



INSTALLATION, OPERATION, AND MAINTENANCE MANUAL
WELKER® INFLOW™ ACE CRUDE OIL SAMPLER
MANUAL INSERTION

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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™ ACE 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™ ACE 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™ ACE Crude Oil Sampler, please contact a Welker® representative immediately.

Phone: 281.491.2331

Address: 13839 West Belfort 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™ ACE 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™ ACE can be safely inserted and retracted manually in up to 40 psig or automatically with the optional insertion tool without interfering with or venting pipeline pressure. Once all desired samples have been collected, the inFlow™ ACE can be fully evacuated of internal sample volume using the purge tube, thus preparing the sampler for the next sample batch.

The inFlow™ ACE 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.

With protection from an external sand relief and check and relief valves designed for sandy oils, this sampler is capable of sampling product containing sand or debris. For added safety, the inFlow™ ACE is equipped with a dustcover, shaft wipers to protect seals, and an adjustable Chevron® packing for emergency shutdown leak protection.

Designed with ease of use in mind, the optional external sample volume adjustment and insertion tool simplify operation of the inFlow™ ACE even further. The external adjustment allows the operator to adjust the sample volume without having to remove the inFlow™ ACE from the pipeline. The optional insertion tool is integral to smooth insertion and retraction of the unit. Though easily removable, the insertion tool can remain attached to the inFlow™ ACE without adding bulk.



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™ ACE to suit the particular application and specifications of each customer.

1.3 Important Information

1. The grease injection port should remain plugged at all times except when performing maintenance on a sampler that has been isolated from pipeline pressure and/or removed from the pipeline.
2. Prior to injecting Welker® Great Barrier Grease™ into the injection port, the plug must be removed and an appropriately sized grease fitting installed.
3. After Welker® Great Barrier Grease™ has been injected into the grease injection port, the grease fitting must be removed and the plug reinstalled before the sampler can be exposed to pipeline pressure and returned to operation.



Failure to remove the grease fitting and return the plug to the grease injection 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 customizations of your equipment.**

Table 1: inFlow™ ACE 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, Anodized Aluminum Upper Housing, Carbon Steel Lubricator Body, PTFE, Kalrez® Wetted Seals, and Buna and Viton® Non-Wetted Seals Others Available
Maximum Allowable Operating Pressure	150 ANSI Carbon Steel: 285 psig @ -20 °F to 100 °F (19 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 Carbon Steel: 1480 psig @ -20 °F to 100 °F (102 barg @ -28 °C to 37 °C)
Maximum Allowable Insertion/Retraction Pressure (Manual Insertion)	40 psig (2.7 barg)
Pipeline Connection	Size: 2" (Standard) or 3" Rating: 150, 300, or 600 ANSI RF
Sample Outlet Connection	¼" FNPT
Motor Housing Actuation Ports	¼" FNPT ½" FNPT ⅜" FNPT (Standard)
Insertion Length	0–24" (0–60 cm) 0–36" (0–91 cm)
Utility Requirements	Hydraulic or Pneumatic Supply for Motor Operation: 100–150 psig (6–10 barg) Inert Gas Supply for Purge Operation: ¼" FNPT Connection
Sample Volume	D-Style Collection Head: 0.5–10 cc (Standard) C-Style Collection Head: 3–24 cc
Features	Chevron® Packing External Sand Relief Purge Tube
Options	External Adjustment Hydraulic Hand Pump Insertion Tool NACE Compliance

