recommends installing a needle valve to the lubrication port, as it can be closed in the event of seal failure to stop the leak until the unit can be removed from service.

2. Prior to injecting lubricant into the lubrication port, the customer-supplied muffler or needle valve must be removed and an appropriately sized grease fitting installed.



DO NOT use excessive pressure when injecting lubricant into the lubrication port, as applying excessive pressure could damage the seals.

3. After lubricant has been injected into the lubrication port, the grease fitting must be removed and the customer-supplied muffler or needle valve reinstalled before the sampler can be exposed to pipeline pressure and returned to operation.



Failure to remove the grease fitting and return the customer-supplied muffler or needle valve to the lubrication port prior to exposing the sampler to pipeline pressure could result in a product leak and/or injury to the operator.

1.4 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: inFlow™ Specifications

Products Sampled	Condensate, Crude Oil, Liquid Products Compatible With the Materials of Construction, Refined Hydrocarbons, and Water
Materials of Construction	316/316L Stainless Steel Wetted Parts, Carbon Steel Lubricator Body, PTFE, Buna Non-Wetted Seals, and Viton® Wetted Seals Others Available
Maximum Allowable Operating Pressure	150 ANSI Stainless Steel: 275 psig @ -20 °F to 100 °F (18 barg @ -28 °C to 37 °C) 150 ANSI Carbon Steel: 285 psig @ -20 °F to 100 °F (19 barg @ -28 °C to 37 °C) 300 ANSI Stainless Steel: 720 psig @ -20 °F to 100 °F (49 barg @ -28 °C to 37 °C) 300 ANSI Carbon Steel: 740 psig @ -20 °F to 100 °F (51 barg @ -28 °C to 37 °C) 600 ANSI Stainless Steel: 1440 psig @ -20 °F to 100 °F (99 barg @ -28 °C to 37 °C) 600 ANSI Carbon Steel: 1480 psig @ -20 °F to 100 °F (102 barg @ -28 °C to 37 °C) 2" MNPT: 2160 psig @ -20 °F to 120 °F (148 barg @ -28 °C to 48 °C) Others Available
Pipeline Connection	Size: 2" Rating: 150, 300, or 600 ANSI RF Others Available
Sample Outlet Connection	¼" FNPT
Motor Housing Actuation Ports	¼" FNPT (Standard) ½" FNPT
Insertion Length	0–18" (0–45 cm) 0–24" (0–60 cm) (Standard) 0–36" (0–91 cm) Others Available
Utility Requirements	Hydraulic or Pneumatic Supply for Motor Operation: 40–45 psig (2.7–3.1 barg) Inert Gas Supply for Purge Operation: ¼" FNPT Connection (Optional)
Sample Volume	B-Style Collection Head: 0.5 cc, 1.0 cc (Standard), 1.5 cc, or 2.0 cc C-Style Collection Head (Long Motor): 10–30 cc C-Style Collection Head (Short Motor): 0–12 cc D-Style Collection Head (Long Motor): 3–7 cc (½" piston) or 5–12 cc (¾" piston) D-Style Collection Head (Short Motor): 0–2 cc (½" piston) or 0–5 cc (¾" piston) Vanishing Chamber™ Collection Cup: 0.22 cc, 0.5 cc, 1.0 cc, or 1.5 cc
Features	External Adjustable Relief Internal Relief Welker Volume Eliminator
Options	External Sand Relief Packing Adjustment Nut Purge Tube

1.5 Equipment Diagrams

Figure 1: inFlow™ Diagram

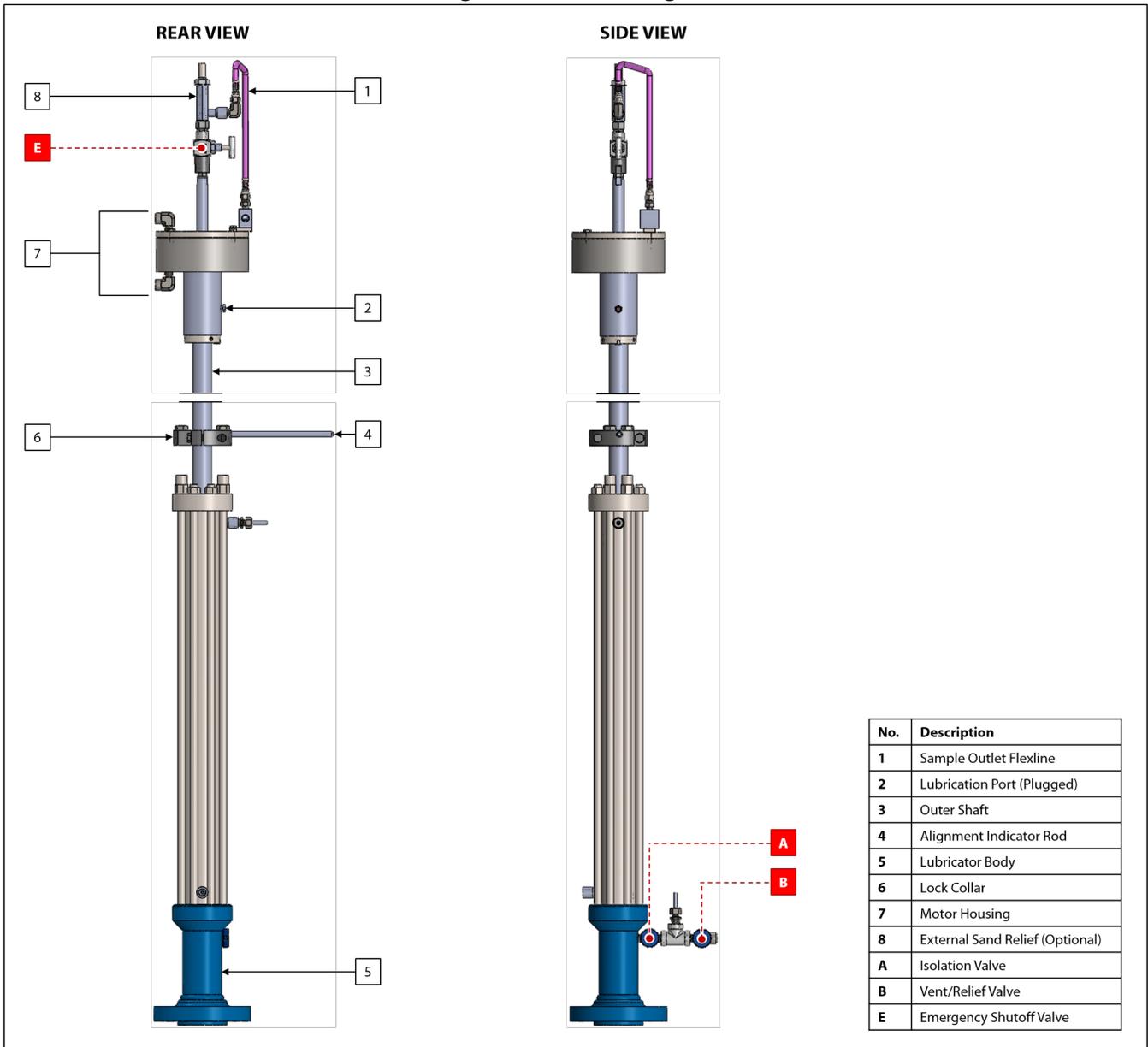


Figure 2: inFlow™ Connections Diagram

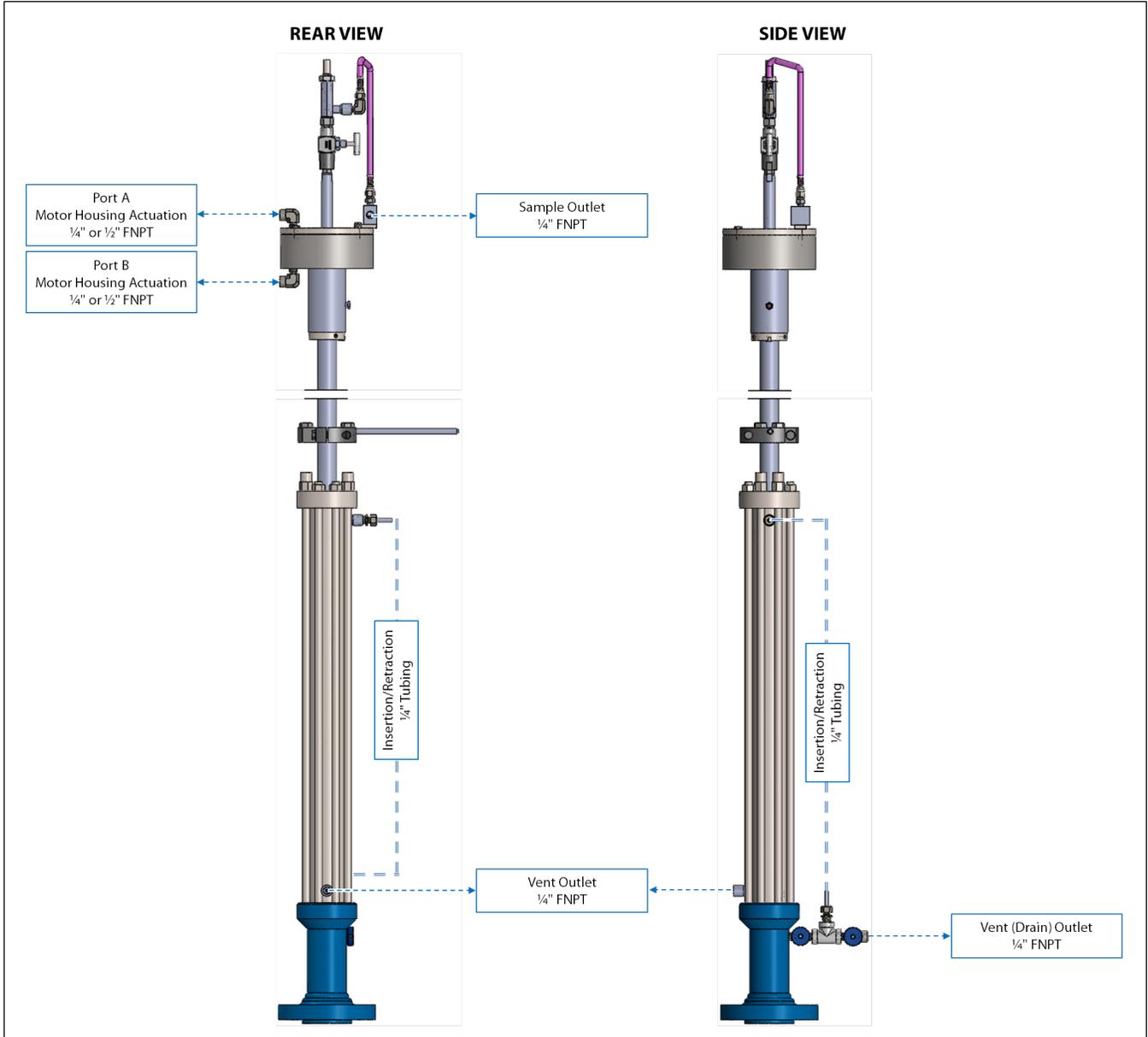
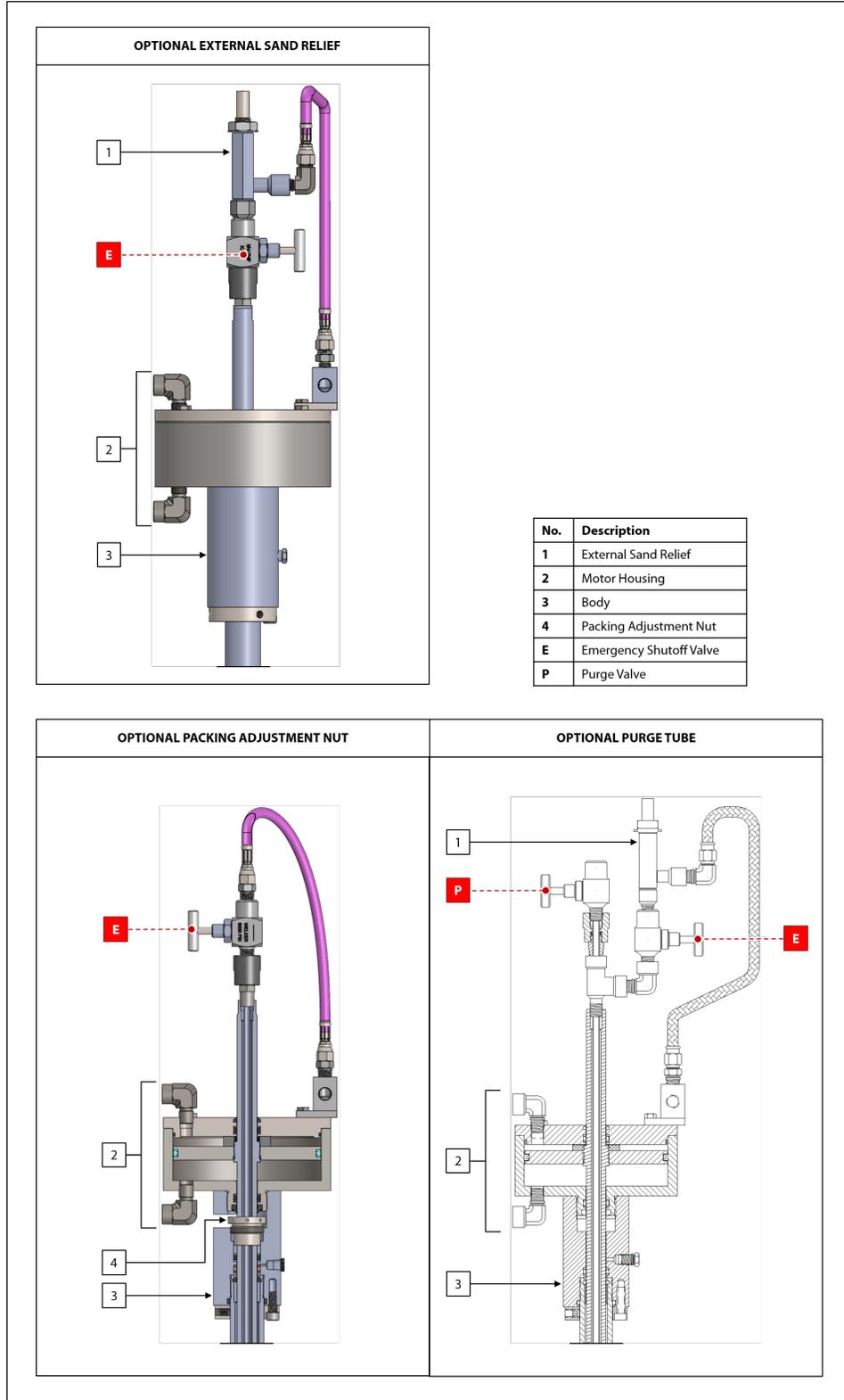


Figure 3: inFlow™ Options Diagram



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.



Take care not to close the pipeline isolation valve on the insertion shaft while the shaft is inserted in the pipeline. This is the most common cause of damage to Welker probes.

1. Welker recommends that the unit be installed to the side of the pipe and inserted into the center one-third ($\frac{1}{3}$) of the pipeline in a location where the product is well-mixed and will yield an accurate and representative sample.
2. Locate the unit at least two to four pipe diameters downstream of an inline static mixer or other flow conditioning system.
3. Handle the unit with care. Avoid bending the insertion shaft, which has a polished surface that travels through seals.
4. Operate the unit slowly and smoothly while inserting and retracting to avoid damaging the unit.

2.2 Setting the Sample Volume



If the inFlow™ is equipped with the B-Style or Vanishing Chamber™ collection head, the sample volume is not adjustable. Proceed to Section 2.3, *Preparing the Unit for Installation*.



Welker can pre-set the sample volume if noted at the time of order.

Figure 4: C-Style Collection Head Diagram

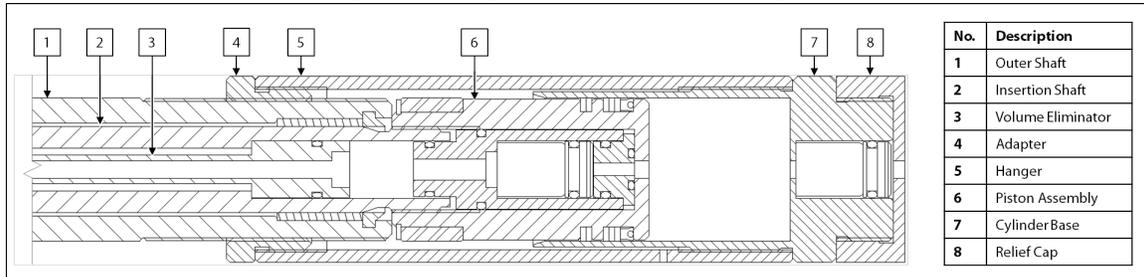
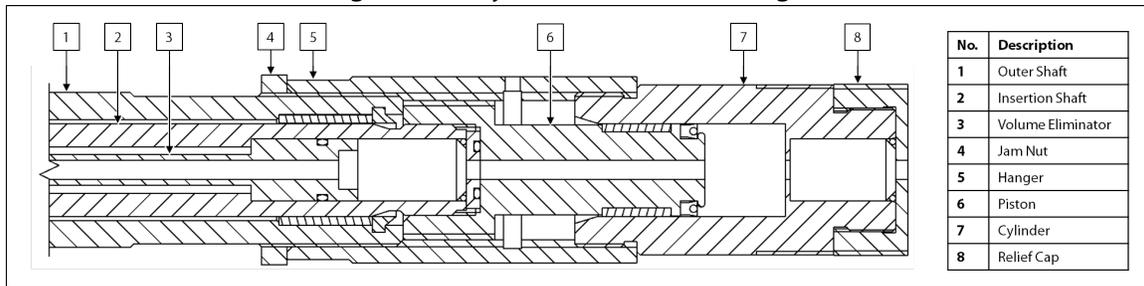


Figure 5: D-Style Collection Head Diagram



1. Loosen the adapter (*Figure 4*) or the jam nut (*Figure 5*) on the collection head.
2. To decrease the sample volume, screw the collection head assembly clockwise. This shortens the stroke of the collection head piston.
3. To increase the sample volume, screw the collection head assembly counterclockwise. This lengthens the stroke of the collection head piston.