1.5 Equipment Diagrams

Figure 1: inFlow™ ACE Diagram

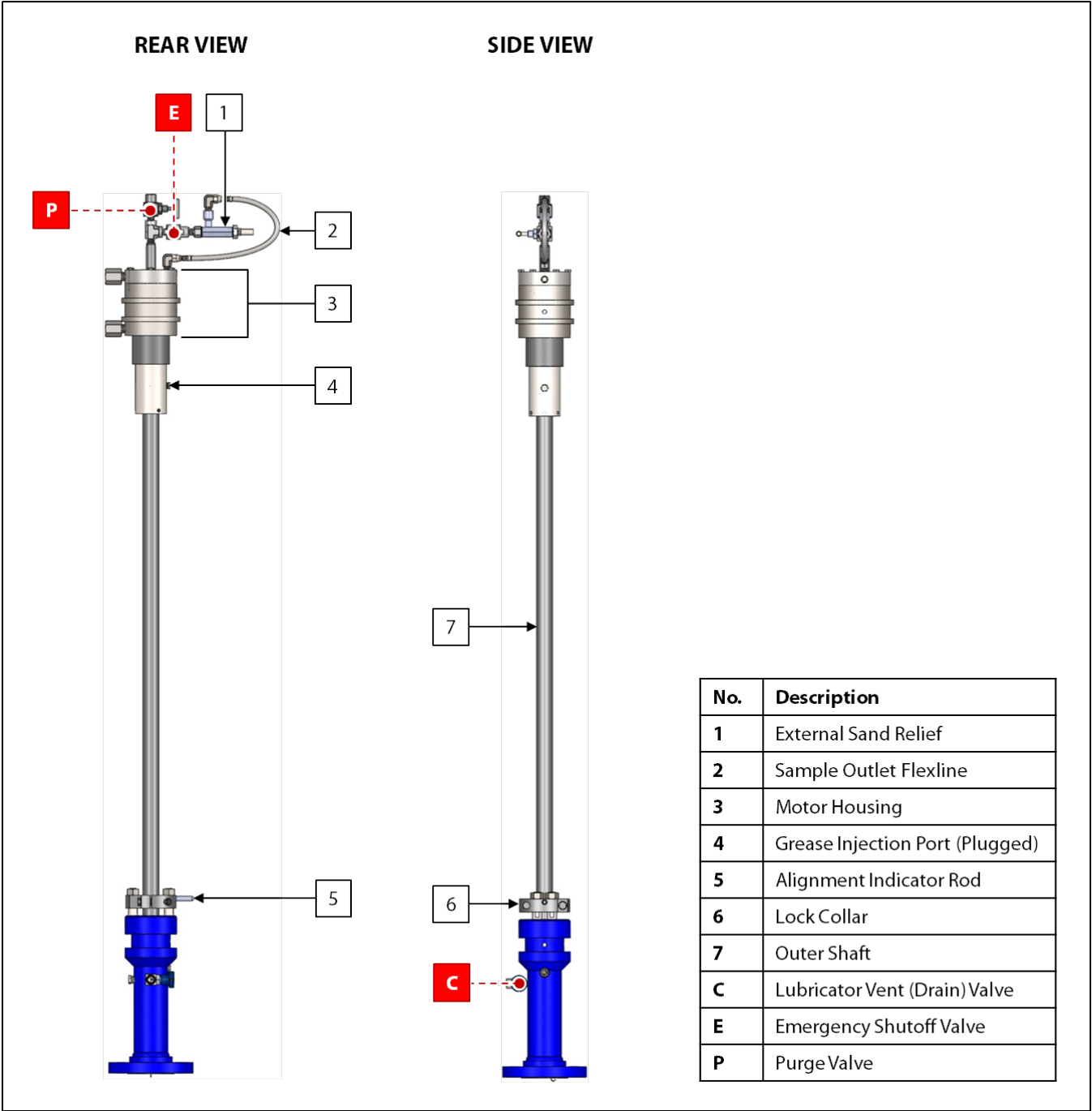


Figure 2: inFlow™ ACE Connections Diagram

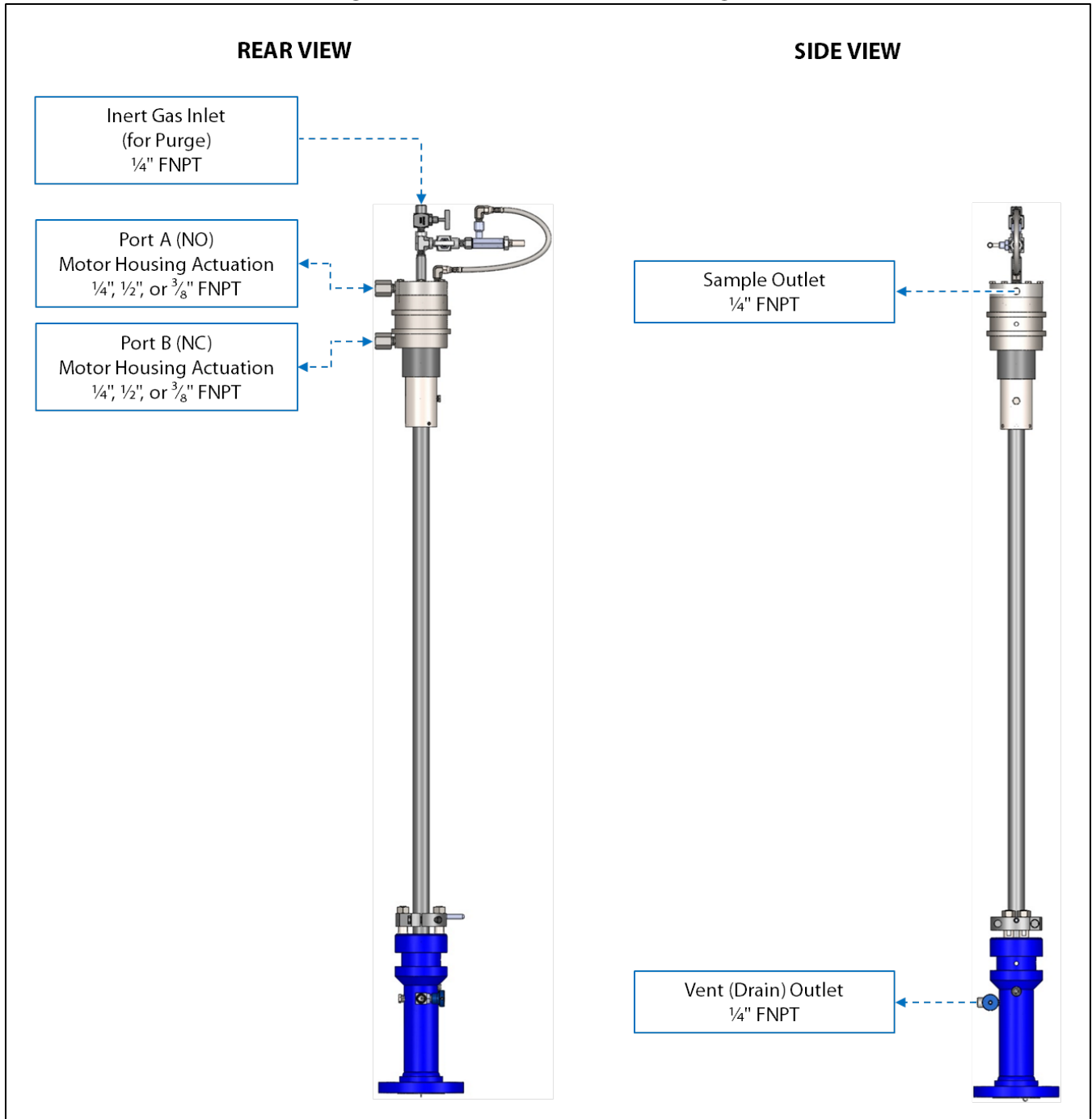


Figure 3: inFlow™ ACE With Optional Insertion Tool Diagram

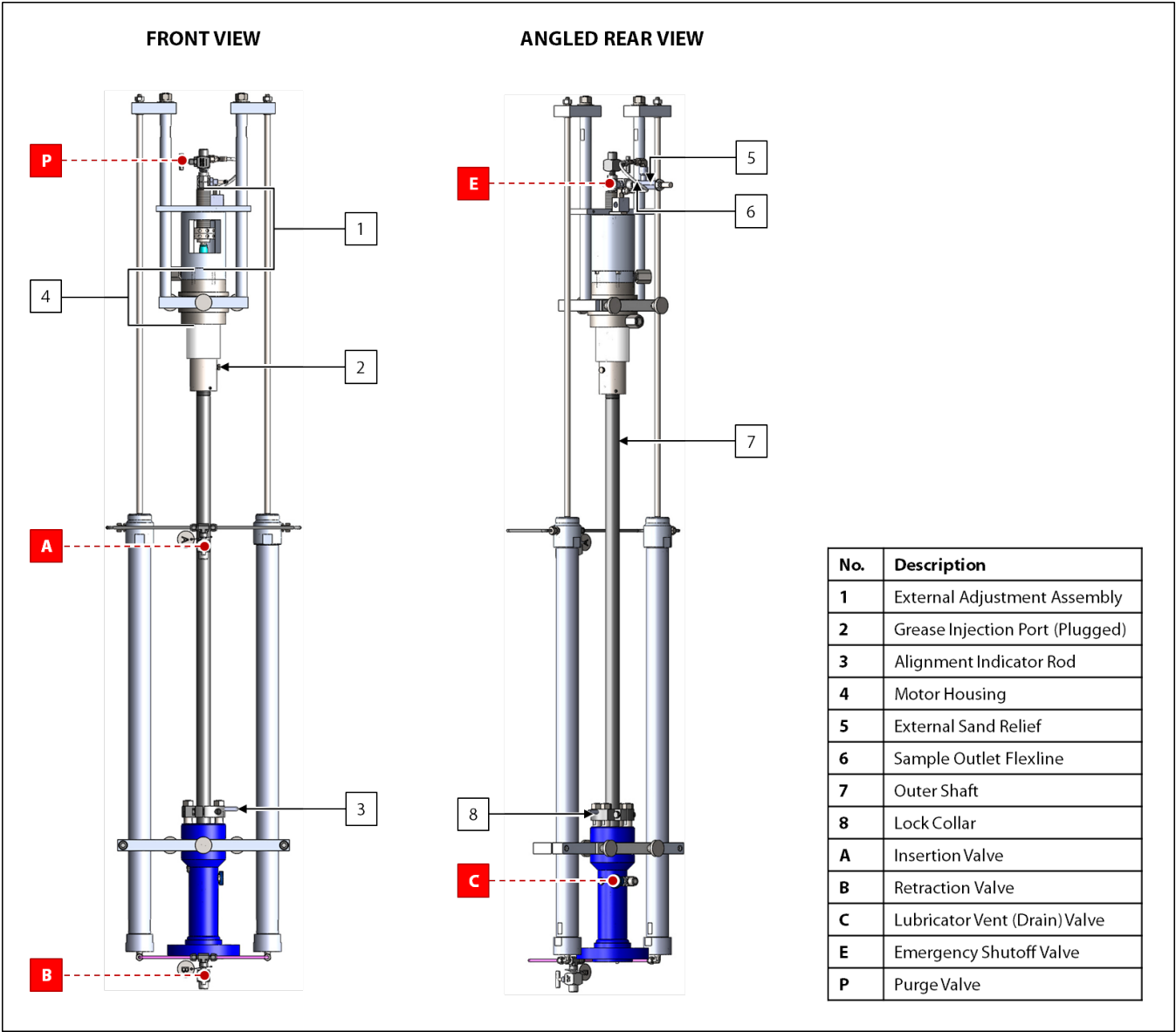
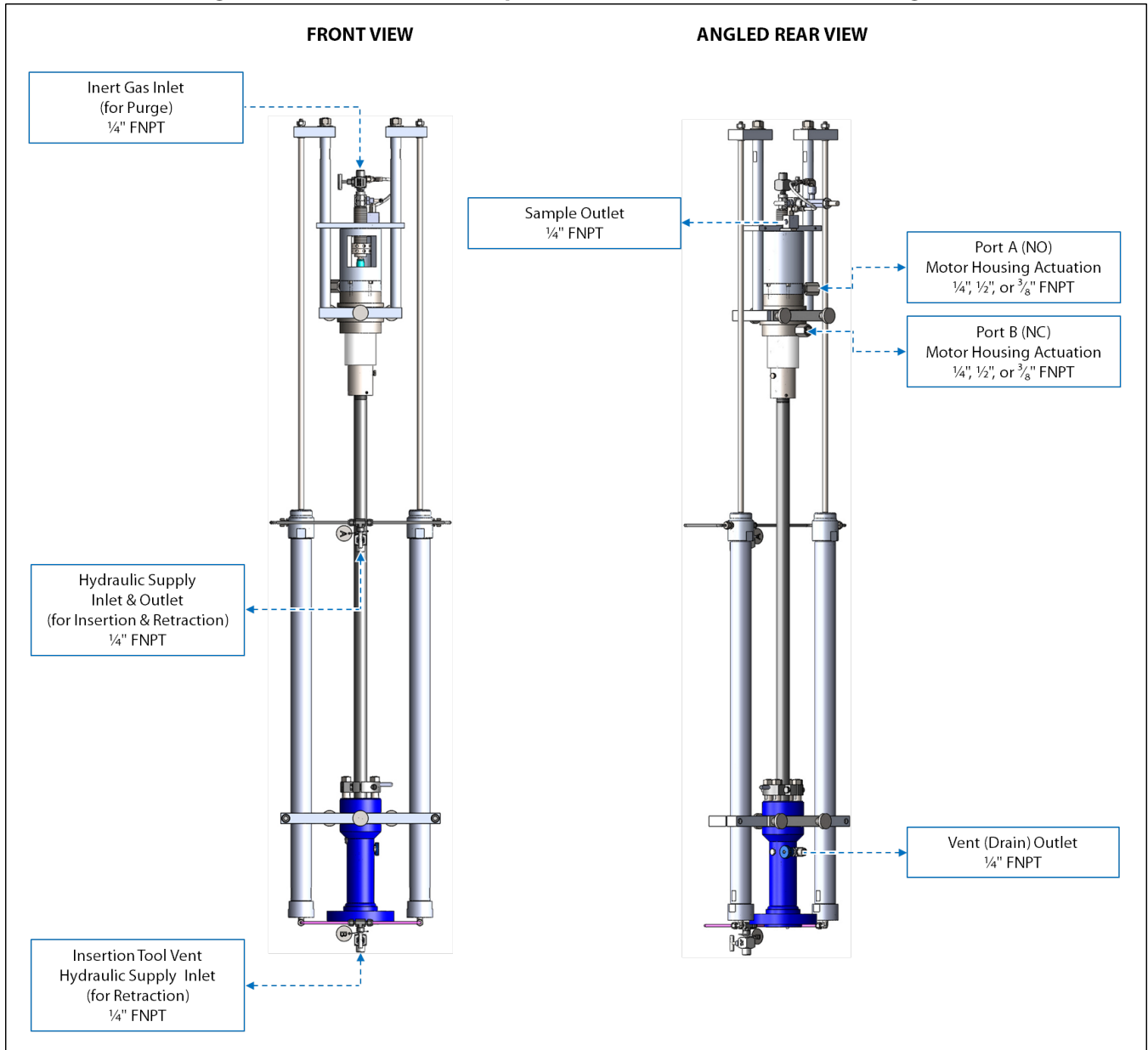


Figure 4: inFlow™ ACE With Optional Insertion Tool Connections Diagram



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.

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 two to four pipe diameters (2–4D) 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.
5. 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.

2.2 Setting the Sample Volume



If the inFlow™ ACE is not equipped with the optional external adjustment assembly, the sample volume must be set prior to installation.
If the inFlow™ ACE is equipped with the optional external adjustment assembly, the sample volume can be set at any time.

- 1. If the inFlow™ ACE is not equipped with the optional external adjustment assembly, continue to step 2 for instructions on setting the sample volume. If the inFlow™ ACE is equipped with the optional external adjustment assembly, proceed to step 6 for instructions on setting the sample volume.