One full rotation of the collection head is approximately:

- 1 cc if the inFlow™ is equipped with the C-Style collection head.
- 0.2 cc if the inFlow™ is equipped with the ½" piston D-Style collection head.
- 0.5 cc if the inFlow™ is equipped with the ¾" piston D-Style collection head.

4. Once the desired sample volume has been reached, firmly tighten the adapter or the jam nut on the collection head to prevent slippage that might lead to inconsistencies in the sample volume.

2.3 Preparing the Unit for Installation

1. If the inFlow™ is equipped with a B-Style or Vanishing Chamber™ collection head, it is necessary to properly align all parts of the inFlow™ prior to installation; continue to step 2. If the inFlow™ is equipped with a C- or D-Style collection head, it is not necessary to bring the inFlow™ into alignment prior to installation; proceed to step 8.

Aligning the Lock Collar

2. Determine the direction of product flow in the pipeline.
3. Lay the inFlow™ on a smooth, clean surface.
4. If the collection head is not fully visible, gently pull the collection head out of the lubricator body.



Note that the lock collar must be loose in order to pull the collection head out of the lubricator body.

5. Loosen the jam nut, and then turn the hanger. The opening in the collection head should face the direction of product flow so that the flowing stream will pass through the opening.
6. Tighten the jam nut on the collection head to prevent the collection head from turning.
7. Align the alignment indicator rod on the lock collar with the opening in the collection head. This should bring the lock collar into alignment with the standoffs on the top cap.

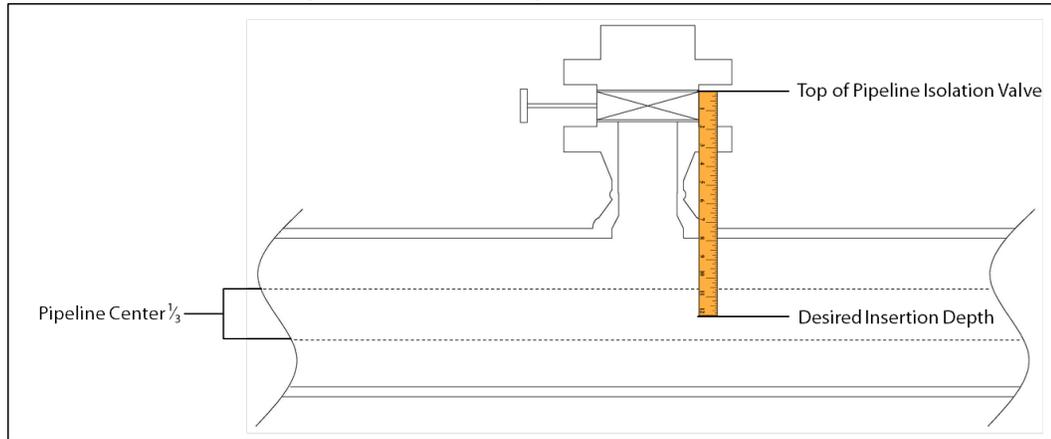


Once the unit is installed to the pipeline, the alignment indicator rod will be an external reference point to the collection head opening.

Setting the Insertion Length

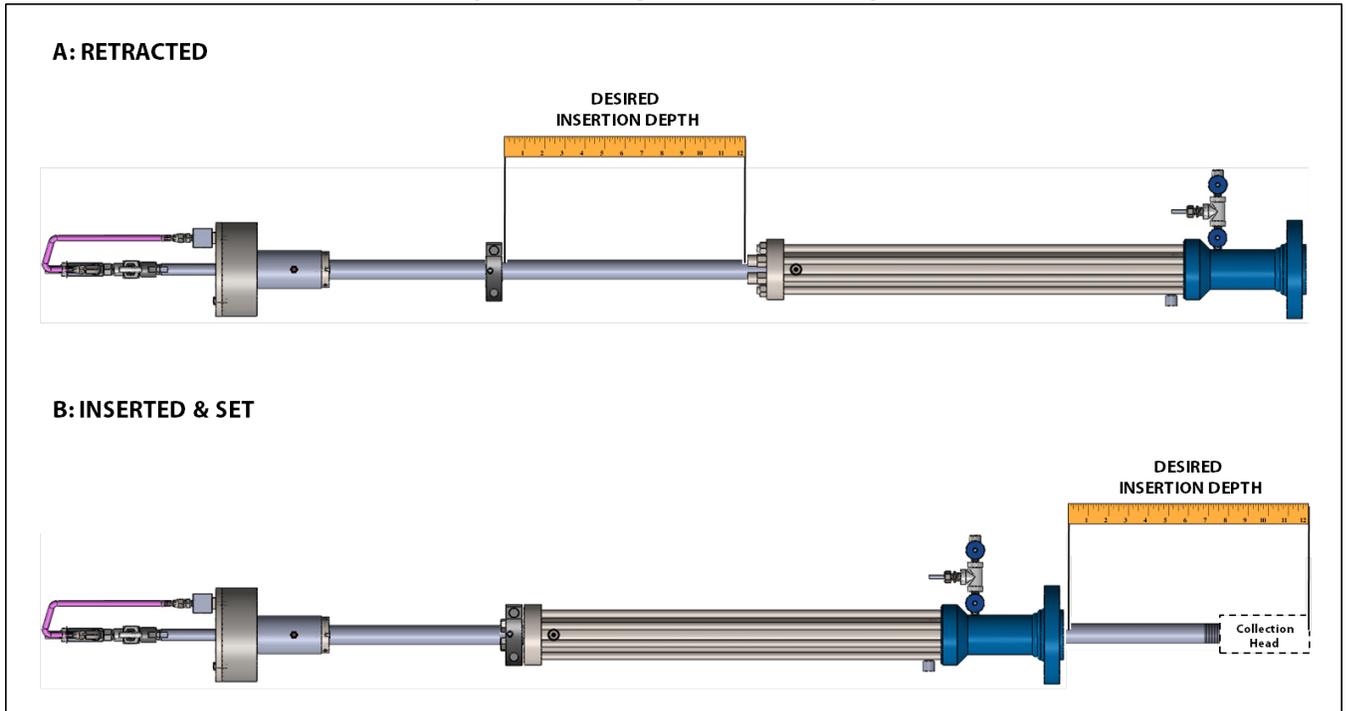
8. Prior to installing the inFlow™, the length the insertion shaft will need to travel inside the pipeline must be determined. Measure the distance the insertion shaft must travel from the top of the pipeline isolation valve to the desired insertion depth (e.g., the center one-third ($\frac{1}{3}$) of the pipeline) (Figure 6). This will be the shaft insertion length.

Figure 6: Determining the Insertion Depth



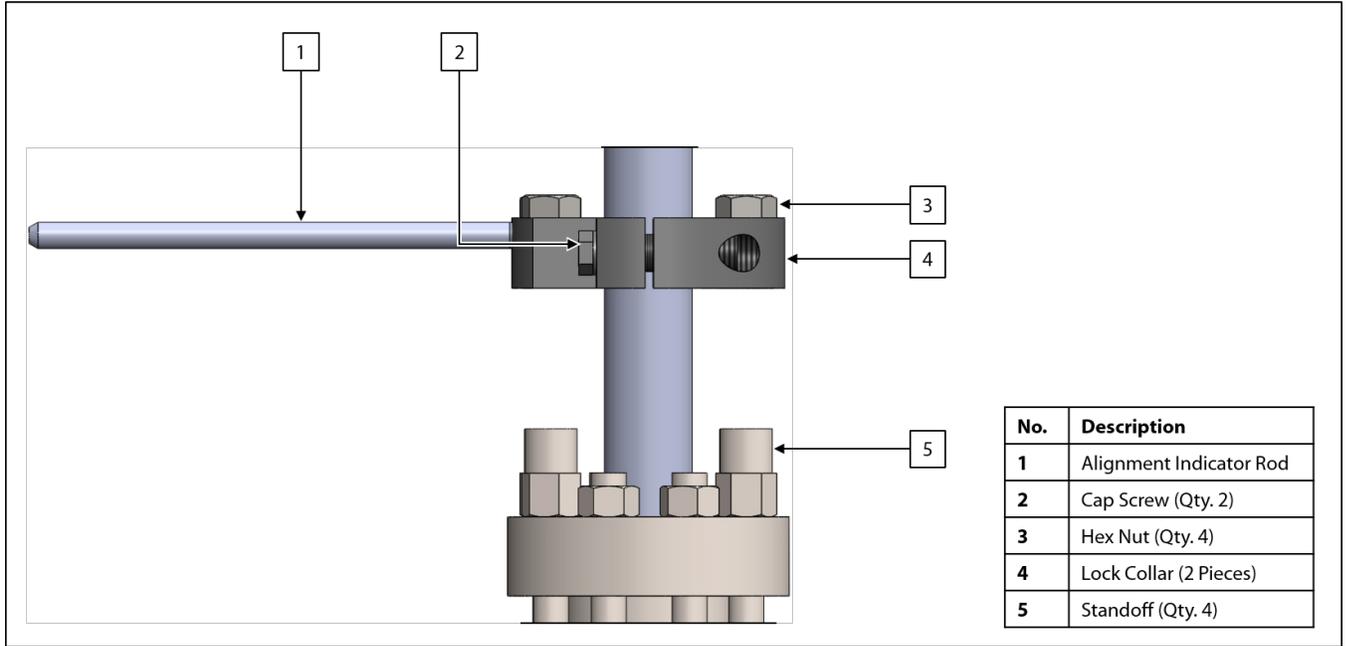
9. Pull up on the insertion shaft to ensure that it is fully retracted. The end of the collection head should be flush with or in close proximity to the flange face (Figure 7).
10. Beginning at the top edge of the standoffs, measure along the insertion shaft to the desired insertion length (Figure 7). As needed, use a felt tip pen to mark this point.

Figure 7: Setting the Insertion Length



11. Remove the hex nuts from the standoffs (Figure 8).

Figure 8: Lock Collar Diagram



12. Loosen the cap screws on the sides of the lock collar (*Figure 8*).
13. Carefully slide the lock collar up the shaft to the shaft insertion length, taking care not to scratch the outer shaft.
14. As necessary, ensure that the alignment indicator rod is still aligned with the opening in the collection head.
15. Tighten the cap screws on the sides of the lock collar to secure the lock collar to the outer shaft at the marked point (*Figure 8*).



This procedure ensures that the insertion length will be mechanically limited by the lock collar and that the lock collar will hold the probe in place when under pressure.

2.4 Installing the Unit

1. Close all valves on the inFlow™.
2. Secure the inFlow™ to a full port pipeline isolation valve.



For long probes installed horizontally, Welker recommends field installation of bracing support for the outlet end of the probe to offset the cantilever effect and prevent bending of the shaft. Any bracing or support installed should NOT contact the probe shaft, as scratching or other damage to the shaft may lead to loss of integrity of the sealing surface.



The vent (drain) outlet on the lubricator body must be pointed down.



If the unit will be inserted using hydraulic fluid, continue to step 3.
 If the unit will be inserted using an auxiliary gas, proceed to step 13.
 If the unit will be inserted using pipeline product, proceed to step 24.

Using Hydraulic Fluid (Optional)



If using hydraulic fluid to insert and retract the insertion shaft, the customer must provide a way to drain the hydraulic fluid from the insertion cylinder.



Welker recommends adding a pressure gauge to the hydraulic supply so that the maximum allowable operating pressure of the unit is not exceeded.



Hydraulic fluid provides the smoothest insertion and retraction.

3. With isolation valve A closed, install a customer-supplied hydraulic supply (e.g., a hydraulic hand pump) to vent/relief valve B (*Figure 1*).
4. Slowly open the pipeline isolation valve. Check for leaks and repair as necessary.
5. Open the valve on the customer-supplied hydraulic supply.
6. Slowly open vent/relief valve B, and then slowly apply hydraulic fluid to the unit. The insertion shaft will begin to insert into the pipeline.



Once the insertion shaft begins to insert, do not open the valve any further. The insertion shaft should be inserted slowly and smoothly. Opening the valve too quickly or too much may cause the insertion shaft to insert into the pipeline too quickly and may result in damage to the unit.

7. Using the alignment indicator rod, guide the shaft slowly into the pipeline. The alignment indicator rod should be parallel to the pipeline.
8. As necessary, align the lock collar holes with the standoffs on the top cap (*Figure 8*).
9. Once the lock collar seats on the standoffs, return the hex nuts to the standoffs and tighten firmly (*Figure 8*).



DO NOT stop applying pressure to the insertion shaft until the lock collar has been secured to the standoffs.

10. Once the lock collar is secured to the top cap, close vent/relief valve B, and then close the customer-supplied hydraulic supply (*Figure 1*).
11. Disconnect the customer-supplied hydraulic supply from vent/relief valve B (*Figure 1*).
12. Proceed to step 34 to complete installation.

Using an Auxiliary Gas (Optional)



An auxiliary gas supply is OPTIONAL for this unit. However, for products containing liquid, sand, or other abrasive contaminants, Welker strongly recommends the use of an auxiliary gas (e.g., clean, dry nitrogen gas) to prevent damage to the insertion cylinder.

13. With isolation valve A closed, connect a customer-supplied auxiliary gas supply to vent/relief valve B (*Figure 1*).
14. Regulate the customer-supplied auxiliary gas supply to a pressure equal to the pipeline pressure.
15. Slowly open the pipeline isolation valve. Check for leaks and repair as necessary.
16. Open the valve on the customer-supplied auxiliary gas supply.
17. Slowly open vent/relief valve B (*Figure 1*). The insertion shaft will begin to insert into the pipeline.



Once the insertion shaft begins to insert, do not open the valve any further. The insertion shaft should be inserted slowly and smoothly. Opening the valve too quickly or too much may cause the insertion shaft to insert into the pipeline too quickly and may result in damage to the unit.

18. Using the alignment indicator rod, guide the shaft slowly into the pipeline. The alignment indicator rod should be parallel to the pipeline.
19. As necessary, align the lock collar holes with the standoffs on the top cap (*Figure 8*).
20. Once the lock collar seats on the standoffs, return the hex nuts to the standoffs and tighten firmly (*Figure 8*).



DO NOT stop applying pressure to the insertion shaft until the lock collar has been secured to the standoffs.

21. Once the lock collar is secured to the top cap, close vent/relief valve B, and then close the customer-supplied auxiliary gas supply (*Figure 1*).
22. Disconnect the customer-supplied auxiliary gas supply from vent/relief valve B (*Figure 1*).
23. Proceed to step 34 to complete installation.

Using Pipeline Product (If Not Using Hydraulic Fluid or an Auxiliary Gas)

24. Ensure that vent/relief valve B is closed (*Figure 1*).
25. Slowly open the pipeline isolation valve. Check for leaks and repair as necessary.
26. Slowly open isolation valve A (*Figure 1*). The insertion shaft will begin to insert into the pipeline.



Once the insertion shaft begins to insert, do not open the valve any further. The insertion shaft should be inserted slowly and smoothly. Opening the valve too quickly or too much may cause the insertion shaft to insert into the pipeline too quickly and may result in damage to the unit.

27. Using the alignment indicator rod, guide the shaft slowly into the pipeline. The alignment indicator rod should be parallel to the pipeline.
28. As necessary, align the lock collar holes with the standoffs on the top cap (*Figure 8*).
29. Once the lock collar seats on the standoffs, return the hex nuts to the standoffs and tighten firmly (*Figure 8*).



DO NOT stop applying pressure to the insertion shaft until the lock collar has been secured to the standoffs.

30. Once the lock collar is secured to the top cap, close isolation valve A (*Figure 1*).
31. Open vent/relief valve B to relieve pipeline pressure (*Figure 1*). The insertion shaft will remain in the pipeline, held in place mechanically by the lock collar.
32. Close vent/relief valve B (*Figure 1*).
33. Continue to step 34 to complete installation.