Setting the Sample Volume at the Collection Head



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

Figure 5: D-Style Collection Head Diagram

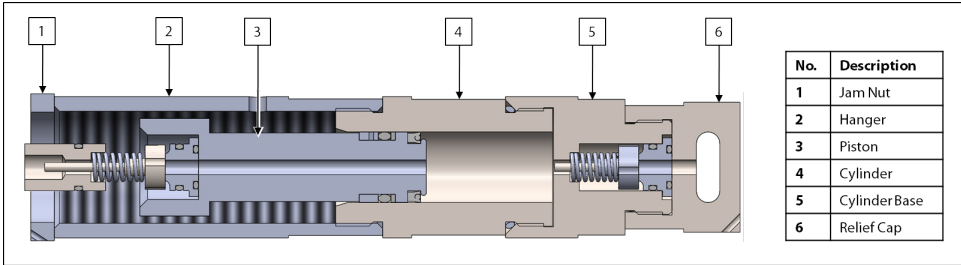
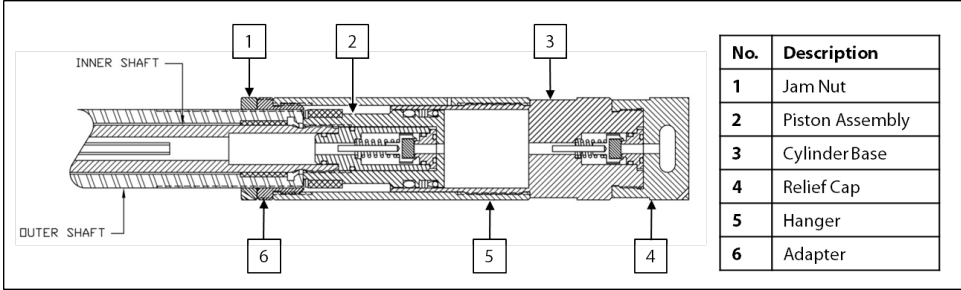


Figure 6: C-Style Collection Head Diagram



- 2. Loosen the jam nut on the collection head (Figure 5 or Figure 6).
- 3. To decrease the sample volume, screw the collection head assembly clockwise. This shortens the stroke of the collection head piston.
- 4. 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:

- 0.4 cc if the inFlow™ ACE is equipped with the D-Style collection head.
- 1 cc if the inFlow™ ACE is equipped with the C-Style collection head.

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

Setting the Sample Volume Using the Optional External Adjustment

6. Locate the exposed external adjustment chamber in the motor top (Figure 7).

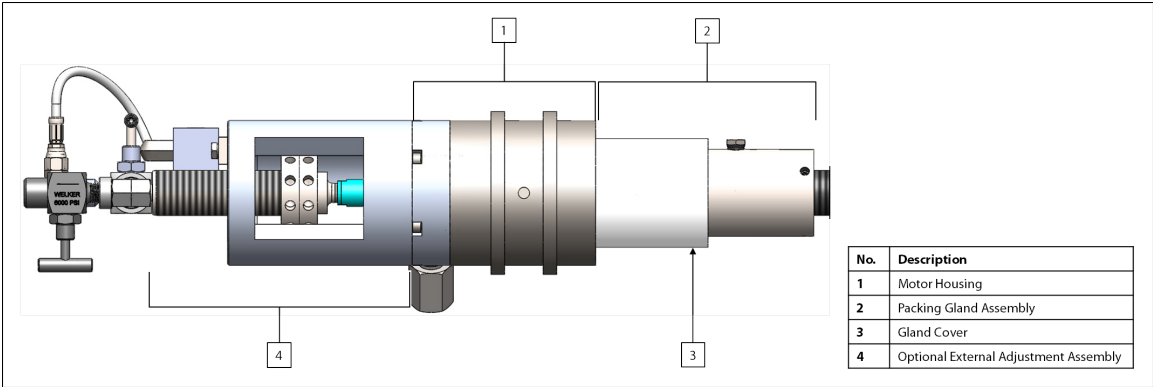


Setting the sample volume is accomplished by rotating the upper external adjustment ring to attain the desired sample volume.



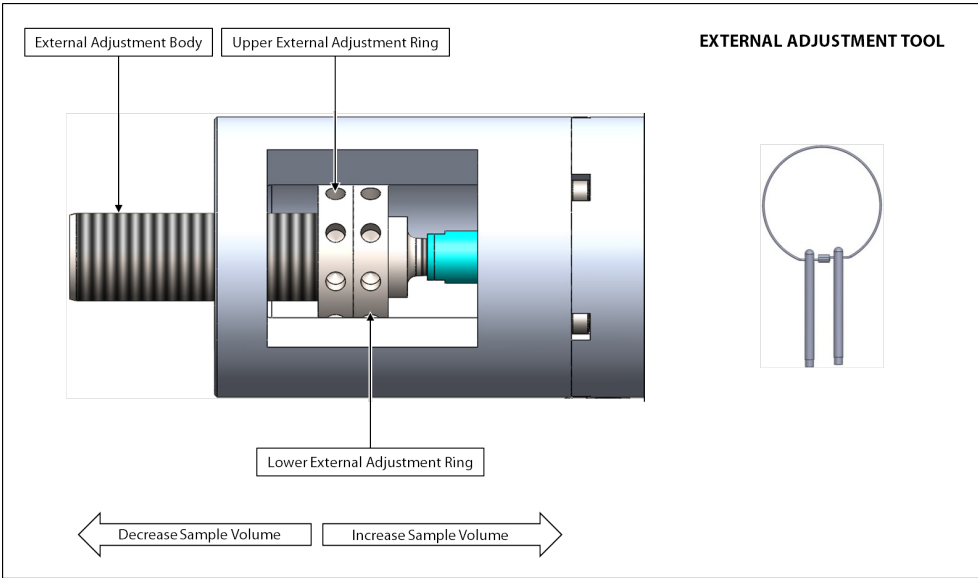
Once the desired volume is set, the sample volume can be changed at any time externally without removing the inFlow™ ACE from the pipeline.

Figure 7: Upper Housing Diagram



7. As necessary, gently push down on the external adjustment body so that the external adjustment rings are accessible through the chamber (Figure 8).

Figure 8: Setting the External Adjustment Rings



8. Begin with the upper external adjustment ring at the top of the external adjustment body (Figure 8).



Welker recommends using a felt tip pen to mark the front of both external adjustment rings so that it is clear when the adjustment rings have made a full rotation.

9. Using the provided external adjustment tool, turn the upper adjustment ring to the desired volume (*Figure 8*).



One full rotation of the upper external adjustment ring is approximately 1 cc if the inFlow™ ACE is equipped with the D-Style collection head. Each hole in the upper external adjustment ring is equal to approximately 0.10 cc.

10. Turn the lower external adjustment ring until it meets the upper external adjustment ring. Tighten firmly to prevent slippage that might lead to inconsistencies in sample volume.



The lower external adjustment ring and O-ring are used to lock the upper external adjustment ring in place to prevent slippage and subsequent changes in sample volume during sampling.

11. Turn ON and actuate the hydraulic or pneumatic supply to 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.

12. As necessary, repeat steps 6–11 to further adjust the sample volume.

2.3 Preparing the Unit for Installation

Aligning the Lock Collar

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



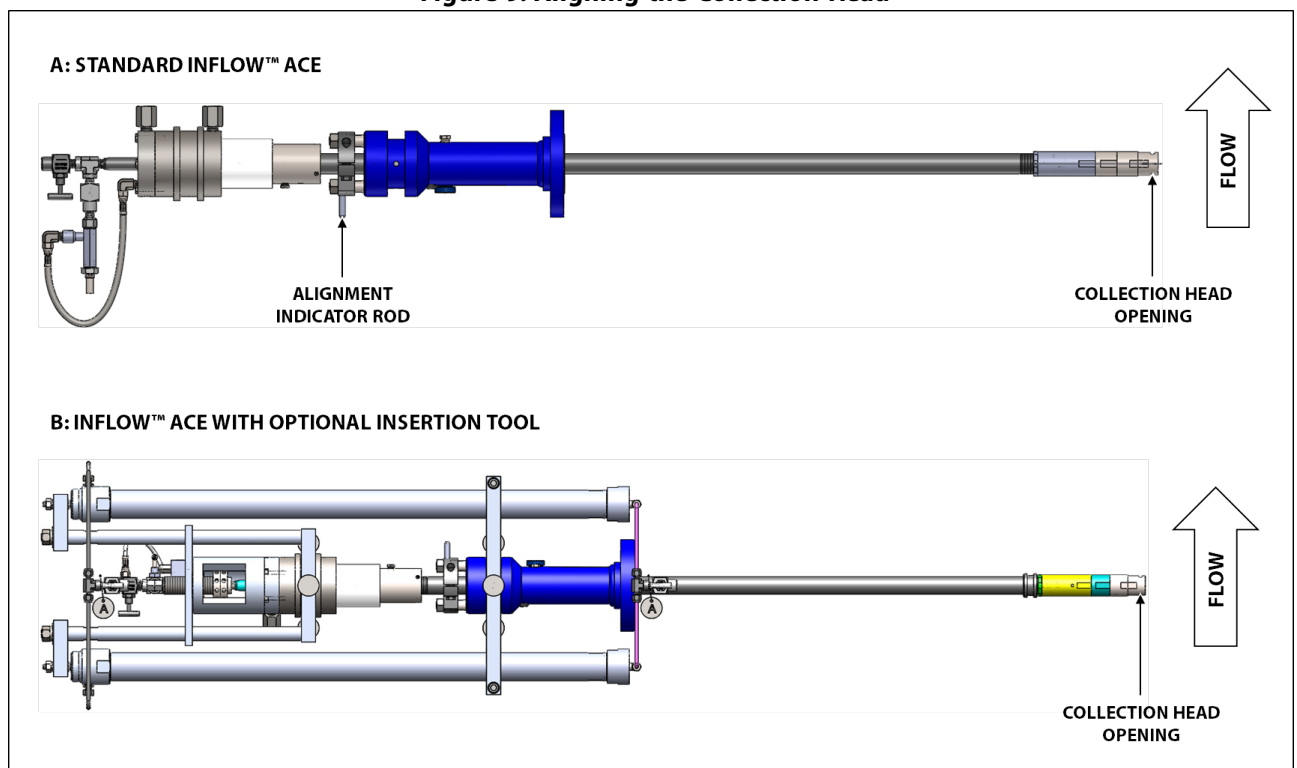
Note that the lock collar must be loose in order to pull the collection head out of the lubricator body.

4. Loosen the jam nut, and then turn the hanger (*Figure 5 or Figure 6*). The opening in the collection head should face the direction of product flow so that the flowing stream will pass through the opening.
5. Tighten the jam nut on the collection head. The tightened jam nut and safety wire will prevent the collection head from turning.
6. 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 lubricator body.



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

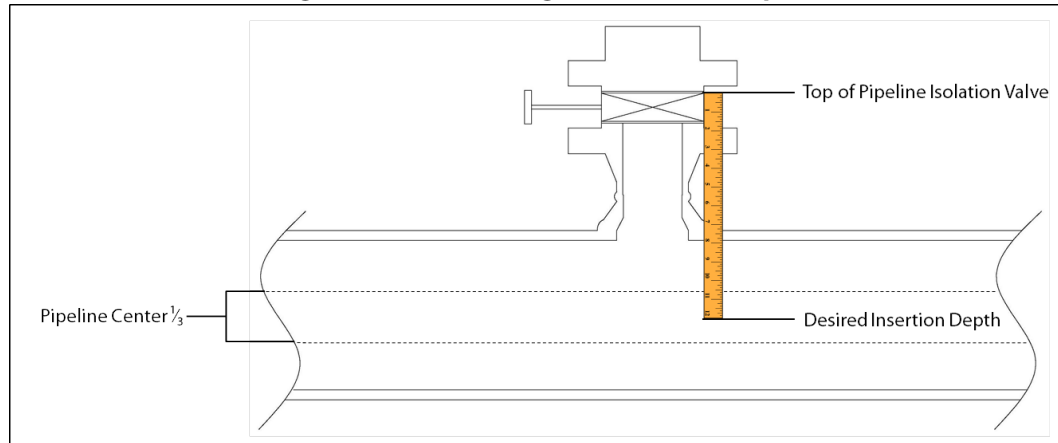
Figure 9: Aligning the Collection Head



Setting the Insertion Length

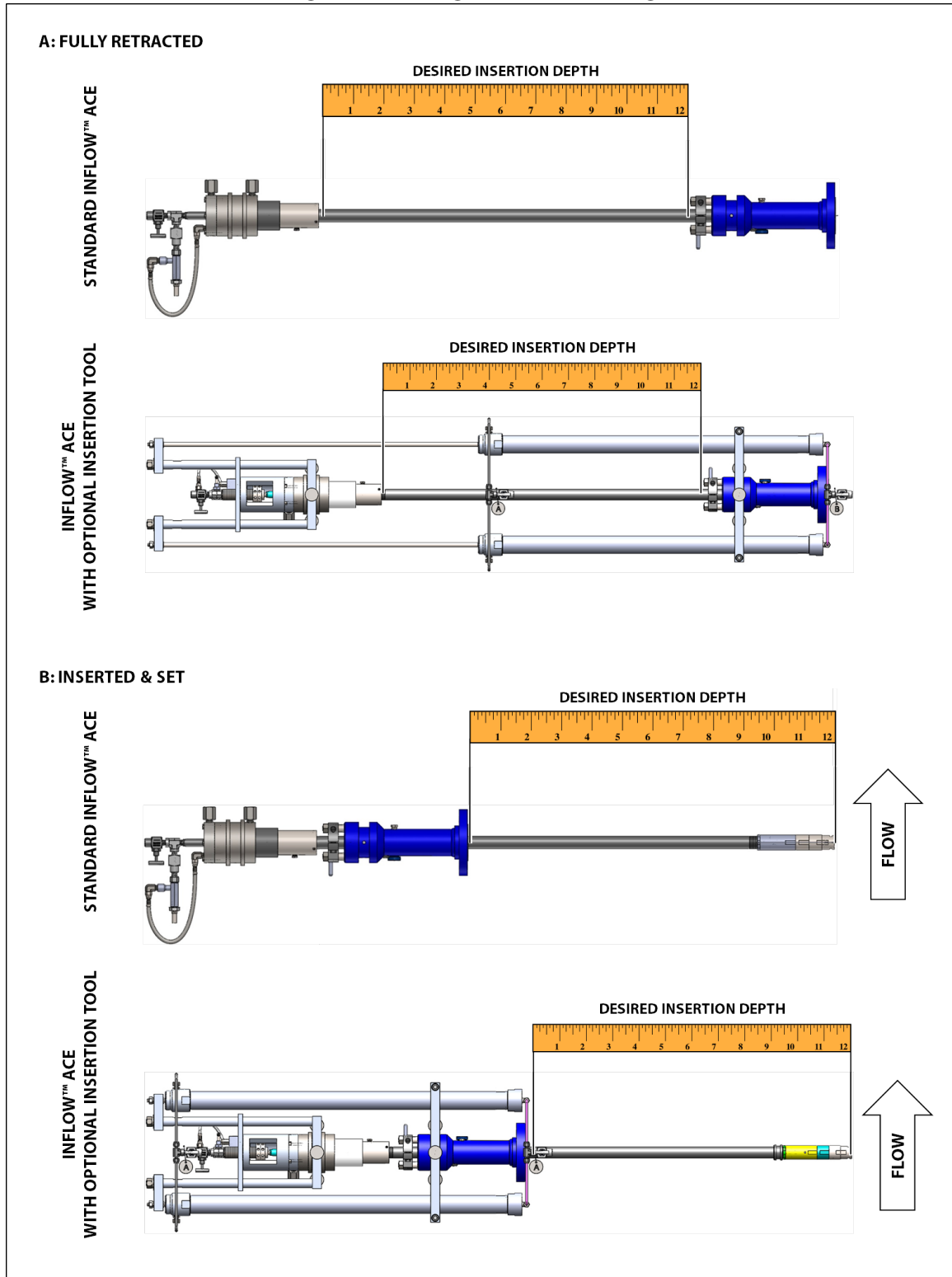
7. Prior to installing the inFlow™ ACE, the length the insertion shaft will need to travel inside the pipeline must be determined. Measure the distance the insertion shaft must travel from the top of the pipeline isolation valve to the desired insertion depth (e.g., the center one-third ($\frac{1}{3}$) of the pipeline) (*Figure 10*). This will be the shaft insertion length.

Figure 10: Determining the Insertion Depth



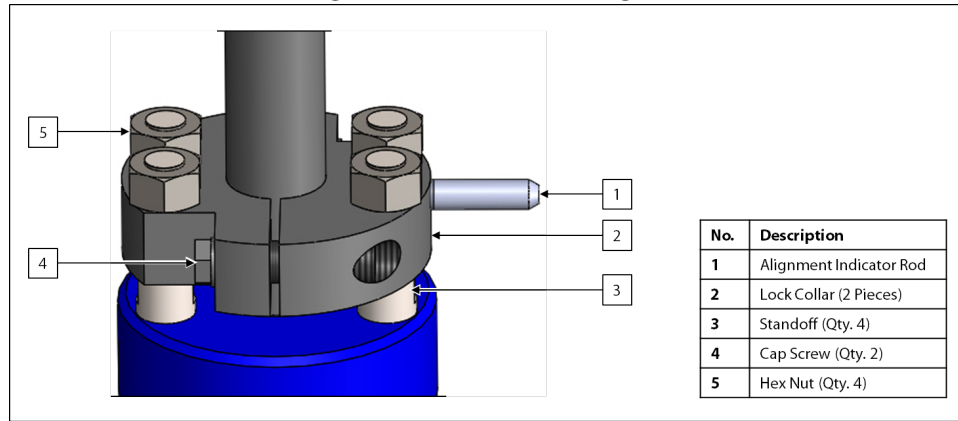
8. Pull up on the insertion shaft to ensure that it is fully retracted. The end of the collection head should be flush with or in close proximity to the flange face (*Figure 11*).
9. Beginning at the top edge of the standoffs, measure along the insertion shaft to the desired insertion length (*Figure 11*). As needed, use a felt tip pen to mark this point.

Figure 11: Setting the Insertion Length



10. Remove the hex nuts from the standoffs (*Figure 12*).

Figure 12: Lock Collar Diagram



11. Loosen the cap screws on the sides of the lock collar (*Figure 12*).
12. Carefully slide the lock collar up the shaft to the shaft insertion length, taking care not to scratch the outer shaft.
13. Ensure that the alignment indicator rod is still aligned with the opening in the collection head.
14. 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 12*).



This procedure ensures that the insertion length will be mechanically limited by the lock collar.

2.4 Installing the Unit

1. Close all valves on the inFlow™ ACE.
2. Secure the inFlow™ ACE 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 installed bracing or support should NOT contact the probe shaft, as scratching or other damage of the shaft may lead to loss of integrity of the sealing surface.



Lubricator vent (drain) valve C on the lubricator body must be pointed down.



If the unit will be inserted manually, continue to step 3.
If the unit will be inserted using the optional insertion tool, proceed to step 7.

Manual Insertion



At pressures above 40 psig, the inFlow™ ACE cannot be safely inserted or retracted manually. To insert the inFlow™ ACE, the pipeline pressure will need to be reduced to 40 psig or below.



At least two (2) people are required to correctly and safely insert the inFlow™ ACE into the pipeline.

3. Slowly open the pipeline isolation valve. Check for leaks and repair as necessary.
4. Using the alignment indicator rod, manually insert the shaft slowly into the pipeline. The alignment indicator rod should be parallel to the pipeline.
5. Secure the inFlow™ ACE in place by guiding the lock collar over the standoffs on the lubricator body and firmly tightening the hex nuts (*Figure 12*).