Completing Installation

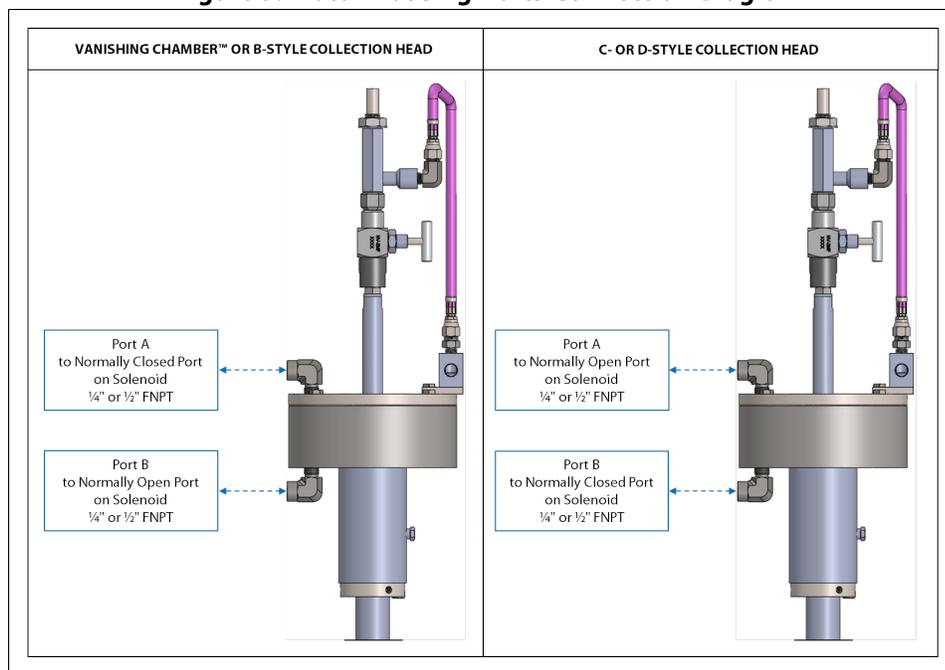
34. Once the inFlow™ is inserted and secured, use ¼" tubing to connect from the sample outlet to an appropriate customer-supplied sample container, such as a Welker TCC Transportable Crude Oil Container.



Customer-supplied ¼" tubing must slope downward from the inFlow™ to the sample container.

35. If the inFlow™ is equipped with a Vanishing Chamber™ or B-Style collection head, use appropriately sized tubing to connect from the normally open port on the solenoid to port B on the motor housing (Figure 9). Use appropriately sized tubing to connect from the normally closed port on the solenoid to port A on the motor housing (Figure 9).
36. If the inFlow™ is equipped with a C- or D-Style collection head, use appropriately sized tubing to connect from the normally open port on the solenoid to port A on the motor housing (Figure 9). Use appropriately sized tubing to connect from the normally closed port on the solenoid to port B on the motor housing (Figure 9).

Figure 9: Motor Housing Ports Connection Diagram



The normally open port should be stamped "A" or "NO."
The normally closed port should be stamped "B" or "NC."

37. Open emergency shutoff valve E (Figure 1).
38. As necessary, adjust the external adjustable relief. Refer to the *Installation, Operation, and Maintenance (IOM) Manual* for the relief for instructions on adjusting and setting the relief.



The external adjustable relief should be set to approximately 100 psig above maximum pipeline operating pressure.



The external adjustable relief comes factory-set by the manufacturer if requested at the time of order.

39. As necessary, adjust the external sand relief. With emergency shutoff valve E open, loosen the jam nut, tighten the adjusting screw on the external sand relief, and then tighten the jam nut as a locking device (*Figure 13*).



After the external sand relief valve has been set, emergency shutoff valve E must remain open during sampling. For more information about emergency shutoff valve E, see *Section 2.7, Emergency Shutoff*.



The external sand relief comes factory-set by the manufacturer if requested at the time of order.

2.5 Operating the Unit

1. Turn ON the hydraulic or pneumatic supply.
2. As necessary, adjust the hydraulic or pneumatic supply to 40–45 psig.
3. Set the timer or controller to actuate the solenoid at the desired sampling actuation frequency based on the sampling equations provided (*Figure 10*).

Figure 10: Sampling Frequency Equations

Liquid Sampling, Proportional to Flow Collection
<p>Equation 1: Number of Samples Needed <i>Number of Samples Needed to Fill to 80%</i> = $\frac{(\text{Container Size (cc)} * 0.8)}{\text{Bite Size (cc)}}$</p> <p>Equation 2: Proportional-to-Flow <i>Volume of Flow Between Sample Grabs</i> = $\frac{\text{Batch Size (Total Volume to be Sampled)}}{\text{Number of Samples Needed (Eq. 1)}}$</p>
<p><i>Use Equation 1 to determine the number of actuations needed.</i> <i>Use Equation 2 to determine how often (after what volume of flow) to take each sample.</i></p>
Liquid Sampling, Timed Collection
<p>Equation 1: Number of Samples Needed <i>Number of Samples Needed to Fill to 80%</i> = $\frac{(\text{Container Size (cc)} * 0.8)}{\text{Bite Size (cc)}}$</p> <p>Equation 2: Timed Sampling <i>Time Between Sample Grabs</i> = $\frac{\text{Total Time in Sample Period}}{\text{Number of Samples Needed (Eq. 1)}}$</p>
<p><i>Use Equation 1 to determine the number of actuations needed.</i> <i>Use Equation 2 to determine how often (after what amount of time) to take each sample.</i></p>



Never fill the container above 80% of its capacity. Allow at least 20% room for product expansion should the container be exposed to increased temperatures.



Note the 0.8 in Equation 1 represents the 80% volume limit for liquid sampling.

4. Ensure that emergency shutoff valve E is open (*Figure 1*).
5. As necessary, turn on electrical power and activate the hydraulic or pneumatic supply to actuate the solenoid at the set sampling frequency.



At start-up, several actuations may be required to displace trapped air and fill the insertion shaft with product before sample appears at the outlet port.

6. Collect a sample from the sample outlet to ensure that the sample volume collected is the same as the desired sample volume.



Welker recommends the Welker Checkpoint™ Sample Bite Verification Panel for use with this unit.

2.6 Purging the Unit (Optional)



The purge tube is an option of the inFlow™ that allows the sampler to be completely evacuated of sample from the inlet to the sample container. If the inFlow™ is equipped with the optional purge tube, automated purging can be achieved with the Welker PNP Plug & Purge Panel.



To prevent cross-contamination between samples, Welker recommends that the inFlow™ be evacuated, or purged, following each sample batch to inject all sampled product remaining in the unit into the sample container.

1. Connect an appropriate customer-supplied nitrogen or other inert gas supply to purge valve P (*Figure 3*).



Welker recommends using nitrogen or helium as the inert gas supply.

2. Set the inert gas supply pressure to approximately 50 psig above the external relief on the inFlow™.



Prior to purging the unit, ensure that the purge pressure (i.e., the purge setting minus the external adjustable relief setting) does not exceed the pressure rating of the sample container.

3. Turn ON the inert gas supply.
4. Open purge valve P (*Figure 3*).
5. Allow product in the inFlow™ to drain. Monitor the sample container for under- or over-purging.



If no inert gas is heard entering the sample container, the purge pressure has been set too low and previous product remains in the sampler.
If more than a burst of inert gas is heard entering the sample container, the purge pressure has been set too high and the operator risks overpressurizing the sample container.

6. Turn off the inert gas supply.
7. Close purge valve P (*Figure 3*).
8. Disconnect the inert gas supply from purge valve P (*Figure 3*).

2.7 Emergency Shutoff

1. If sample begins to free flow from the sample outlet, turn OFF the hydraulic or pneumatic supply to the motor, and then close emergency shutoff valve E (*Figure 1*).



DO NOT operate the pump after emergency shutoff valve E is closed. Operating the pump while emergency shutoff valve E is closed may damage the pump.



Free flow from the sample outlet indicates that the external adjustable relief has not been set correctly or that the external adjustable relief has failed.

2. If leaking becomes evident elsewhere on the inFlow™, turn OFF the hydraulic or pneumatic supply to the motor, and then tighten the packing adjustment nut to stop the leak until the unit can be removed for service (*Figure 3*).

2.8 Retracting the Unit



To avoid injury, DO NOT stand over the sampler motor housing during retraction.

1. If the inFlow™ is equipped with the optional purge tube, ensure that the inFlow™ has been purged. See *Section 2.6, Purging the Unit (Optional)*, for instructions on properly purging the inFlow™.
2. Deactivate or turn OFF the hydraulic or pneumatic supply.
3. Depressurize, drain, and disconnect the hydraulic or pneumatic supply lines.
4. Close emergency shutoff valve E (*Figure 1*).
5. Disconnect the sample container from the sample outlet.



If the unit will be retracted using hydraulic fluid, continue to step 6.
If the unit will be retracted using an auxiliary gas, proceed to step 14.
If the unit will be retracted using pipeline product, proceed to step 24.

Using Hydraulic Fluid (Optional)



If using hydraulic fluid to insert and retract the insertion shaft, the customer must provide a way to drain the hydraulic fluid from the insertion cylinder.



Welker recommends adding a pressure gauge to the hydraulic supply so that the maximum allowable operating pressure of the unit is not exceeded.



Hydraulic fluid provides the smoothest insertion and retraction.

6. With isolation valve A closed, install a customer-supplied hydraulic supply (e.g., a hydraulic hand pump) to vent/relief valve B (*Figure 1*).
7. Open the hydraulic supply.
8. Slowly open vent/relief valve B to ensure that adequate pressure is applied to the internal shaft piston (*Figure 1*).



Failure to ensure that adequate pressure is applied to the internal shaft piston prior to retraction could result in unexpected retraction of the insertion shaft, which could damage the unit or injure the operator.

9. Remove the hex bolts from the top of the lock collar (*Figure 8*).
10. Slowly drain the hydraulic fluid from the insertion cylinder. This will relieve pressure from the internal shaft piston, allowing the insertion shaft to begin retracting from the pipeline. If pipeline pressure is not sufficient to push the insertion shaft out of the line, the insertion shaft may be retracted manually or by applying auxiliary gas to the vent outlet.



Once the insertion shaft begins to retract, do not open the valve any further. The insertion shaft should be retracted slowly and smoothly. Opening the valve too quickly or too much may cause the insertion shaft to retract from the pipeline too quickly and may result in damage to the unit.

11. Once the insertion shaft is fully retracted, close vent/relief valve B, and then close the pipeline isolation valve to isolate the unit from pressure (*Figure 1*).
12. Disconnect the customer-supplied hydraulic supply from vent/relief valve B (*Figure 1*).
13. Proceed to step 31 to complete retraction.

Using an Auxiliary Gas (Optional)

14. With isolation valve A closed, connect a customer-supplied auxiliary gas supply to vent/relief valve B (*Figure 1*).
15. Regulate the customer-supplied auxiliary gas supply to a pressure equal to the pipeline pressure.
16. Open the valve on the customer-supplied auxiliary gas supply.
17. Slowly open vent/relief valve B to ensure that adequate pressure is applied to the internal shaft piston (*Figure 1*).



Failure to ensure that adequate pressure is applied to the internal shaft piston prior to retraction could result in unexpected retraction of the insertion shaft, which could damage the unit or injure the operator.

18. Close vent/relief valve B (*Figure 1*).
19. Disconnect the customer-supplied auxiliary gas supply from vent/relief valve B (*Figure 1*).
20. Remove the hex bolts from the top of the lock collar (*Figure 8*).
21. Slowly open vent/relief valve B. This will relieve pressure from the internal shaft piston, allowing the insertion shaft to begin retracting from the pipeline. If pipeline pressure is not sufficient to push the insertion shaft out of the line, the insertion shaft may be retracted manually or by applying auxiliary gas to the vent outlet.



Once the insertion shaft begins to retract, do not open the valve any further. The insertion shaft should be retracted slowly and smoothly. Opening the valve too quickly or too much may cause the insertion shaft to retract from the pipeline too quickly and may result in damage to the unit.

22. Once the insertion shaft is fully retracted, close vent/relief valve B, and then close the pipeline isolation valve to isolate the unit from pressure (*Figure 1*).
23. Proceed to step 31 to complete retraction.

Using Pipeline Product (If Not Using Hydraulic Fluid or an Auxiliary Gas)

24. Ensure that vent/relief valve B is connected to a customer-supplied recovery system. Valve B should remain closed.
25. Slightly open isolation valve A to ensure that pipeline pressure is applied to the internal shaft piston (*Figure 1*).



Failure to ensure that adequate pressure is applied to the internal shaft piston prior to retraction could result in unexpected retraction of the insertion shaft, which could damage the unit or injure the operator.

26. Remove the hex bolts from the top of the lock collar (*Figure 8*).
27. Close isolation valve A (*Figure 1*).
28. Slowly open vent/relief valve B (*Figure 1*). This will relieve pipeline pressure from the internal shaft piston, allowing the insertion shaft to begin retracting from the pipeline. If pipeline pressure is not sufficient to push the insertion shaft out of the line, the insertion shaft may be retracted manually or by applying auxiliary gas to the vent outlet.



Once the insertion shaft begins to retract, do not open the valve any further. The insertion shaft should be retracted slowly and smoothly. Opening the valve too quickly or too much may cause the insertion shaft to retract from the pipeline too quickly and may result in damage to the unit.

29. Once the insertion shaft is fully retracted, close vent/relief valve B, and then close the pipeline isolation valve to isolate the unit from pressure (*Figure 1*).
30. Continue to step 31 to complete retraction.

Completing Retraction

31. Loosen the cap screws on the sides of the lock collar, and then slide the lock collar down onto the alignment nuts on the top cap.
32. Tighten the hex bolts to secure the lock collar to the alignment nuts on the top cap to prevent the insertion shaft from moving while the unit is being removed from the pipeline.
33. Slowly open vent/relief valve B and isolation valve A to bleed any pressure or liquids trapped in the lubricator body (*Figure 1*).
34. As necessary, ensure that the customer-supplied recovery system has been disconnected from vent/relief valve B (*Figure 1*).
35. If complete removal of the inFlow™ from the pipeline is desired, the inFlow™ is now ready to be removed from the pipeline isolation valve for maintenance or to be relocated.
36. If the inFlow™ will remain secured to the pipeline after retraction, ensure that the lock collar has been properly secured to the alignment nuts on the top cap.

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 may lead to excess wear on the unit, a more frequent maintenance schedule may 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 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. Adjustable Wrench (Qty. 2)
 - b. Crimp
 - c. Hex Key Set
 - d. High Pressure Grease Gun
 - e. Needle Nose Pliers
 - f. Reversible Snap Ring Pliers
 - g. Seal Pick
 - h. Tongue and Groove Pliers

3.2 Maintenance

1. Prior to performing maintenance, the unit must be removed from the pipeline. See *Section 2.8, Retracting the Unit*, for instructions on retracting the insertion shaft and removing the unit from the pipeline.
2. Relieve any trapped pressure by slowly releasing the spring tension on the external adjustable relief. If the inFlow™ is equipped with the optional external sand relief, loosen the jam nut and turn the adjusting screw on the external sand relief counterclockwise (*Figure 13*). If the inFlow™ is equipped with the optional purge tube, open purge valve P to relieve any trapped pressure (*Figure 14*).
3. Lay the inFlow™ on a smooth, clean surface

Collection Head Assembly



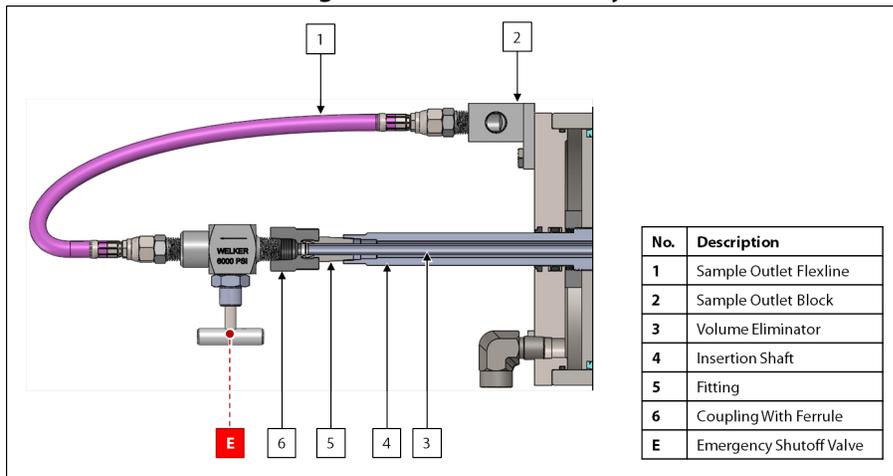
Welker recommends noting the position of the jam nut on the outer shaft to ease reassembly.

4. Loosen the lock collar, and then expose the collection head manually by gently pushing the collection head out of the lubricator body.
5. As necessary, cut the safety wire from the relief cap to the jam nut, and then remove the safety wire.
6. Unscrew and remove the collection head assembly from the outer shaft.
7. Refer to *Appendix B, B-Style Collection Head Maintenance*, *Appendix C, C-Style Collection Head Maintenance*, *Appendix D, D-Style Collection Head Maintenance*, or *Appendix E, Vanishing Chamber™ Collection Head Maintenance*, for instructions on performing maintenance on the collection head.

Outlet Assembly

8. If the inFlow™ is not equipped with the optional purge tube, continue to step 9. If the inFlow™ is equipped with the optional purge tube, proceed to step 21.