DO NOT release the inFlow™ ACE until the lock collar has been secured to the lubricator body.



If the lock collar does not align with the standoffs, the inFlow™ ACE may be out of alignment. See *Section 2.3, Preparing the Unit for Installation*, for instructions on properly aligning the unit.

6. Proceed to step 20 to complete installation.

Using the Optional Insertion Tool

7. Attach a customer-supplied hydraulic hand pump to insertion valve A (*Figure 3*).
8. Slowly open the pipeline isolation valve. Check for leaks and repair as necessary.
9. Open retraction valve B to vent trapped air (*Figure 3*).
10. Close the release valve on the outlet of the customer hydraulic hand pump.
11. Open insertion valve A (*Figure 3*).
12. Slowly stroke the customer hydraulic hand pump to insert the insertion tool shafts into the insertion tool housings. 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.

13. Using the alignment indicator rod, guide the shaft slowly into the pipeline. The alignment indicator rod should be parallel to the pipeline.
14. Continue to stroke the customer hydraulic hand pump until either the desired insertion depth has been reached or the insertion tool shafts are completely inserted into the insertion tool housings.
15. As necessary, align the lock collar holes with the standoffs on the lubricator body.
16. Once the lock collar seats on the standoffs, return the hex nuts to the standoffs and tighten firmly (*Figure 12*).



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



If the lock collar does not align with the standoffs, the inFlow™ ACE may be out of alignment. See *Section 2.3, Preparing the Unit for Installation*, for instructions on properly aligning the unit.

17. Once the lock collar is secured to the lubricator body, close all valves, and then close the customer hydraulic hand pump (*Figure 3*).
18. Disconnect the customer hydraulic hand pump from insertion valve A (*Figure 3*).
19. Continue to step 20 to complete installation.

Completing Installation

20. Once the inFlow™ ACE 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 mini Transportable Crude Oil Container.



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

21. Use appropriately sized tubing to connect from the normally open port on the solenoid to port A on the motor housing (*Figure 2 or Figure 4*). Use appropriately sized tubing to connect from the normally closed port on the solenoid to port B on the motor housing (*Figure 2 or Figure 4*).



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

The normally closed port should be stamped "B" or "NC."

22. Open emergency shutoff valve E (*Figure 1 or Figure 3*).
23. As necessary, adjust the external sand relief. With emergency shutoff valve E open, tighten the jam nut on the external sand relief until no product emerges from the outlet (*Figure 18*).



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 100 psig.
- 3. Set the timer or controller to actuate the solenoid at the desired sampling actuation frequency based on the sampling equations provided (Figure 13).

Figure 13: Sampling Frequency Equations

Liquid Sampling, Proportional to Flow Collection
<p>Equation 1: Number of Samples Needed</p> $\text{Number of Samples Needed to Fill to 80\%} = \frac{(\text{Container Size (cc)} * 0.8)}{\text{Bite Size (cc)}}$ <p>Equation 2: Proportional-to-Flow</p> $\text{Volume of Flow Between Sample Grabs} = \frac{\text{Batch Size (Total Volume to be Sampled)}}{\text{Number of Samples Needed (Eq. 1)}}$
<p>Use Equation 1 to determine the number of actuations needed. Use Equation 2 to determine how often (after what volume of flow) to take each sample.</p>
Liquid Sampling, Timed Collection
<p>Equation 1: Number of Samples Needed</p> $\text{Number of Samples Needed to Fill to 80\%} = \frac{(\text{Container Size (cc)} * 0.8)}{\text{Bite Size (cc)}}$ <p>Equation 2: Timed Sampling</p> $\text{Time Between Sample Grabs} = \frac{\text{Total Time in Sample Period}}{\text{Number of Samples Needed (Eq. 1)}}$
<p>Use Equation 1 to determine the number of actuations needed. Use Equation 2 to determine how often (after what amount of time) to take each sample.</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 or Figure 3).
- 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



The purge tube allows the sampler to be completely evacuated of sample from the inlet to the sample container. Automated purging can be achieved with the Welker® PNP Plug & Purge Panel.



To prevent cross-contamination between samples, Welker recommends that the inFlow™ ACE 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 2* or *Figure 4*).



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™ ACE.



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. Open purge valve P (*Figure 1* or *Figure 3*).
4. Turn ON the inert gas supply.
5. Allow product in the inFlow™ ACE 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 1* or *Figure 3*).
8. Disconnect the inert gas supply from purge valve P (*Figure 1* or *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 or Figure 3).



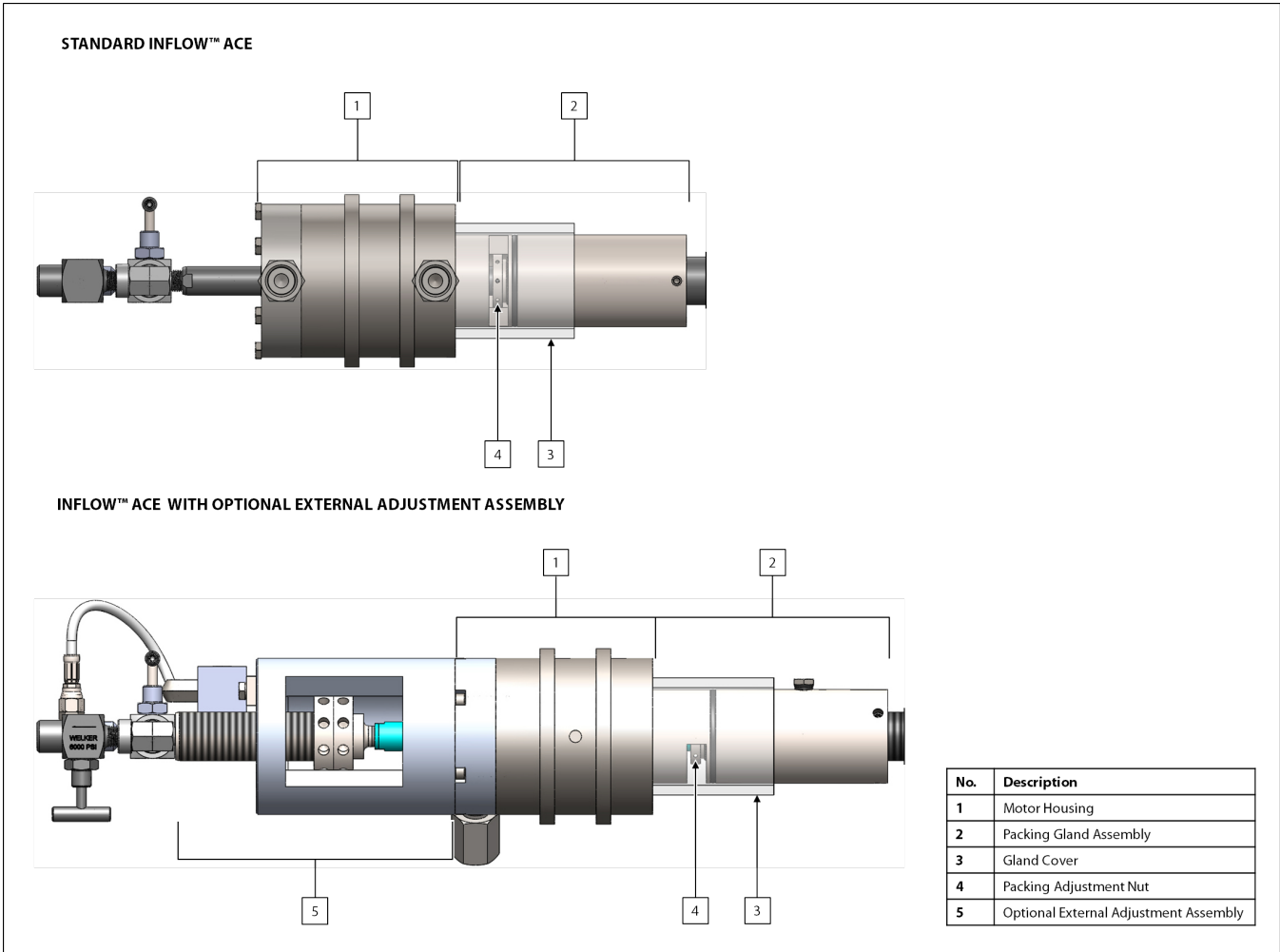
DO NOT operate the pump after emergency shutoff valve E is closed. Operating the pump while emergency shutoff valve E is closed may damage the pump.



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™ ACE, 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 14).

Figure 14: Packing Adjustment Nut



2.8 Retracting the Unit



To avoid injury, DO NOT stand over the top of the sampler during retraction.

1. Ensure that the inFlow™ ACE has been purged. See *Section 2.6, Purging the Unit*, for instructions on properly purging the inFlow™ ACE.
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* or *Figure 3*).
5. Disconnect the sample container from the sample outlet.



If the unit will be retracted manually, continue to step 6.

If the unit will be retracted using the optional insertion tool, proceed to step 10.

Manual Retraction



At pressures above 40 psig, the inFlow™ ACE cannot be safely inserted or retracted manually. To retract the inFlow™ ACE, the pipeline pressure will need to be reduced to 40 psig or below.



At least two (2) people are required to correctly and safely retract the inFlow™ ACE from the pipeline.

6. With one person firmly pushing on the top of the motor housing of the inFlow™ ACE, another person can remove the hex nuts securing the lock collar to the standoffs on the lubricator body (*Figure 12*).



Failure to ensure that adequate pressure is applied to the top of the unit at the motor housing prior to retraction could result in unexpected retraction of the insertion shaft at great speed, which could damage the unit or injure the operator.

7. If the pipeline is under pressure, the insertion shaft will begin to retract from the pipeline. If the pipeline is not under pressure, it may be necessary to manually pull on the insertion shaft to retract the shaft.
8. Once the shaft has been fully retracted from the pipeline, close the pipeline isolation valve to isolate the unit from pressure.
9. Proceed to step 23 to complete retraction.

Using the Optional Insertion Tool

10. Attach the customer hydraulic hand pump to insertion valve A (*Figure 3*).
11. Ensure that the hydraulic hand pump release valve on the customer hydraulic hand pump is closed.
12. Open insertion valve A (*Figure 3*).
13. Stroke the customer hydraulic hand pump to ensure that there is positive hydraulic pressure in the insertion tool housing.
14. Loosen the hex nuts securing the lock collar to the lubricator body (*Figure 12*). If the insertion tool shafts move, tighten the hex nuts, and then stroke the customer hydraulic hand pump a few more times to increase pressure in the insertion tool housings.



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

15. Once the hex nuts securing the lock collar to the lubricator body are loose and the insertion tool shafts are not moving, remove the hex nuts completely.
16. Close insertion valve A, and then disconnect the customer hydraulic hand pump (*Figure 3*).
17. Connect the hydraulic fluid return line from the customer hydraulic hand pump to insertion valve A, and then open insertion valve A (*Figure 3*).
18. Slowly open the hydraulic hand pump release valve to allow hydraulic fluid to flow back into the customer hydraulic hand pump reservoir through insertion valve A. This will relieve pressure from the insertion tool housings, 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 connecting the customer hydraulic hand pump to retraction valve B and applying hydraulic pressure to the insertion tool housings.



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.

19. As necessary, open retraction valve B to vent trapped air (*Figure 3*).
20. Once the insertion tool shafts have traveled through the insertion tool housings and the insertion shaft is fully retracted from the pipeline, close all valves, and then close the pipeline isolation valve to isolate the unit from pressure (*Figure 3*).
21. Disconnect the customer hydraulic hand pump from insertion valve A (*Figure 3*).
22. Continue to step 23 to complete retraction.

Completing Retraction

23. Loosen the cap screws on the sides of the lock collar, and then slide the lock collar down onto the standoffs on the lubricator body.
24. Tighten the hex nuts to secure the lock collar to the standoffs on the lubricator body to prevent the insertion shaft from moving while the unit is being removed from the pipeline.
25. Slowly open lubricator vent (drain) valve C to bleed any pressure or liquids trapped in the lubricator body (*Figure 1* or *Figure 3*).
26. If complete removal of the inFlow™ ACE from the pipeline is desired, the unit is now ready to be removed from the pipeline isolation valve for maintenance or to be relocated.
27. If the inFlow™ ACE will remain secured to the pipeline after retraction, ensure that the lock collar has been properly secured to the standoffs on the lubricator body.

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.

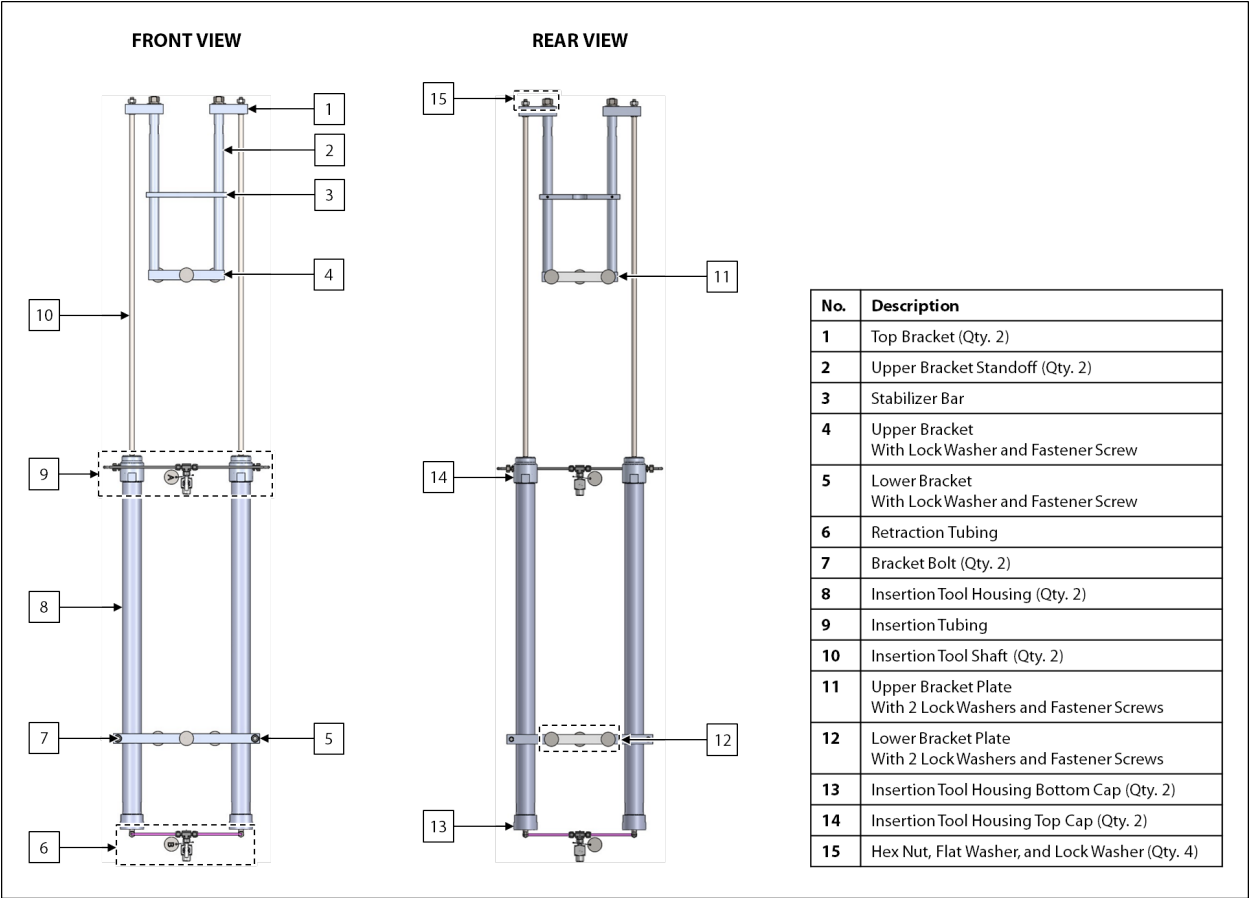
3. All maintenance and cleaning of the unit should be performed on a smooth, clean surface.
4. Welker recommends having the following tools available for maintenance. Please note that the exact tools required may vary by model.
 - a. Hex Key Set
 - b. Large Crescent Wrench (Qty. 2)
 - c. Medium Crescent Wrench (Qty. 2)
 - d. Seal Pick
 - e. Small Flathead Screwdriver
 - f. Spanner Wrench
 - g. Strap Wrench

3.2 Maintenance: Optional Insertion Tool

1. Prior to performing maintenance on the optional insertion tool, the inFlow™ ACE must be removed from the pipeline. See Section 2.8, Retracting the Unit, for instructions on retracting the insertion shaft and removing the inFlow™ ACE from the pipeline.
2. Lay the inFlow™ ACE on a smooth, clean surface with the tube fittings facing up.

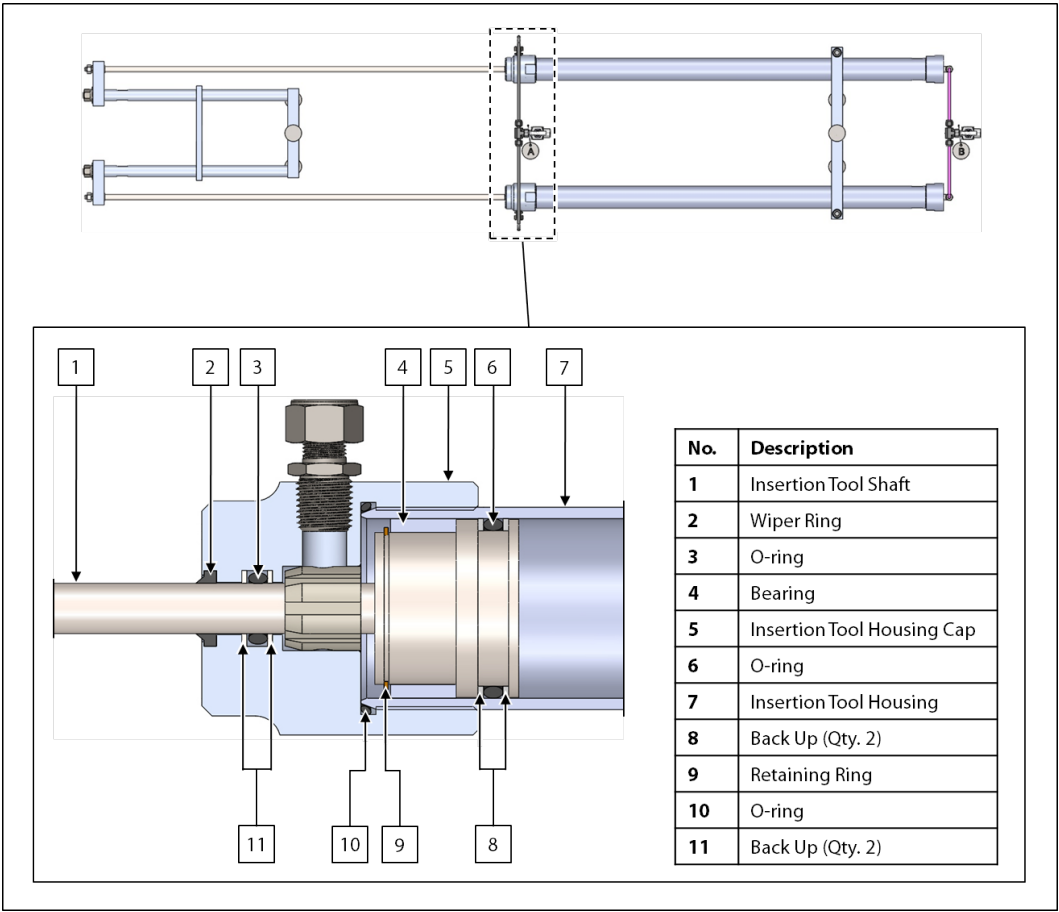
Removing the Insertion Tool

Figure 15: Insertion Tool Diagram



3. Remove the hex nuts, flat washers, and lock washers from the top of each insertion tool shaft and upper bracket standoff.
4. Remove the top brackets.
5. Unscrew the fastener screws from the upper bracket plate, and then loosen the front fastener screw on the upper bracket.
6. Holding the upper bracket standoffs, carefully lift the stabilizer bar and upper bracket from the motor housing.
7. Remove the bracket bolts from the lower bracket.
8. Unscrew the fastener screws from the lower bracket plate, and then loosen the front fastener screw on the lower bracket.
9. Holding both insertion tool housings, carefully lift the lower bracket from the lubricator body. Note that the lower bracket will remain attached to the insertion tool housings.