Figure 11: Outlet Assembly

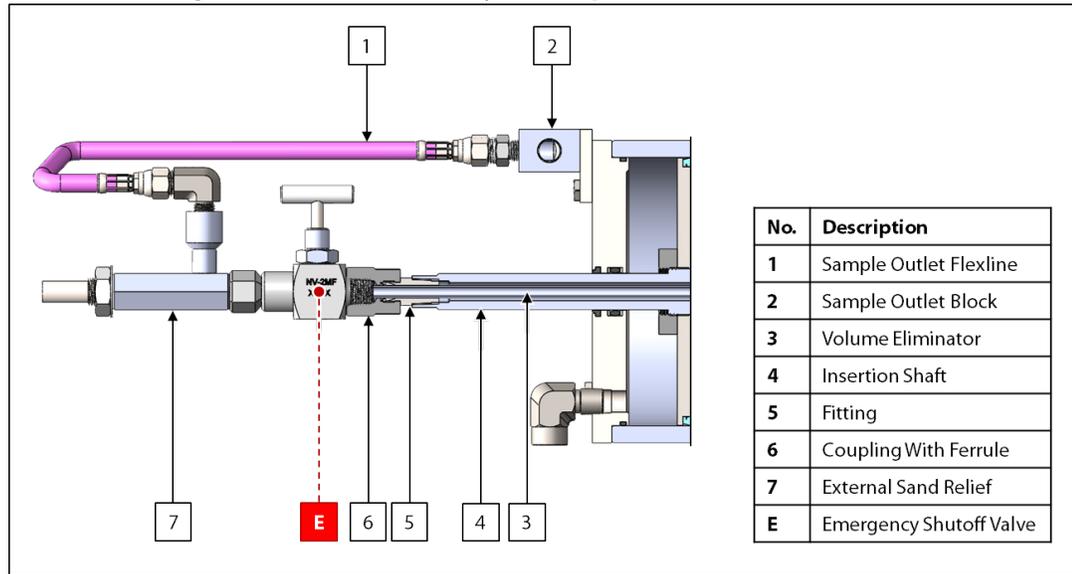


9. Unscrew the sample outlet flexline from the sample outlet block.
10. Unscrew the outlet assembly from the insertion shaft. Note that the ferrule set, coupling, emergency shutoff valve E, and sample outlet flexline will be removed at this time.
11. If the inFlow™ is equipped with the external adjustable relief, refer to the *Installation, Operation, and Maintenance (IOM) Manual* for the relief for maintenance instructions, and then proceed to step 25. If the inFlow™ is equipped with the optional external sand relief, continue to step 12.

External Sand Relief (Optional)

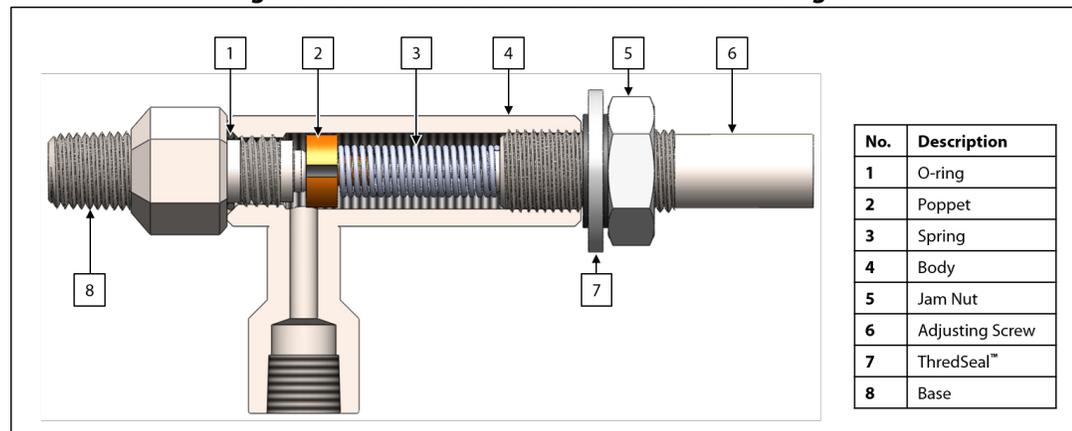
12. Unscrew the external sand relief from emergency shutoff valve E (*Figure 12*).

Figure 12: Outlet Assembly With Optional External Sand Relief



13. Unscrew the base of the external sand relief from the body (*Figure 13*).

Figure 13: External Sand Relief Maintenance Diagram

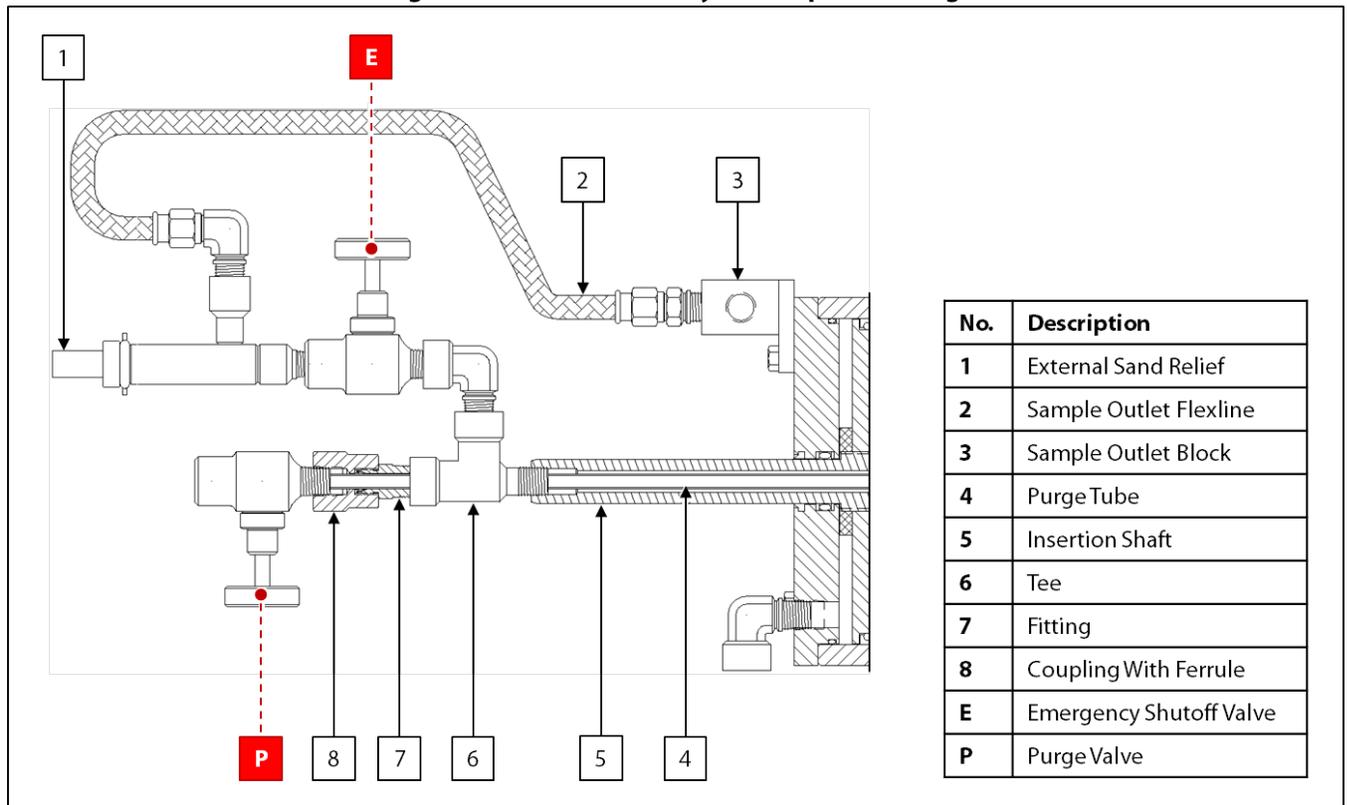


14. Replace the O-ring on the base.
15. Unscrew the jam nut from the adjusting screw.
16. Inspect the poppet for scratches or other damage. If scratches or other damage are present on the poppet (face) seat, replace the poppet.
17. Reassemble the external sand relief.
18. Screw the external sand relief into emergency shutoff valve E (*Figure 12*).
19. Screw the flexline into the elbow in the external sand relief (*Figure 12*).
20. Proceed to step 25 for instructions on disassembling the upper housing.

Purge Tube (Optional)

21. Unscrew the sample outlet flexline from the sample outlet block (Figure 14).

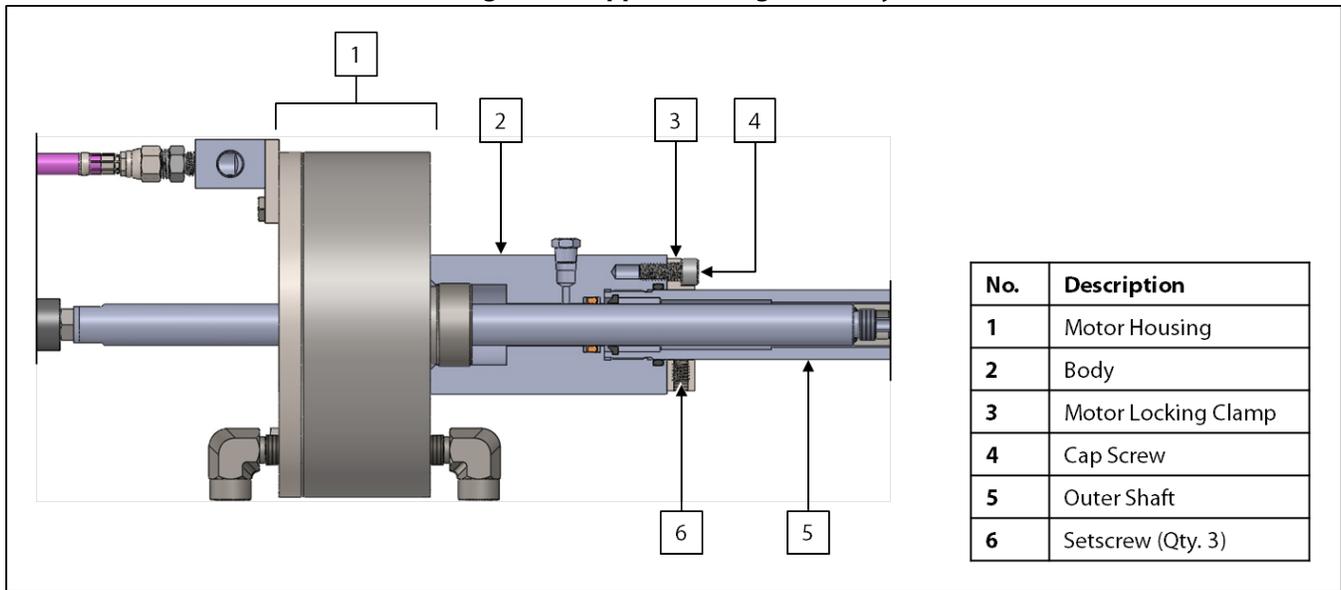
Figure 14: Outlet Assembly With Optional Purge



22. Unscrew the purge assembly at the tee connecting it to the insertion shaft. Note that the long purge tube is attached to the purge assembly and will also be removed at this time. Take care not to bend or otherwise damage the purge tube.
23. Maintain the external relief. If the inFlow™ is equipped with the external adjustable relief, refer to the *Installation, Operation, and Maintenance (IOM) Manual* for the relief for maintenance instructions. If the inFlow™ is equipped with the optional external sand relief, see steps 12–19 for maintenance instructions.
24. Continue to step 25 for instructions on disassembling the upper housing.

Disassembling the Upper Housing

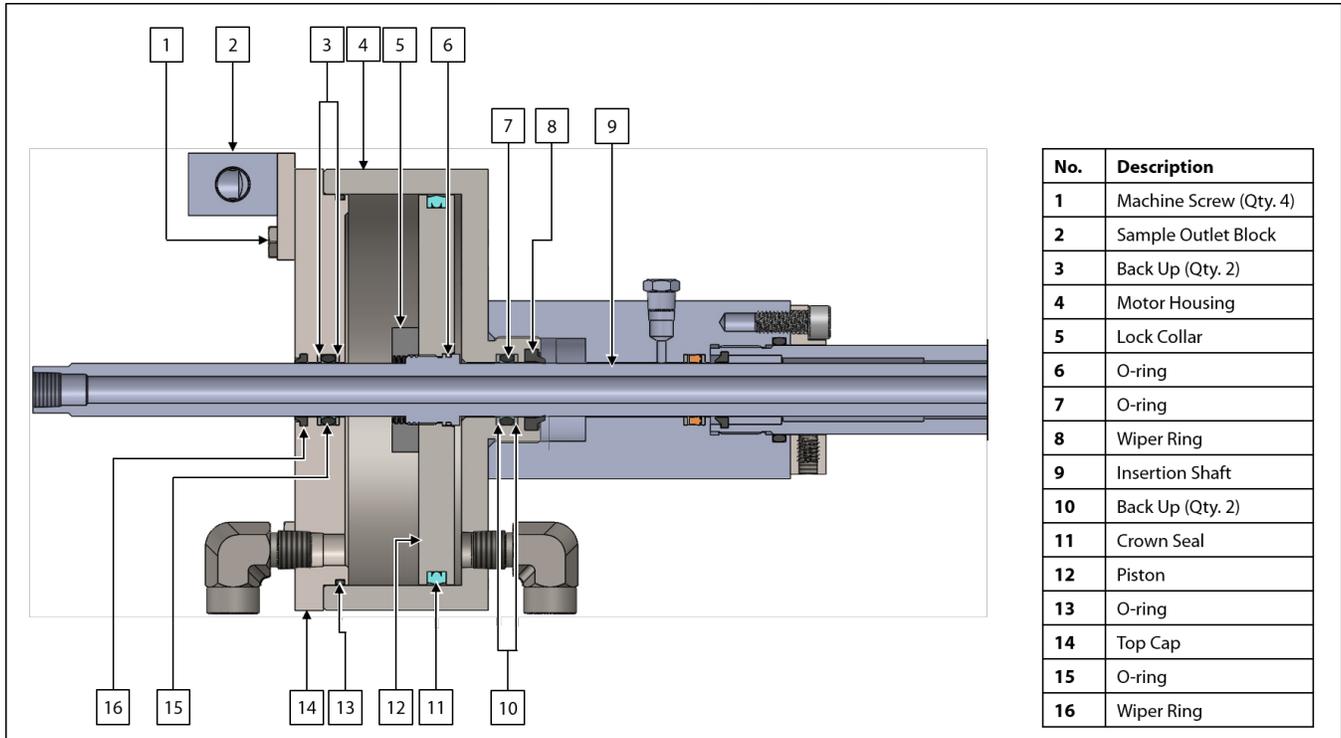
Figure 15: Upper Housing Assembly



25. Unscrew the setscrews from the motor locking clamp at the base of the body.
26. Unscrew and remove the upper housing assembly from the outer shaft. Note that the insertion shaft is attached to this assembly and will be removed at this time. Take care not to scratch or otherwise damage the insertion shaft.
27. Unscrew the machine screws from the top cap and carefully remove the top cap from the motor housing (*Figure 16*).
28. Unscrew the motor housing from the body and carefully remove the motor housing. Note that the insertion shaft is attached to the motor piston and will be removed at this time. Take care not to scratch or otherwise damage the insertion shaft.

Motor Housing Assembly

Figure 16: Motor Housing Assembly

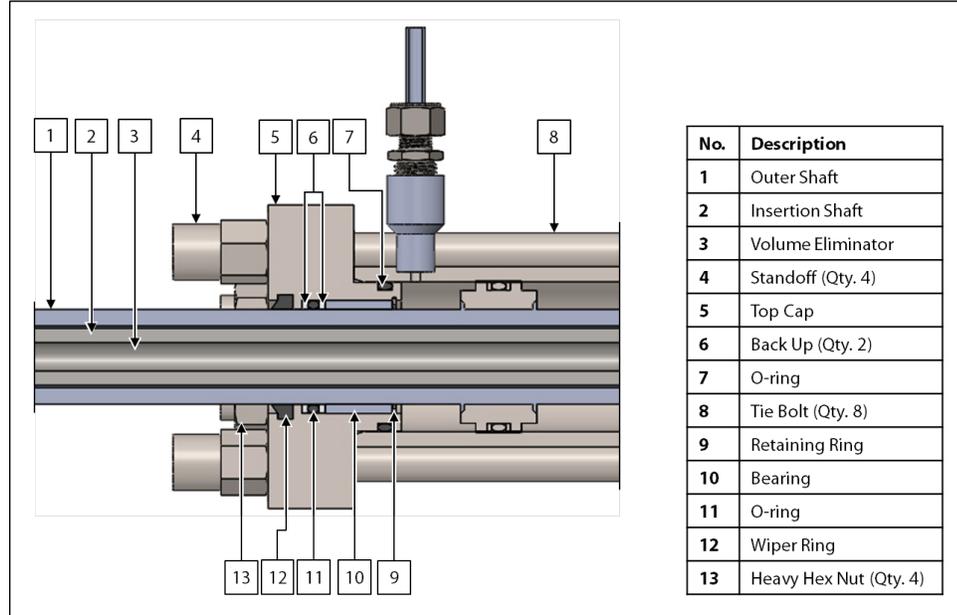


29. Replace the O-rings and back ups on the top cap.
30. Inspect the wiper ring in the top cap. Replace it if it shows signs of wear or damage.
31. Replace the O-ring and crown seal on the piston.
32. Replace the O-ring and back ups on the motor housing.
33. Inspect the wiper ring in the motor housing. Replace it if it shows signs of wear or damage.
34. Inspect the polished portion of the insertion shaft. If any scratches or damage are present, repair or replace as necessary.

Top Cap and Lubricator Body Maintenance

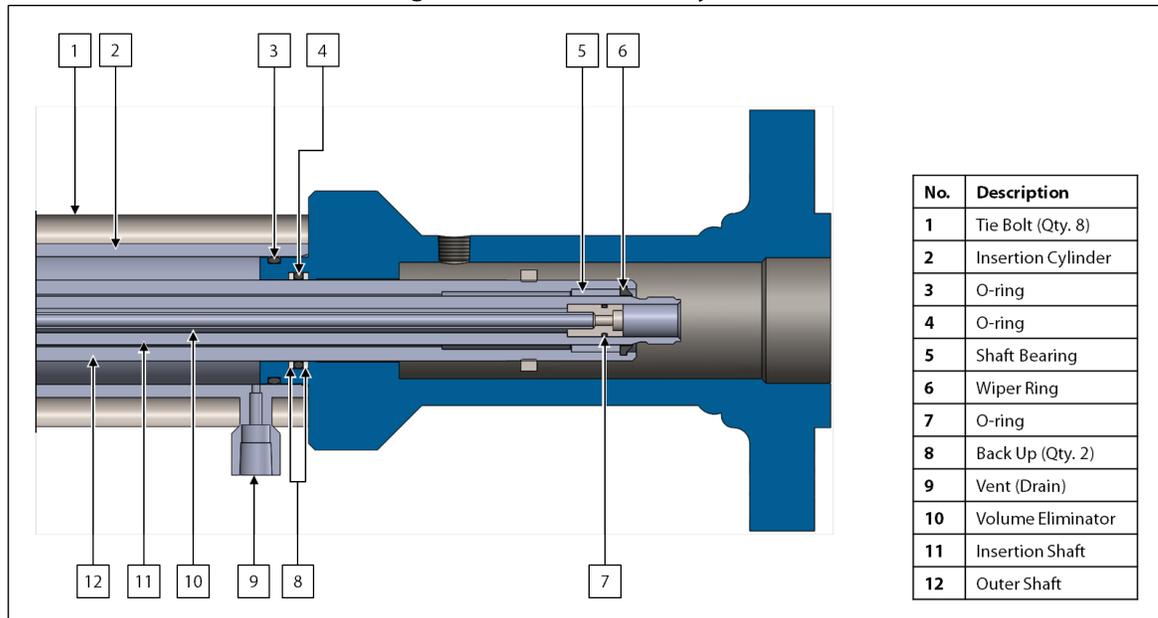
35. Loosen and remove the lock collar from the outer shaft (Figure 8).

Figure 17: Top Cap Detail



36. Remove the heavy hex nuts and standoffs, and then slide the top cap off the outer shaft.
 37. Inspect the retaining ring, bearing, and wiper ring in the top cap. Replace them if they show signs of wear or damage.
 38. Replace the O-rings and back ups in the top cap.

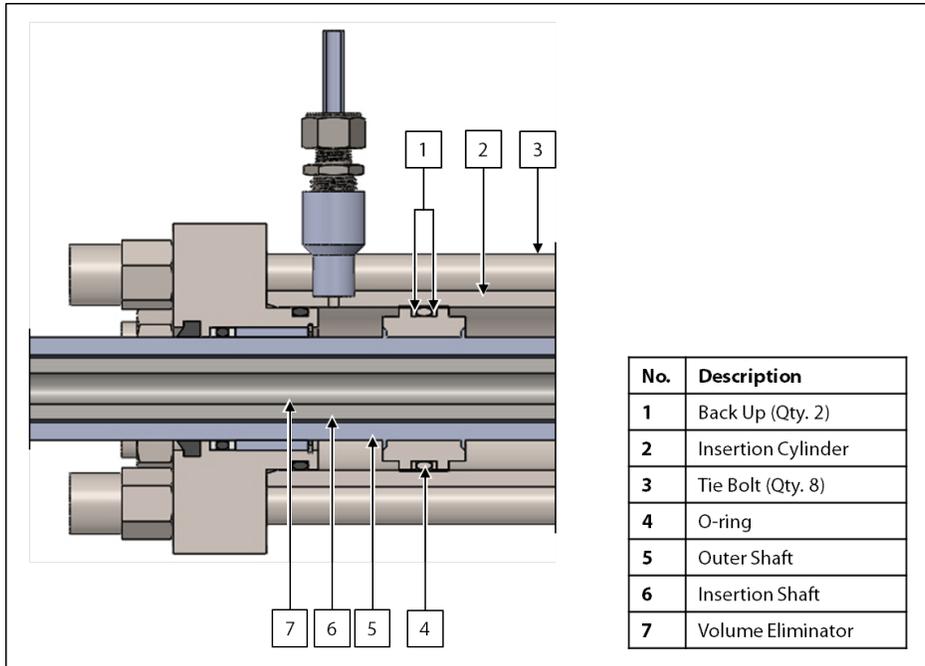
Figure 18: Lubricator Body Detail



39. With the collection head and upper housing removed, carefully pull the outer shaft out and the insertion cylinder off of the lubricator body. As necessary, remove the tie bolts.
 40. Replace the O-rings and back ups on the lubricator body.

Shaft and Cylinder Maintenance

Figure 19: Shaft Detail



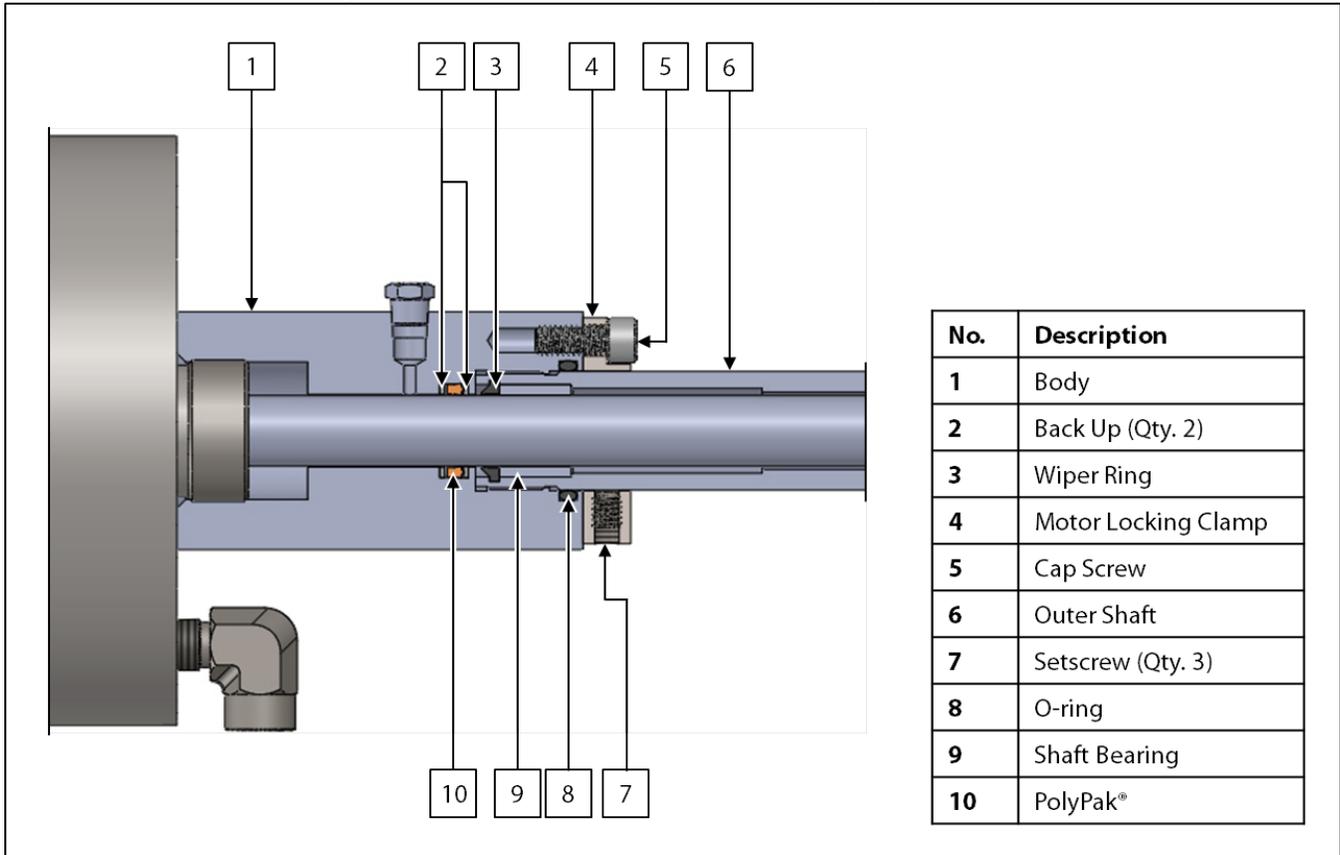
41. Remove the outer shaft from the insertion cylinder.
42. Replace the O-ring and back ups on the piston.
43. Closely inspect the polished outer diameter of the outer shaft. Scratches or pits may cause the seals to leak. If scratches or pits are present, the unit may need to be repaired or replaced. Contact Welker for service options.
44. Inspect the wiper ring and shaft bearing in the outer shaft (*Figure 18*). Replace them if they show signs of wear or damage.

Body

45. Unscrew the cap screw connecting the motor locking clamp to the body, and then separate the motor locking clamp from the body. Set the motor locking clamp aside.
46. If the inFlow™ is not equipped with the optional packing adjustment nut, continue to step 47. If the inFlow™ is equipped with the optional packing adjustment nut, proceed to step 53.

Without Optional Packing Adjustment Nut

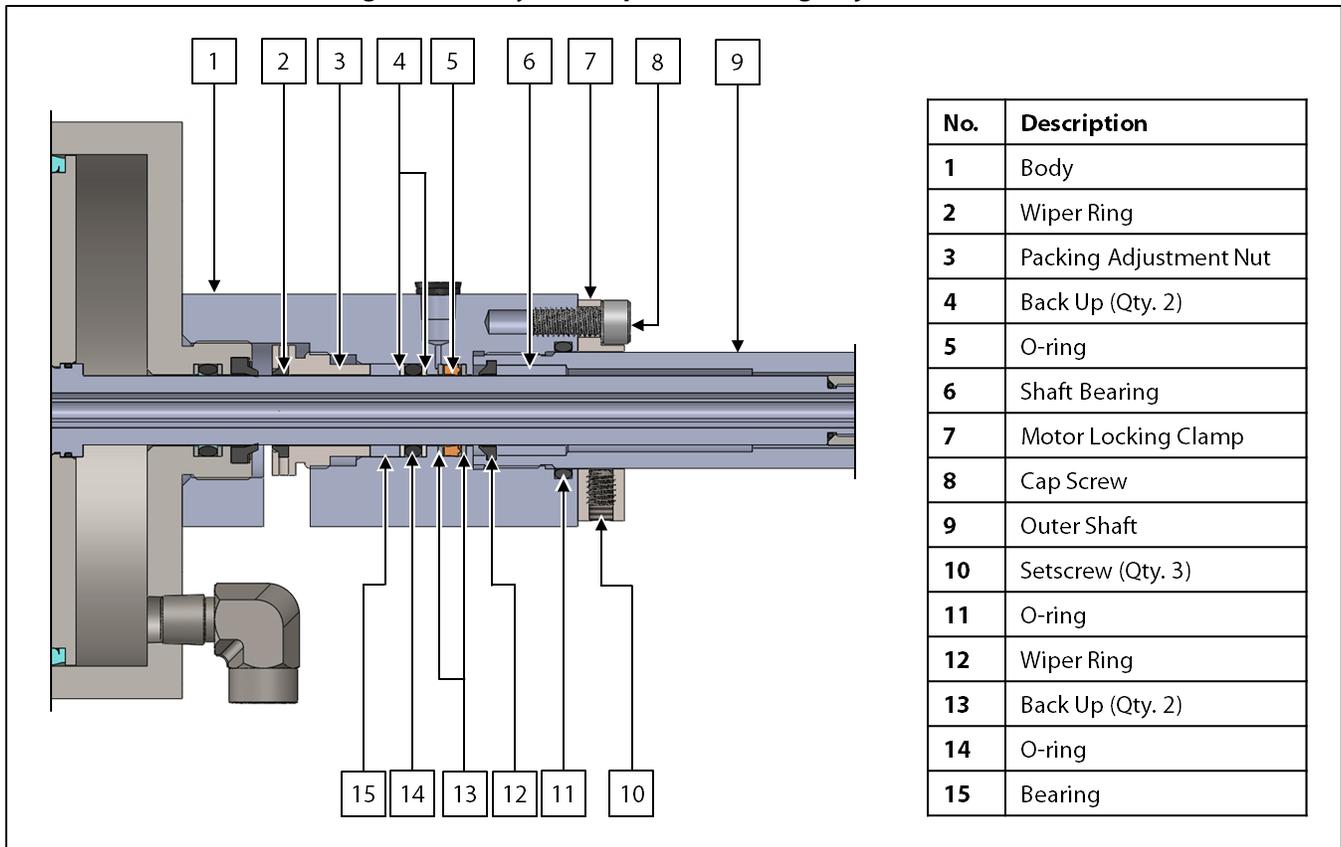
Figure 20: Body Without Optional Packing Adjustment Nut



47. Replace the O-ring, back ups, and PolyPak® in the body.
48. Inspect the wiper ring and shaft bearing in the outer shaft. Replace them if they show signs of wear or damage.
49. Using the cap screw, secure the motor locking clamp to the body.
50. Carefully screw the motor housing into the body.
51. Insert the top cap into the motor housing and bolt in place.
52. Proceed to step 61 for reassembly instructions.

With Optional Packing Adjustment Nut

Figure 21: Body With Optional Packing Adjustment Nut

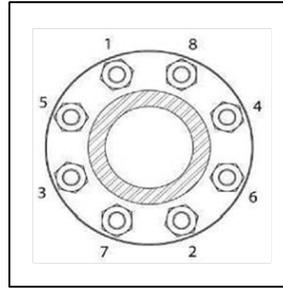


53. Unscrew the packing adjustment nut from the body.
54. Replace the O-rings and back ups in the body.
55. Inspect the bearing. Replace it if it shows signs of wear or damage.
56. Inspect the wiper ring and shaft bearing in the outer shaft. Replace them if they show signs of wear or damage.
57. Screw the packing adjustment nut into the body.
58. Using the cap screw, secure the motor locking clamp to the body.
59. Carefully screw the motor housing into the body.
60. Insert the top cap into the motor housing and bolt in place.

Reassembly

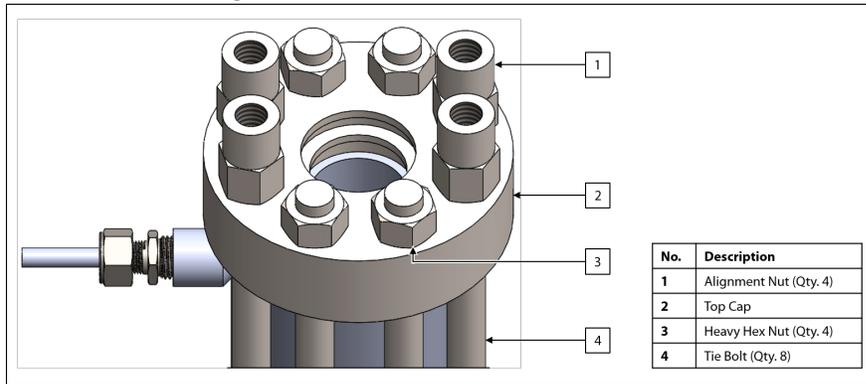
61. Carefully slide the insertion cylinder onto the lubricator body.
62. Coat the inside of the top end of the insertion cylinder with lubricant. The bottom of the insertion cylinder can be identified by its vent port.
63. Liberally lubricate the outer shaft.
64. Slide the outer shaft into the lubricator body.
65. Carefully slide the top cap onto the top end of the outer shaft and down to the insertion cylinder.
66. As necessary, install the tie bolts following a cross-bolting sequence (*Figure 22*).

Figure 22: Cross-Bolting Sequence



67. Install the four (4) standoffs and the four (4) heavy hex nuts to the tie bolts so that the lock collar can later be secured to the top cap (*Figure 23*).

Figure 23: Correct Standoff Installation



68. Following a cross-bolting sequence, tighten the standoffs and heavy hex nuts to the appropriate torque (*Figure 23* and *Table 2*).

Table 2: Torque Specifications for Tie Bolts

Tie Bolt Diameter	Foot-Pounds (ft•lb)	Kilograms per Meter (kg/m)
½"	15–20	2.07–2.76

69. Carefully slide the lock collar onto the outer shaft, and then tighten the lock collar cap screws.
70. With the upper housing assembly attached to the inner shaft, insert the insertion shaft into the outer shaft, and then tighten the thread of the body to the outer shaft.
71. Tighten the setscrews in the motor locking clamp to secure the upper housing assembly to the outer shaft.
72. If applicable, insert the volume eliminator into the insertion shaft, and then screw the outlet assembly into the insertion shaft.
73. If applicable, insert the purge tube into the insertion shaft, and then screw the purge assembly into the insertion shaft.
74. Reconnect the flexline at the sample outlet block.
75. Tighten the collection head onto the outer shaft.
76. The unit is now ready for installation.

3.3 Troubleshooting

Table 3: inFlow™ Troubleshooting

Issues	Possible Causes	Solutions
The inFlow™ is not actuating properly.	The hydraulic supply may be too low or	Inspect the electro-hydraulic unit (EHUC).