Figure 16: Insertion Tool Housing Cap Diagram



- 10. Disconnect the insertion tubing from the insertion tool housing cap.
- 11. Unscrew the insertion tool housing cap from the insertion tool housing.
- 12. Carefully pull the insertion tool shaft from the insertion tool housing.
- 13. Carefully pull the insertion tool shaft through the insertion tool housing cap.
- 14. Replace the O-rings and back ups in the insertion tool housing cap and on the insertion tool shaft piston.
- 15. Inspect the wiper ring, retaining ring, and bearing in the insertion tool housing cap and on the insertion tool shaft piston for signs of damage or wear. Replace as necessary.
- 16. Inspect the insertion tool housing for scratches. All cylinder bores should be clean. If scratches are present, polish the insertion tool housing.
- 17. Inspect the insertion tool shaft for scratches. If scratches are present, polish the insertion tool shaft.
- 18. Wrap the exposed threads at the top of the insertion tool shaft with PTFE tape, and then lightly lubricate the outer diameter of the insertion tool shaft.
- 19. Wrap the exposed threads at the top of the insertion tool housing with PTFE tape.
- 20. Carefully push the insertion tool shaft through the insertion tool housing cap, and then install the insertion tool housing cap to the insertion tool housing.
- 21. Tighten the insertion tool housing cap.
- 22. To maintain the second insertion tool assembly, repeat steps 10–21.
- 23. Once both insertion tool assemblies have been maintained and reassembled, continue to step 24.

Reassembling the Insertion Tool

24. Lay the upper bracket standoffs with the stabilizer bar and upper bracket attached between the insertion tool shafts.
25. Using the flat washers, lock washers, and hex nuts, secure the top brackets to the upper bracket standoffs.
26. Using the flat washers, lock washers, and hex nuts, secure the top brackets to the insertion tool shafts.
27. Connect the insertion tubing to the insertion tool housing caps.
28. To continue maintenance on the inFlow™ ACE, set the insertion tool aside and continue to *Section 3.3, Maintenance: inFlow™ ACE*

3.3 Maintenance: inFlow™ ACE

1. Prior to performing maintenance, the inFlow™ ACE 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. If applicable, remove the optional insertion tool prior to performing maintenance. See *Section 3.2, Maintenance: Optional Insertion Tool*, for instructions on removing and maintaining the insertion tool.
3. Back off the jam nut on the external sand relief and open purge valve P to relieve any trapped pressure (*Figure 17* and *Figure 18*).
4. Lay the inFlow™ ACE on a smooth, clean surface

Collection Head Assembly

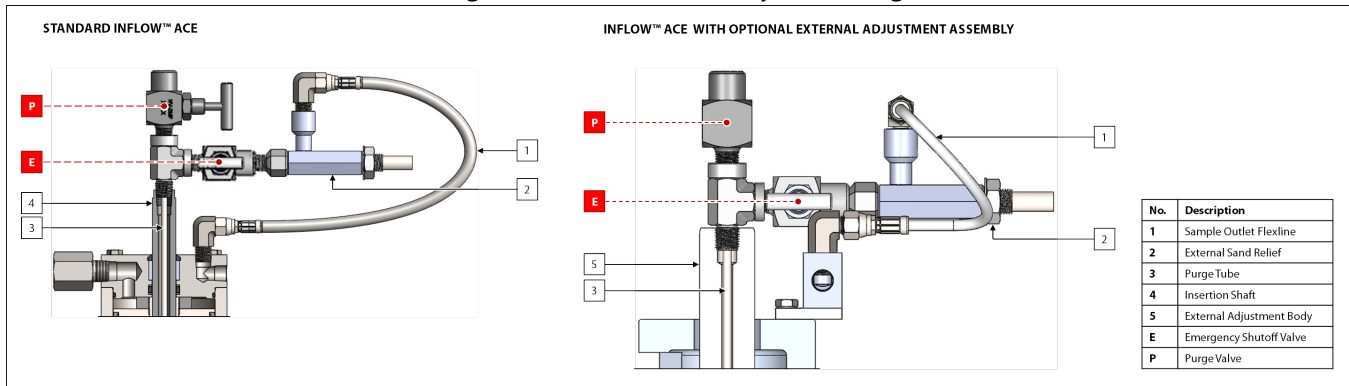


Welker recommends noting the position of the jam nut on the outer shaft to ease reassembly.

5. Loosen the lock collar, and then expose the collection head manually by gently pushing the collection head out of the lubricator body.
6. Unscrew and remove the collection head assembly from the outer shaft.
7. Refer to *Appendix B, D-Style Collection Head Maintenance*, or *Appendix C, C-Style Collection Head Maintenance*, for instructions on performing maintenance on the collection head.

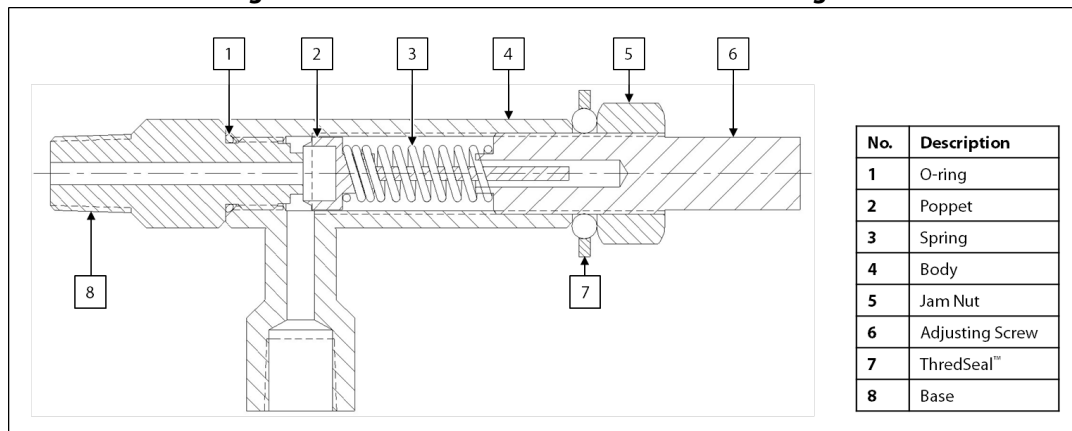
Purge Assembly

Figure 17: Outlet Assembly With Purge



8. Unscrew the sample outlet flexline from the elbow above the sample outlet.
9. Unscrew the purge assembly at the tee connecting it to the insertion shaft or to the external adjustment body. 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.
10. Unscrew the external sand relief from emergency shutoff valve E.
11. Unscrew the flexline from the elbow in the external sand relief.
12. Unscrew the base of the external sand relief from the body (Figure 18).

Figure 18: External Sand Relief Maintenance Diagram



13. Replace the O-ring on the base.
14. Unscrew the jam nut from the adjusting screw.
15. Inspect the poppet for scratches or other damage. If scratches or other damage are present on the poppet (face) seat, replace the poppet.
16. Reassemble the external sand relief.
17. Screw the external sand relief into emergency shutoff valve E (Figure 17).
18. Screw the flexline into the elbow in the external sand relief (Figure 17).

Disassembling the Upper Housing

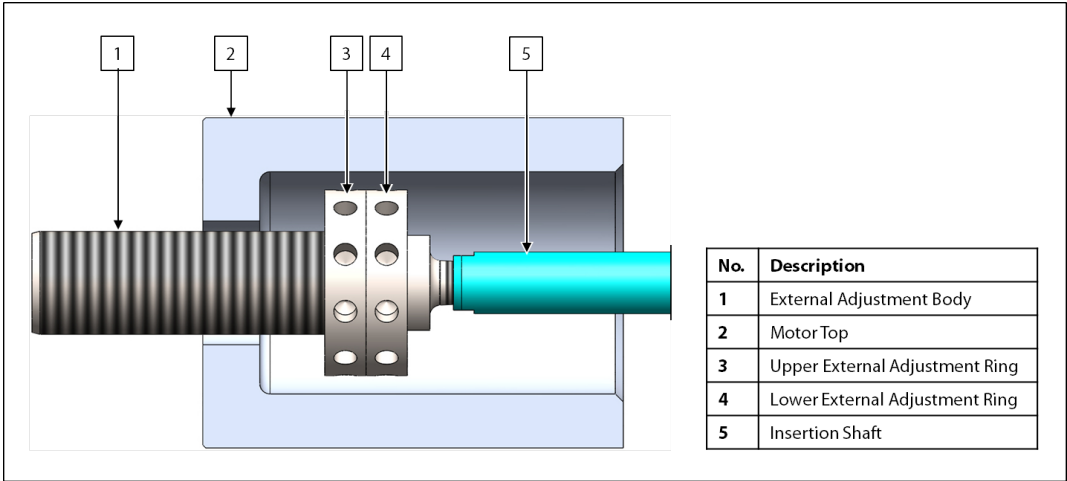
- 19. If the inFlow™ ACE is not equipped with the optional external adjustment, continue to step 20. If the inFlow™ ACE is equipped with the optional external adjustment, proceed to step 22.