Table 3: inFlow™ Troubleshooting

Issues	Possible Causes	Solutions
	<p>not operating.</p> <p>The pneumatic supply may be too high, too low, or not operating.</p> <p>The solenoid may not be operating properly.</p>	<p>Add hydraulic oil as necessary. If the EHUC is not operating, refer to the <i>Installation, Operation, and Maintenance (IOM) Manual</i> for the EHUC.</p> <p>Inspect the pneumatic supply and regulator to ensure that air is supplied at the appropriate pressure.</p> <p>Use the manual override button on the solenoid and ensure proper operation. If the solenoid is operating improperly, refer to the <i>Installation, Operation, and Maintenance (IOM) Manual</i> for the solenoid.</p>
<p>The sample container is not filling.</p>	<p>The inlet valve on the sample container may be closed.</p> <p>The outlet on the sample container may be open.</p> <p>The inFlow™ is not collecting the correct sample volume.</p> <p>The inFlow™ may be set at a slower sampling frequency than desired.</p> <p>The relief on the inFlow™ may be set too high.</p>	<p>Ensure that the sample inlet valve on the sample container is open during sampling.</p> <p>Ensure that the sample outlet valve on the sample container is closed during sampling.</p> <p>Welker recommends the Welker Checkpoint™ Sample Bite Verification Panel for verifying the sample volume of the inFlow™. See <i>Section 2.2, Setting the Sample Volume</i>, for instructions on adjusting the sample volume.</p> <p>Adjust the inFlow™ to sample at the desired rate. Ensure that the calculations used to determine the sample frequency are correct (<i>Figure 10</i>).</p> <p>Check the setting on the relief and adjust as necessary.</p>

Table 3: inFlow™ Troubleshooting (Continued)

Issues	Possible Causes	Solutions
The sample container is filling too quickly.	<p>The inFlow™ is not collecting the correct sample volume.</p> <p>The inFlow™ may be set at a faster sampling frequency than desired.</p> <p>The relief on the inFlow™ may be set too low.</p>	<p>Welker recommends the Welker Checkpoint™ Sample Bite Verification Panel for verifying the sample volume of the inFlow™. See <i>Section 2.2, Setting the Sample Volume</i>, for instructions on adjusting the sample volume.</p> <p>Adjust the inFlow™ to sample at the desired rate. Ensure that the calculations used to determine the sample frequency are correct (<i>Figure 10</i>).</p> <p>Check the setting on the relief and adjust as necessary.</p>

APPENDIX A: REFERENCED OR ATTACHED DOCUMENTS

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

- IOM-105: Welker NV-1 and NV-2 Instrument Valves
- IOM-117: Welker TCC-1 Transportable Crude Oil Container
- IOM-134: Welker Checkpoint™ Sample Bite Verification Panel
- IOM-165: Welker PNP Plug & Purge Panel
- IOM-186: Welker TCC Optimum™ Transportable Crude Oil Container
- IOM-197: Welker TCC-5 Transportable Crude Oil Container
- IOM-206: Welker TCC-2 Transportable Crude Oil Container
- IOM-207: Welker TCC-3 Transportable Crude Oil Container
- IOM-208: Welker TCC-10 Transportable Crude Oil Container

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

- Kepner Products Company Kepsel® Cartridge Insert Valves (Welker IOM-V078)
- Parker Hannifin Corporation Fluoropolymer Hose (Welker IOM-V174)
- Swagelok Company Proportional Relief Valves R Series (Welker IOM-V086)

Welker drawings and schematics suggested for use with this unit:

- Assembly Drawing: AD083CO.O2 (Standard inFlow™)
- Assembly Drawing: AD083CO.O6 (inFlow™ With Optional Purge Tube)
- Assembly Drawing: AD083DG (inFlow™ With Optional Packing Adjustment Nut)
- Collection Head Drawing: AD084BB (Vanishing Chamber™ Collection Head With Cartridge Relief)
- Collection Head Drawing: AD084BO (Vanishing Chamber™ Collection Head With B-Style Inline Relief)
- Collection Head Drawing: AD130BO (Vanishing Chamber™ Collection Head With Internal Sand Relief)
- Collection Head Drawing: AD168BC (C-Style Collection Head With Internal Sand Relief)
- Collection Head Drawing: AD168BO (C-Style Collection Head With Cartridge Relief)
- Collection Head Drawing: AD168BQ (C-Style Collection Head With B-Style Inline Relief)
- Collection Head Drawing: AD190BO (B-Style Collection Head With Internal Sand Relief)
- Collection Head Drawing: AD224BM (D-Style Collection Head With Cartridge Relief)
- Collection Head Drawing: AD224BP (D-Style Collection Head With Internal Sand Relief)
- Collection Head Drawing: AD375BA (B-Style Collection Head With B-Style Inline Relief)
- Collection Head Drawing: AD375BF (B-Style Collection Head With Cartridge Relief)

APPENDIX B: B-STYLE COLLECTION HEAD MAINTENANCE

1. Loosen the setscrew in the cylinder base, and then remove the holding pin.
2. Separate the cylinder base from the piston.
3. Unscrew the retainer from the piston.
4. Remove the Welker Seal and piston bearing from the retainer.
5. Inspect the piston bearing for scratches or damage. If scratches or damage are present, repair or replace as necessary.
6. Replace the Welker Seal.
7. Return the retainer to the piston. Tighten the retainer so that the Welker Seal and piston bearing are held securely in place.
8. Return the piston to the base and insert the holding pin.
9. Tighten the setscrew in the cylinder base to secure the assembly.



DO NOT over-tighten the setscrew.

10. Unscrew the hanger from the outer shaft.
11. As necessary, apply approximately 40 psig of instrument air to the top of the piston motor to extend the inner shaft beyond the outer shaft.
12. While holding onto the wrench flats on the inner shaft with one wrench, use a second wrench to slowly unscrew the cylinder from the inner shaft.



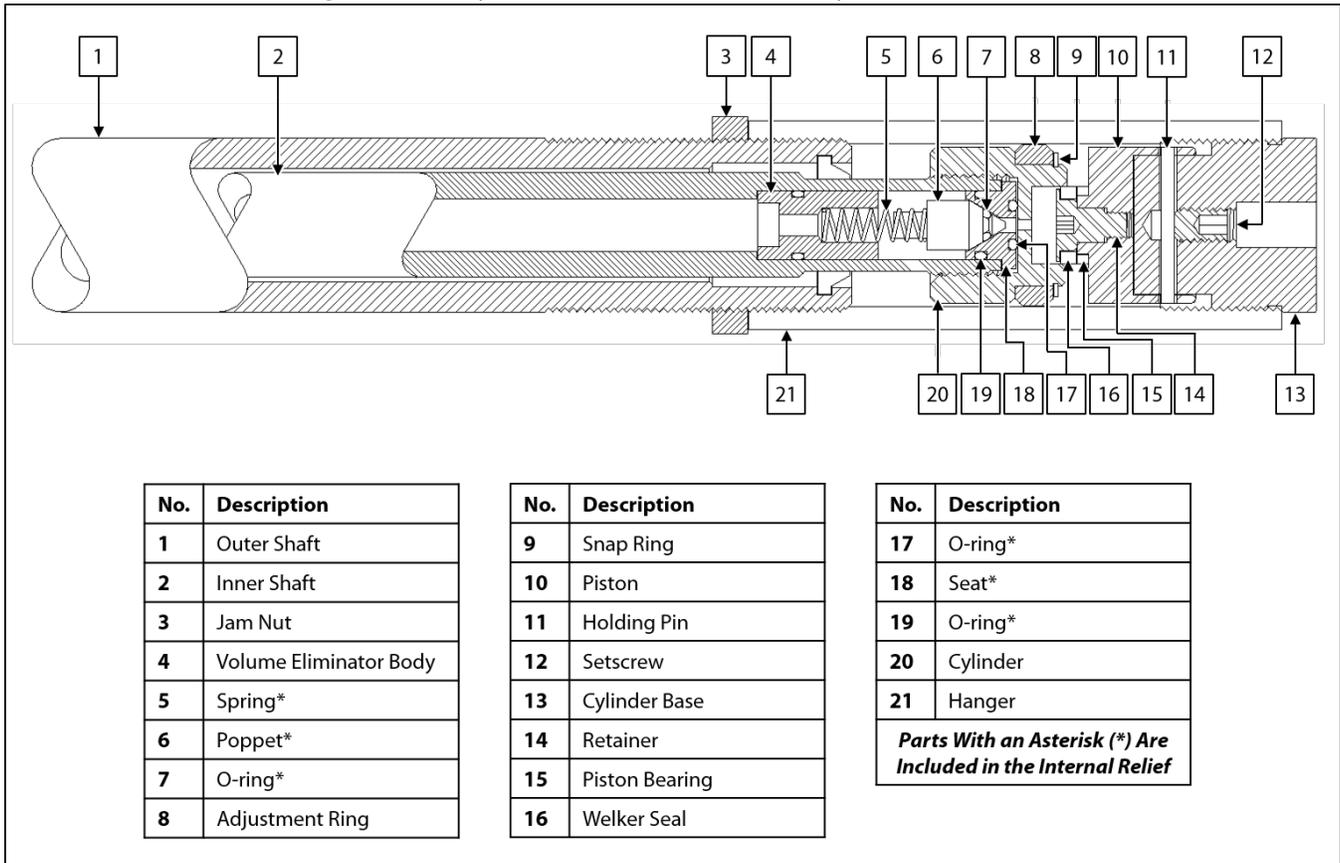
The B-Style and sand internal reliefs are spring loaded and may pop out when removing the cylinder.

13. If the collection head is equipped with a B-Style internal relief, continue to step 14. If the collection head is equipped with a cartridge style internal relief, proceed to step 26. If the collection head is equipped with an internal sand relief, proceed to step 31.

Internal Relief Maintenance

B-Style

Figure B1: B-Style Collection Head With B-Style Internal Relief



14. Remove the seat from the cylinder.
15. Inspect the spring for damage or wear. Replace as necessary.
16. Inspect the poppet for damage or wear. Replace as necessary.
17. Replace the O-ring on the poppet.
18. Inspect the seat for damage or wear. Replace as necessary.
19. Replace the O-rings on the seat.
20. Install the seat to the cylinder.
21. Install the poppet to the seat.
22. Install the spring to the poppet.
23. Carefully screw the B-Style internal relief assembly onto the inner shaft.



The cylinder must be attached securely to the inner shaft.

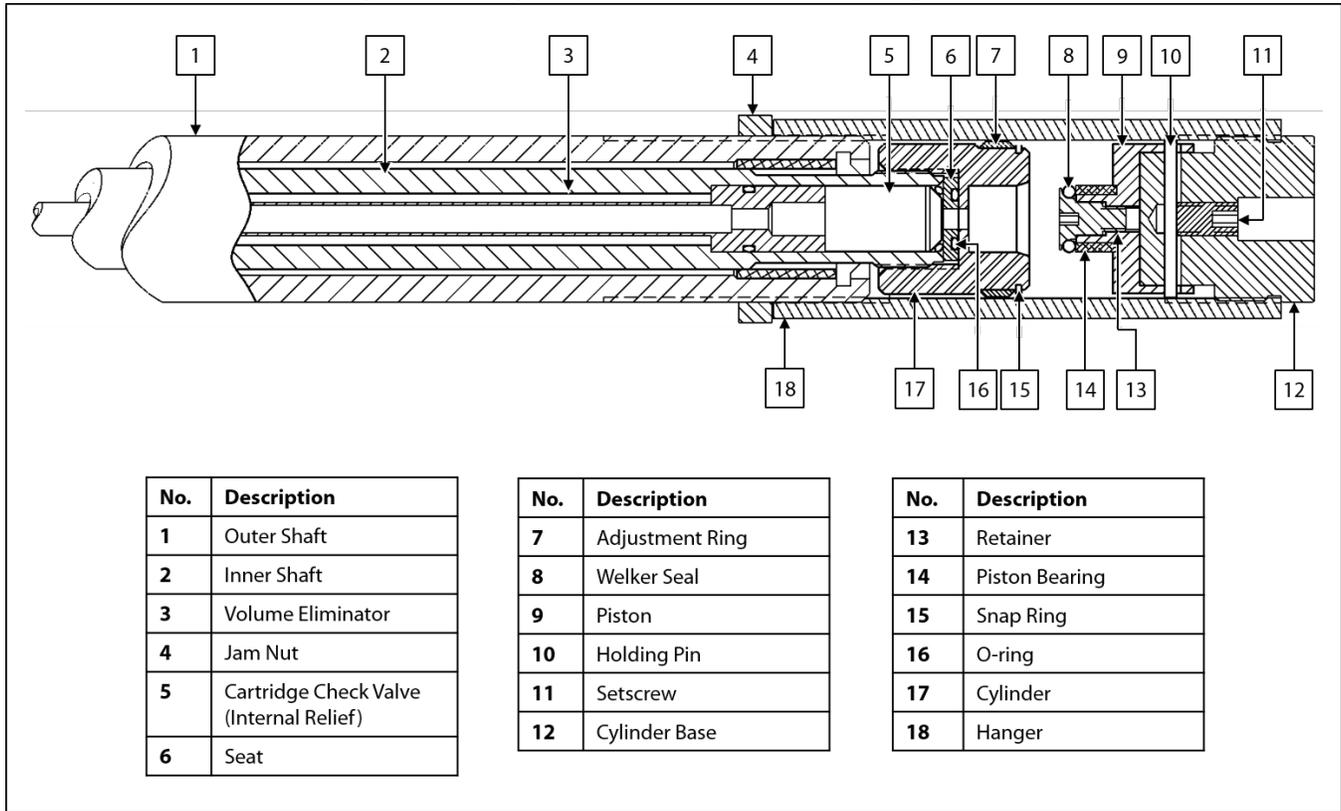
24. Screw the jam nut and hanger onto the outer shaft but do not tighten fully.
25. Proceed to step 41 for reassembly instructions.

Cartridge Style



This non-adjustable relief is designed for use with constant pressure cylinders and crude oil containers.

Figure B2: B-Style Collection Head With Cartridge Relief



26. Replace the O-ring on the seat.
27. Install the seat to the cylinder.
28. Install a replacement cartridge check valve to the cylinder.
29. Carefully screw the cartridge style internal relief assembly onto the inner shaft.

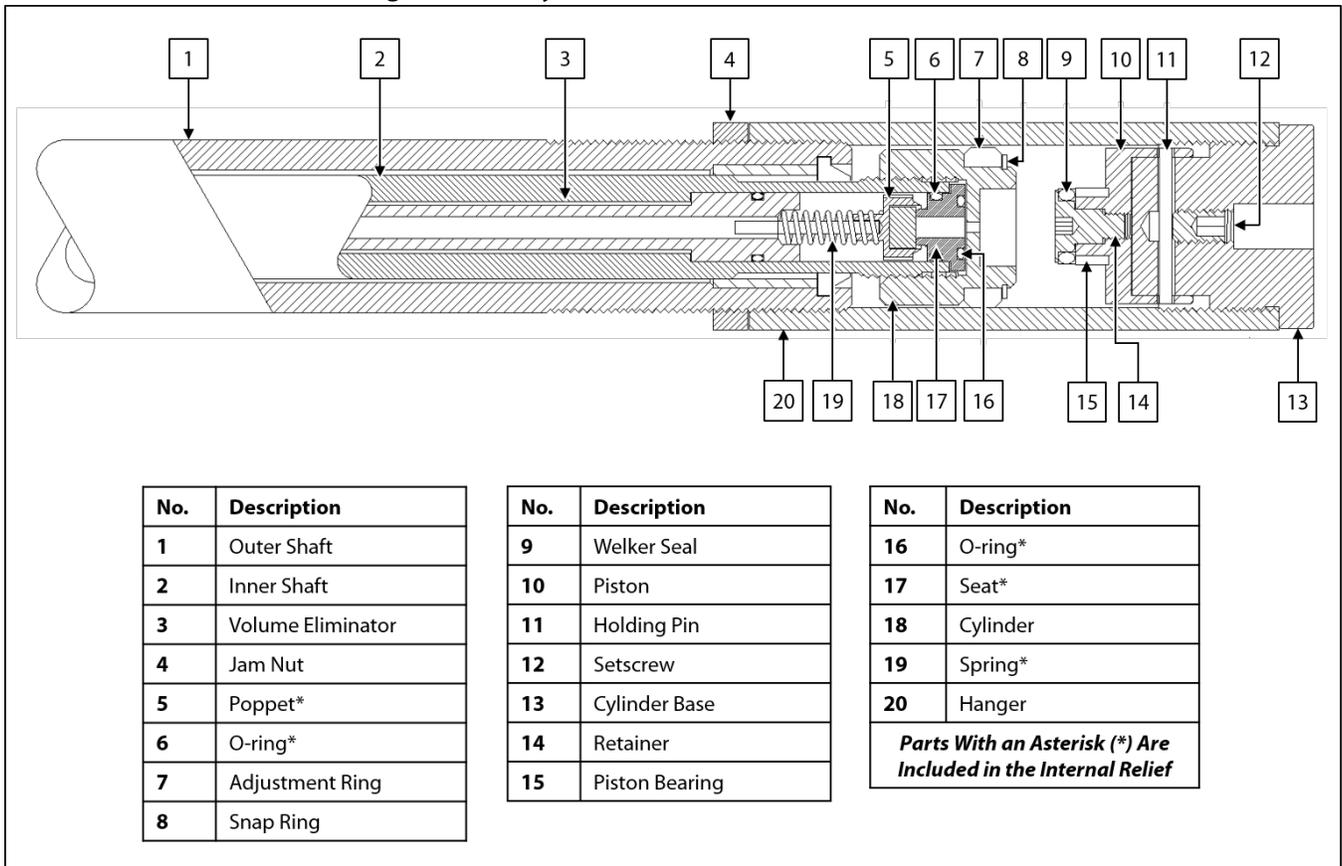


The cylinder must be attached securely to the inner shaft.

30. Proceed to step 41 for reassembly instructions.

Sand Style

Figure B3: B-Style Collection Head With Sand Relief



31. Remove the seat from the cylinder.
32. Inspect the seat for damage or wear. Replace as necessary.
33. Inspect the spring for damage or wear. Replace as necessary.
34. Inspect the poppet for damage or wear. Replace as necessary.
35. Replace the O-rings on the seat.
36. Install the seat to the cylinder.
37. Install the poppet to the seat.
38. Install the spring to the poppet.
39. Carefully screw the sand relief assembly onto the inner shaft.



The cylinder must be attached securely to the inner shaft.

40. Continue to step 41 for reassembly instructions.

Reassembly

41. Screw the cylinder base / piston assembly into the hanger and tighten.
42. Apply instrument air to the bottom of the piston motor to drive the piston to the top of the housing. This will retract the inner shaft and position the collection head cylinder at maximum volume.
43. Screw the hanger up the outer shaft until the gap between the Welker Seal and the top edge of the cylinder is approximately $\frac{3}{16}$ " (5 mm).
44. Tighten the jam nut against the hanger.
45. Using a wrench, tighten the cylinder base and jam nut.
46. Test stroke the inFlow™ to ensure proper stroke length. The B-Style collection head should completely close and then return to the $\frac{3}{16}$ " (5 mm) gap.

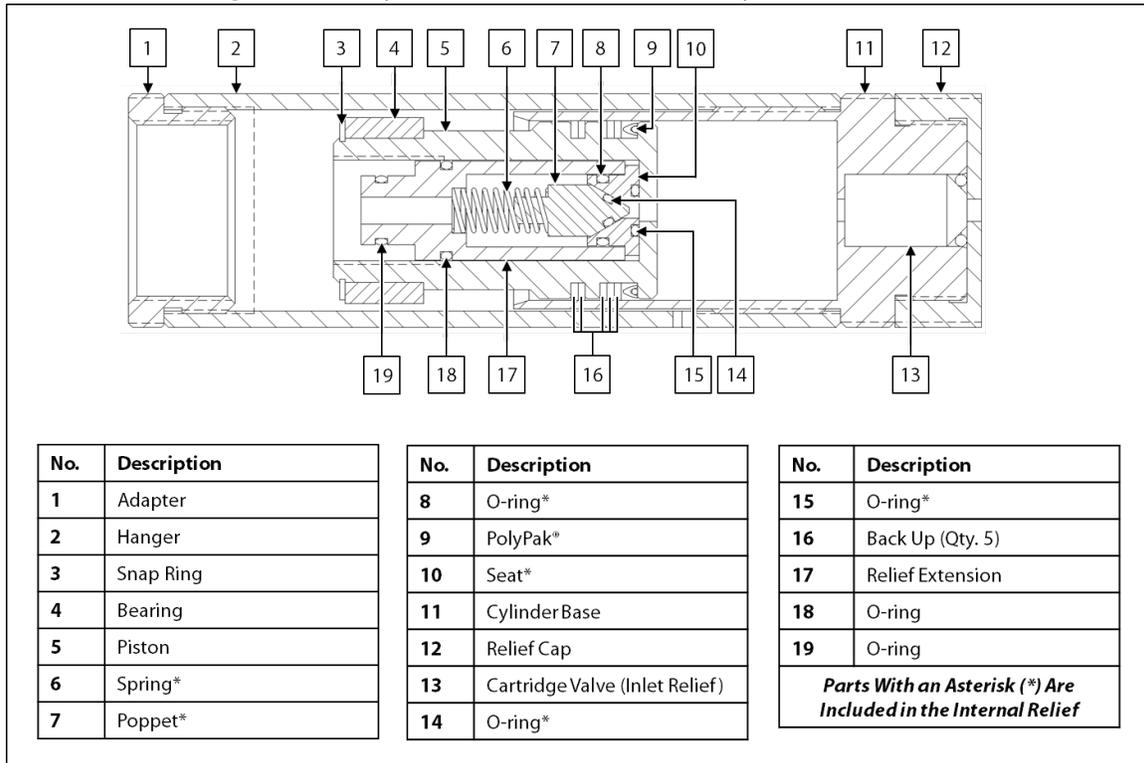
APPENDIX C: C-STYLE COLLECTION HEAD MAINTENANCE

1. Unscrew the relief cap from the cylinder base.
2. Unscrew the cylinder base from the hanger.
3. Remove the cartridge check valve from the cylinder base.
4. Install a replacement cartridge check valve to the cylinder base.
5. Screw the relief cap onto the cylinder base.
6. As necessary, loosen the jam nut.
7. Unscrew the hanger from the adapter.
8. As necessary, apply approximately 40 psig of instrument air to the top of the piston motor to extend the inner shaft beyond the outer shaft.
9. While holding onto the wrench flats on the inner shaft with one wrench, use a second wrench to unscrew the piston from the inner shaft.
10. If the collection head is equipped with a B-Style internal relief, continue to step 11. If the collection head is equipped with a cartridge style internal relief, proceed to step 26. If the collection head is equipped with an internal sand relief, proceed to step 38.

Internal Relief Maintenance

B-Style

Figure C1: C-Style Collection Head With B-Style Internal Relief



11. Remove the relief extension from the piston.
12. Remove the seat from the piston.
13. Inspect the spring for damage or wear. Replace as necessary.
14. Inspect the poppet for damage or wear. Replace as necessary.
15. Replace the O-ring on the poppet.
16. Inspect the seat for damage or wear. Replace as necessary.
17. Replace the O-rings on the seat.
18. Replace the back ups and PolyPak® on the piston.
19. Replace the O-rings on the relief extension.
20. Install the seat to the piston.
21. Install the poppet to the seat.
22. Install the spring to the poppet.
23. Carefully install the relief extension to the piston.
24. Carefully screw the B-Style internal relief assembly onto the inner shaft.



The piston must be attached securely to the inner shaft.

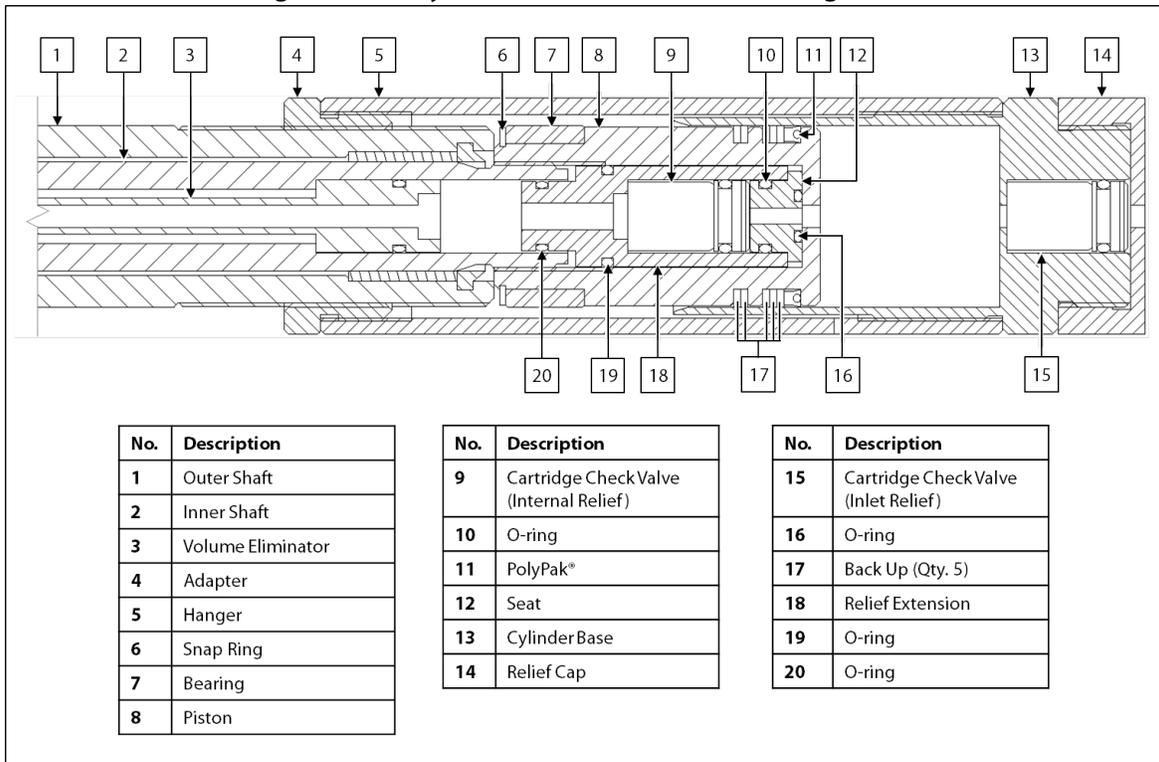
25. Proceed to step 53 for reassembly instructions.

Cartridge Style



This non-adjustable relief is designed for use with constant pressure cylinders and crude oil containers.

Figure C2: C-Style Collection Head With Cartridge Relief



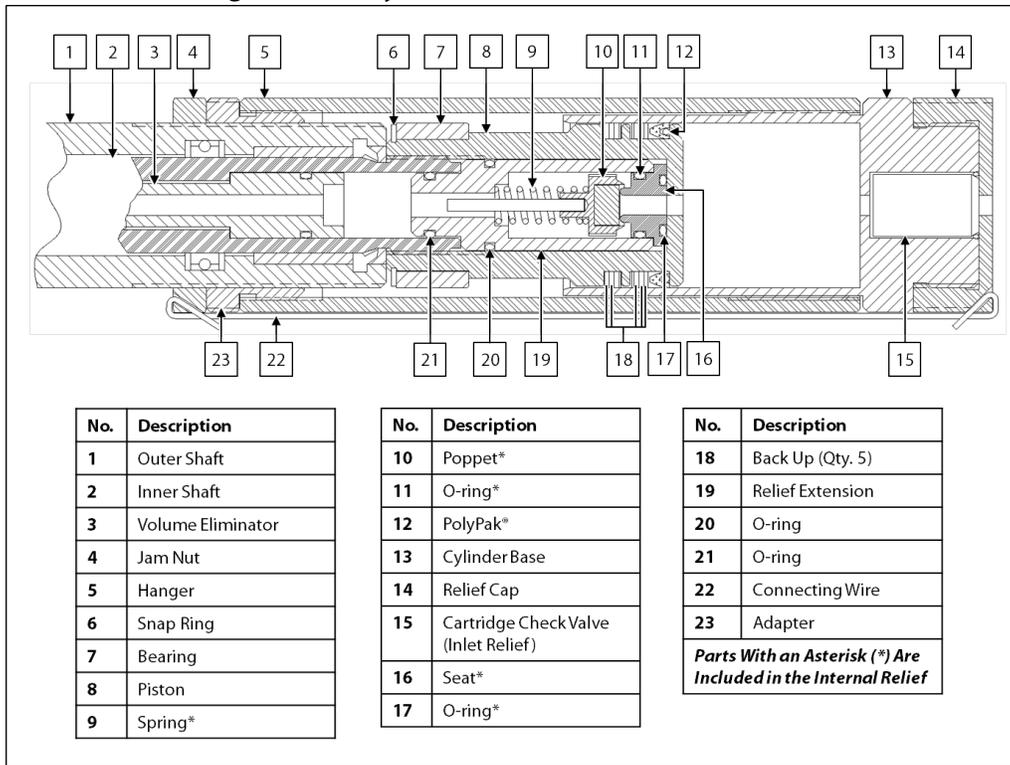
26. Remove the relief extension from the piston.
27. Remove the seat from the piston.
28. Remove the cartridge check valve from the piston.
29. Inspect the seat for damage or wear. Replace as necessary.
30. Replace the O-rings on the seat.
31. Replace the back ups and PolyPak® on the piston.
32. Replace the O-rings on the relief extension.
33. Install the seat to the piston.
34. Install a replacement cartridge check valve to the relief extension.
35. Carefully install the relief extension to the piston.
36. Carefully screw the cartridge style inline relief assembly onto the inner shaft.



The piston must be attached securely to the inner shaft.

37. Proceed to step 53 for reassembly instructions.

Figure C3: C-Style Collection Head With Sand Relief



38. Remove the relief extension from the piston.
39. Remove the poppet and spring from the piston.
40. Remove the seat from the piston.
41. Inspect the seat for damage or wear. Replace as necessary.
42. Inspect the spring for damage or wear. Replace as necessary.
43. Inspect the poppet for damage or wear. Replace as necessary.
44. Replace the O-rings on the seat.
45. Replace the back ups and PolyPak® on the piston.
46. Replace the O-rings on the relief extension.
47. Install the seat to the piston.
48. Install the poppet to the seat.
49. Install the spring to the poppet.
50. Carefully install the relief extension to the piston.
51. Carefully screw the internal sand relief assembly onto the inner shaft.



The piston must be attached securely to the inner shaft.

52. Continue to step 53 for reassembly instructions.

Reassembly

53. For maximum sample volume, ensure that the bottom of the adapter is flush with the bottom of the insertion shaft.
54. Screw the cylinder base into the hanger.
55. Screw the hanger onto the adapter.
56. Using a wrench, tighten the jam nut, cylinder base, and relief cap.
57. As necessary, connect a safety wire from the opening in the relief cap to the jam nut. Ensure that the safety wire is wrapped in a counterclockwise rotation to prevent the associated threads from unscrewing from each other.



If a replacement safety wire is not available, ensure that the relief cap is securely tightened so that it can withstand the pressure of the flowing stream.

APPENDIX D: D-STYLE COLLECTION HEAD MAINTENANCE

1. Unscrew the cylinder assembly from the hanger.
2. Unscrew the relief cap from the cylinder.
3. Remove the cartridge check valve from the cylinder.
4. Install a replacement check valve to the cylinder.
5. Screw the relief cap onto the cylinder.
6. Loosen the jam nut, and then unscrew the hanger from the outer shaft.
7. Unscrew the piston from the inner shaft.



The internal sand relief is spring loaded and may pop out when removing the cylinder.

8. If the collection head is equipped with a cartridge style internal relief, continue to step 9. If the collection head is equipped with an internal sand relief, proceed to step 18.

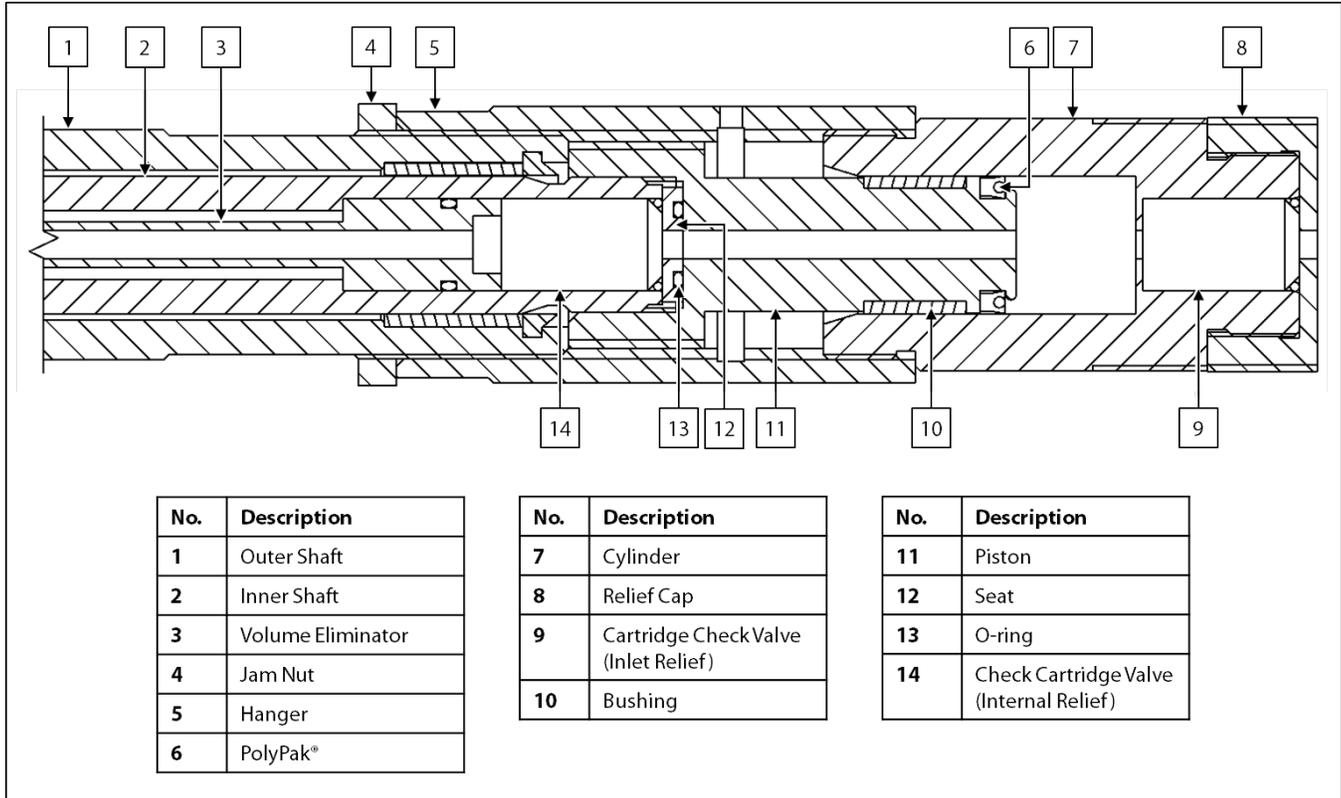
Internal Relief Maintenance

Cartridge Style



This non-adjustable relief is designed for use with constant pressure cylinders and crude oil containers.

Figure D1: D-Style Collection Head With Cartridge Relief



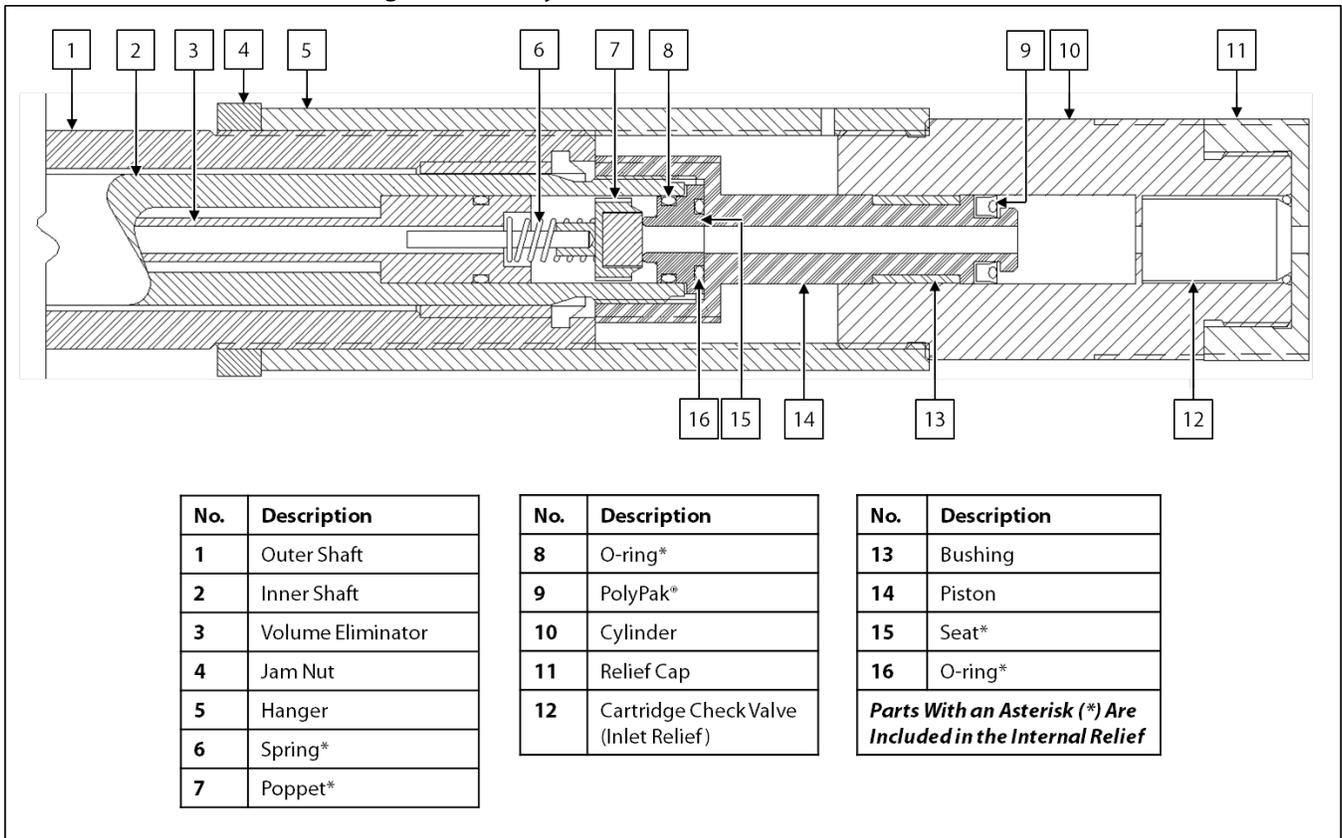
9. Remove the seat from the piston.
10. Inspect the seat for damage or wear. Replace as necessary.
11. Replace the O-ring on the seat.
12. Install the seat to the piston.
13. Install a replacement cartridge check valve to the inner shaft.
14. Carefully screw the piston onto the inner shaft.



The piston must be attached securely to the inner shaft.

15. Inspect the bushing on the piston for signs of damage or wear. Replace as necessary.
16. Replace the PolyPak® on the piston.
17. Proceed to step 27 for reassembly instructions.

Figure D2: D-Style Collection Head With Sand Relief



18. Remove the seat from the piston.
19. Inspect the seat for damage or wear. Replace as necessary.
20. Inspect the spring for damage or wear. Replace as necessary.
21. Inspect the poppet for damage or wear. Replace as necessary.
22. Replace the O-rings on the seat.
23. Install the seat to the piston.
24. Install the spring to the poppet, and then install the poppet assembly to the inner shaft.
25. Carefully screw the piston onto the inner shaft.



The piston must be attached securely to the inner shaft.

26. Continue to step 27 for reassembly instructions.

Reassembly

27. Screw the cylinder assembly into the hanger.
28. Screw the hanger onto the outer shaft.
29. Using a wrench, tighten the jam nut to lock the collection head in place.
30. Using a wrench, tighten the relief cap.

APPENDIX E: VANISHING CHAMBER™ COLLECTION HEAD MAINTENANCE

1. Loosen the setscrew in the cylinder base, and then remove the holding pin.
2. Separate the cylinder base from the collection head shield.
3. Push the collection cup and non-extrusion disc out of the collection head shield.
4. Lubricate the inside of the collection head shield, and then install the replacement collection cup and non-extrusion disc.
5. Return the collection head shield to the base and insert the holding pin.
6. Tighten the setscrew in the cylinder base to secure the assembly.



DO NOT over-tighten the setscrew.

7. Unscrew the hanger from the outer shaft.
8. As necessary, apply approximately 40 psig of instrument air to the top of the piston motor to extend the inner shaft beyond the outer shaft.
9. While holding onto the wrench flats on the inner shaft with one wrench, use a second wrench to slowly unscrew the anvil from the inner shaft.



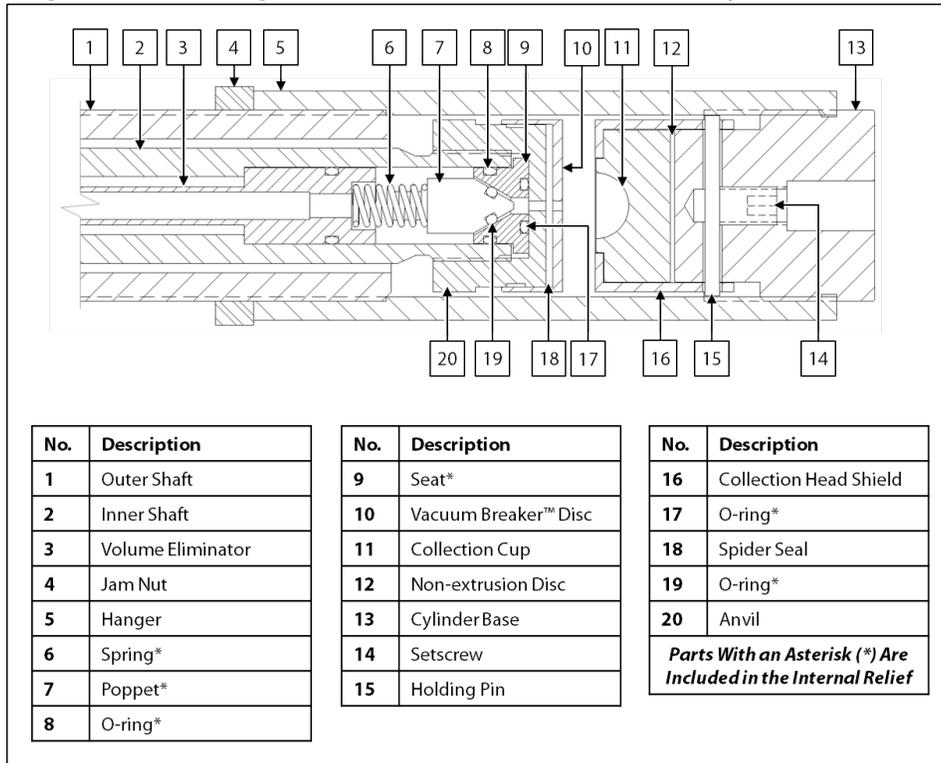
The B-Style and sand internal reliefs are spring loaded and may pop out when removing the cylinder.

10. If the collection head is equipped with a B-Style relief, continue to step 11. If the collection head is equipped with a cartridge style internal relief, proceed to step 25. If the collection head is equipped with an internal sand relief, proceed to step 36.

Internal Relief Maintenance

B-Style

Figure E1: Vanishing Chamber™ Collection Head With B-Style Internal Relief



11. Remove the seat from the anvil.
12. Inspect the spring for damage or wear. Replace as necessary.
13. Inspect the poppet for damage or wear. Replace as necessary.
14. Replace the O-ring on the poppet.
15. Inspect the seat for damage or wear. Replace as necessary.
16. Replace the O-rings on the seat.
17. Remove the Vacuum Breaker™ disc from the anvil.
18. Install a replacement spider seal to the top of the anvil.
19. Inspect the Vacuum Breaker™ disc for damage or wear. Replace as necessary.
20. Return the Vacuum Breaker™ disc to the top of the anvil.
21. Install the seat to the anvil.
22. Install the spring to the poppet, and then install the poppet assembly to the inner shaft.
23. Carefully install the anvil assembly to the insertion shaft.



The anvil must be attached securely to the inner shaft.

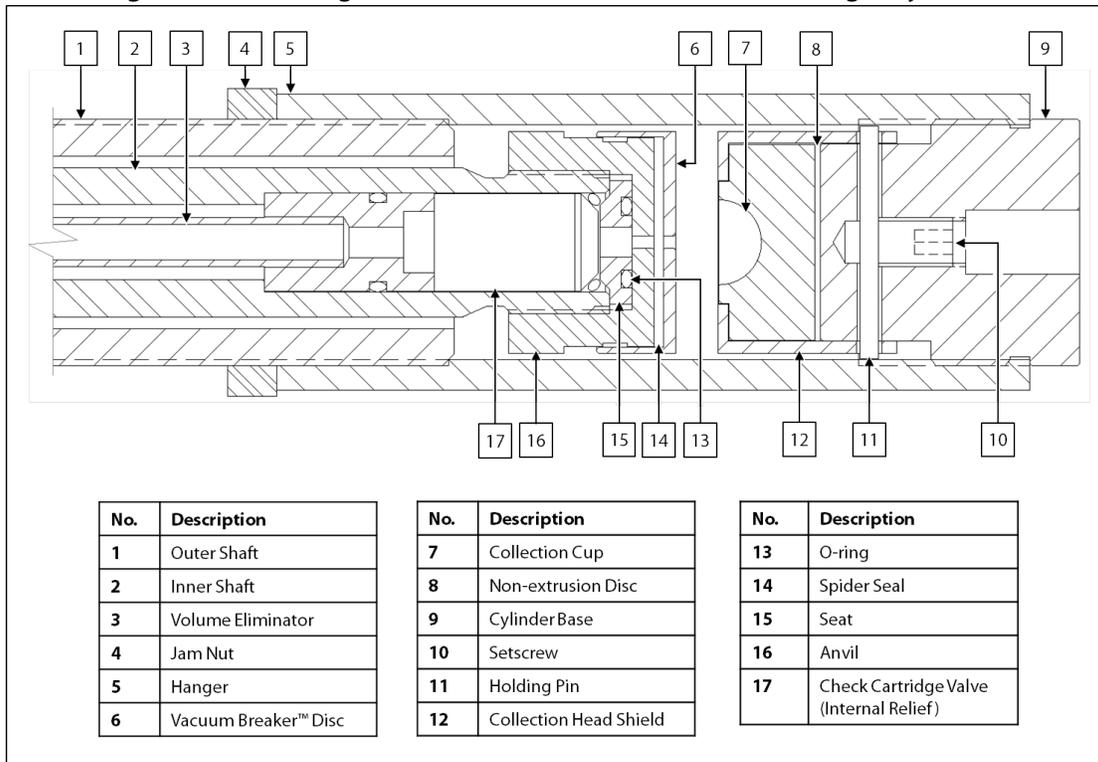
24. Proceed to step 49 for reassembly instructions.

Cartridge Style



This non-adjustable relief is designed for use with constant pressure cylinders and crude oil containers.

Figure E2: Vanishing Chamber™ Collection Head With Cartridge Style Relief



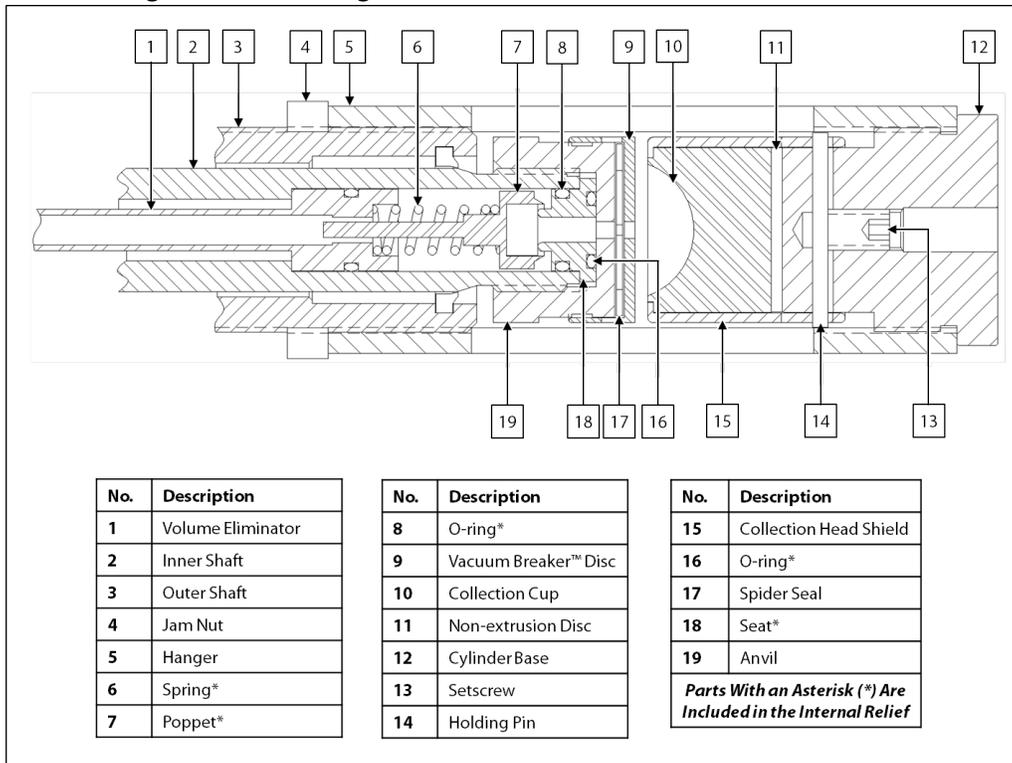
25. Remove the seat from the anvil.
26. Inspect the seat for damage or wear. Replace as necessary.
27. Replace the O-ring on the seat.
28. Remove the Vacuum Breaker™ disc from the anvil.
29. Install the seat to the anvil.
30. Install a replacement check valve cartridge to the inner shaft.
31. Install a replacement spider seal to the top of the anvil.
32. Inspect the Vacuum Breaker™ disc for damage or wear. Replace as necessary.
33. Return the Vacuum Breaker™ disc to the anvil.
34. Carefully install the anvil assembly to the insertion shaft.



The anvil must be attached securely to the inner shaft.

35. Proceed to step 49 for reassembly instructions.

Figure E3: Vanishing Chamber™ Collection Head With Sand Relief



36. Remove the seat from the anvil.
37. Inspect the seat for damage or wear. Replace as necessary.
38. Inspect the spring for damage or wear. Replace as necessary.
39. Inspect the poppet for damage or wear. Replace as necessary.
40. Replace the O-rings on the seat.
41. Remove the Vacuum Breaker™ disc from the anvil.
42. Install a replacement spider seal to the top of the anvil.
43. Inspect the Vacuum Breaker™ disc for damage or wear. Replace as necessary.
44. Return the Vacuum Breaker™ disc to the anvil.
45. Install the seat to the anvil.
46. Install the spring to the poppet.
47. Carefully install the poppet assembly to the inner shaft.



The anvil must be attached securely to the inner shaft.

48. Continue to step 49 for reassembly instructions.

Reassembly

49. Screw the cylinder base assembly into the hanger and tighten.
50. Apply instrument air to the bottom of the piston motor to drive the piston to the top of the housing. This will retract the inner shaft to the maximum insertion length.
51. Screw the hanger up the outer shaft until the gap between the anvil and the collection cup is approximately $\frac{3}{16}$ " (5 mm).
52. Tighten the jam nut against the hanger.
53. Using a wrench, tighten the cylinder base and jam nut.
54. Test stroke the inFlow™ to ensure proper stroke length. The Vanishing Chamber™ should collapse without excessive stress on the metal components and then return to the $\frac{3}{16}$ " (5 mm) gap.