Without Optional External Adjustment Assembly

- 20. Unscrew the machine screws from the top cap and carefully remove the top cap from the motor housing (*Figure 20*).
- 21. Proceed to step 26.

With Optional External Adjustment Assembly

Figure 19: External Adjustment Assembly



- 22. Unscrew the motor top from the motor housing.
- 23. Carefully remove the motor top from the external adjustment body.
- 24. Carefully unscrew the external adjustment body from the insertion shaft. Note that the external adjustment rings will remain attached to the external adjustment body and will also be removed at this time.
- 25. Unscrew the cap screws from the top cap and carefully remove the top cap from the motor housing (*Figure 21*).
- 26. Unscrew the setscrews from the base of the packing gland body (*Figure 22*).
- 27. Unscrew the outer shaft from the packing gland body.
- 28. Unscrew the packing gland body from the motor housing, and then carefully remove the packing gland body from the insertion shaft. Take care not to scratch or otherwise damage the insertion shaft.
- 29. Carefully pull the insertion shaft out through the motor housing.

Motor Housing Assembly

Figure 20: Motor Housing Assembly Without Optional External Adjustment

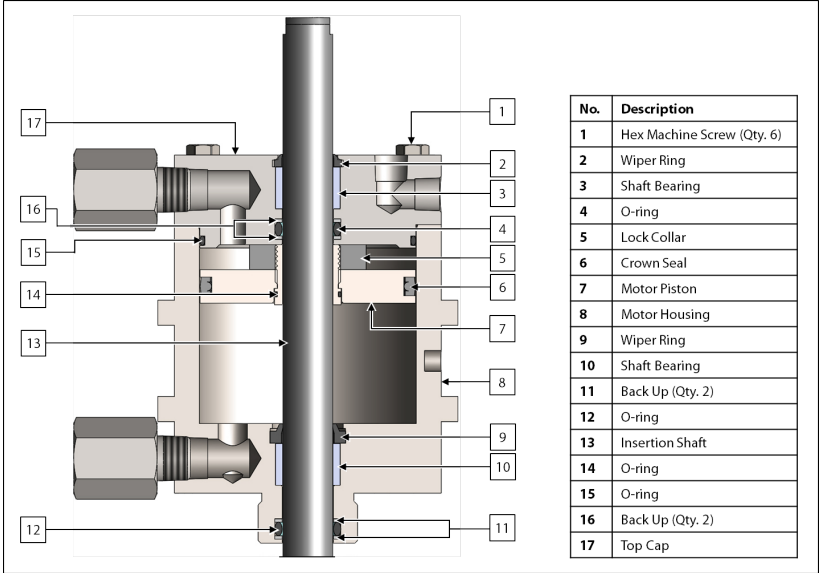
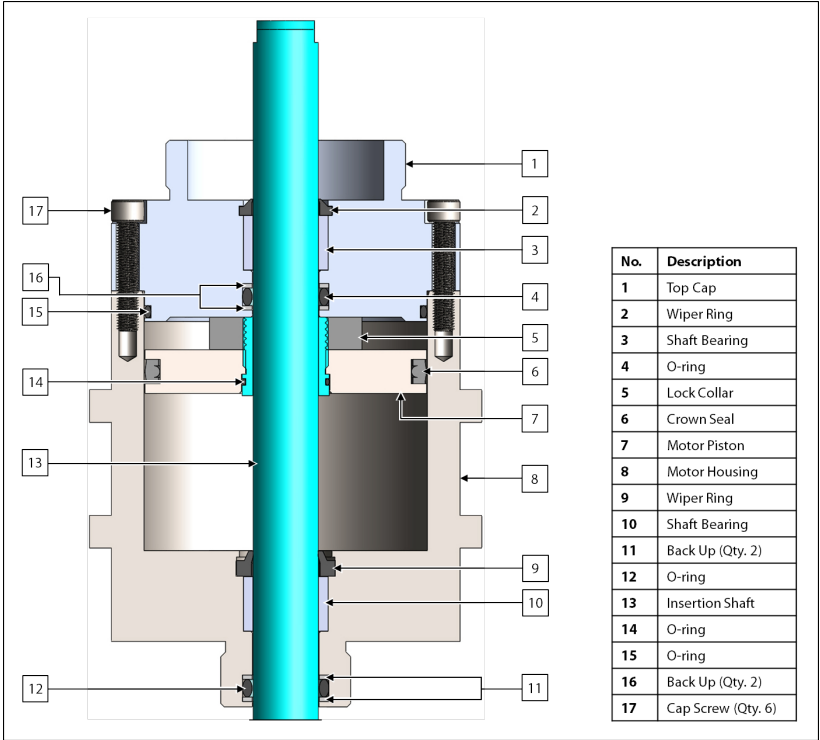


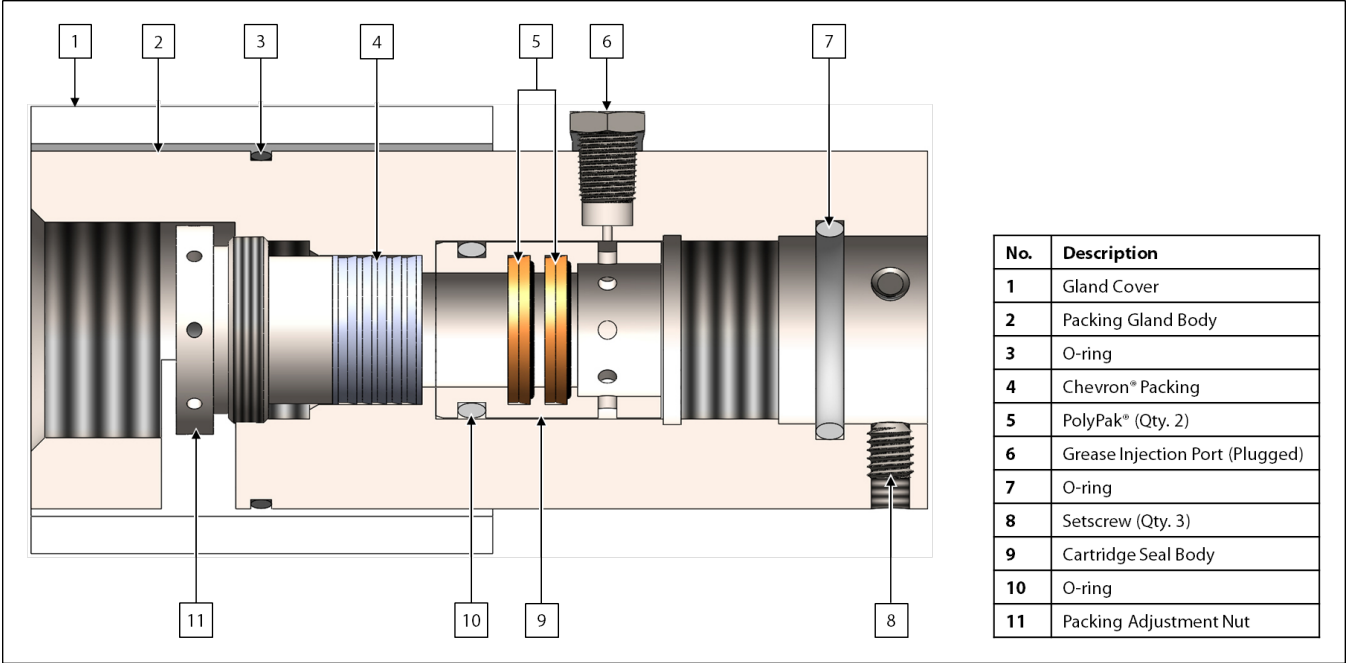
Figure 21: Motor Housing Assembly With Optional External Adjustment



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

Packing Gland Body

Figure 22: Packing Gland Assembly



- 36. Slide the gland cover off the packing gland body.
- 37. Replace the O-ring on the packing gland body.
- 38. Unscrew the packing adjustment nut from the packing gland body.
- 39. Inspect the wiper ring in the packing adjustment nut. Replace if it shows signs of wear or damage.
- 40. Replace the Chevron® packing in the packing gland body. The Chevron® packing should be installed so that the "V" is open against the direction of product flow.
- 41. Remove the cartridge seal body from the packing gland body.
- 42. Replace the O-ring and PolyPak® seals on the cartridge seal body.
- 43. Return the cartridge seal body to the packing gland body.
- 44. Screw the packing adjustment nut into the packing gland body.
- 45. Replace the O-ring in the packing gland body.

Reassembling the Upper Housing

46. Carefully insert the insertion shaft through the packing gland body, taking care not to scratch the shaft.
47. Slide the gland cover onto the packing gland body.
48. Carefully slide the motor housing onto the insertion shaft, taking care not to scratch the shaft.
49. Carefully screw the motor housing into the packing gland body.
50. Return the top cap to the top of the insertion shaft and carefully slide the top cap down to the motor housing.
51. If the inFlow™ ACE is not equipped with the optional external adjustment, continue to step 52. If the inFlow™ ACE is equipped with the optional external adjustment, proceed to step 54.

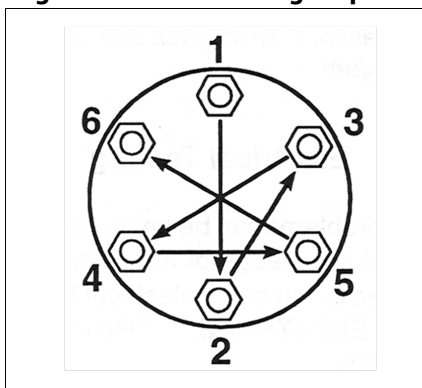
Without Optional External Adjustment Assembly

52. Bolt the top cap in place.
53. Proceed to step 57.

With Optional External Adjustment Assembly

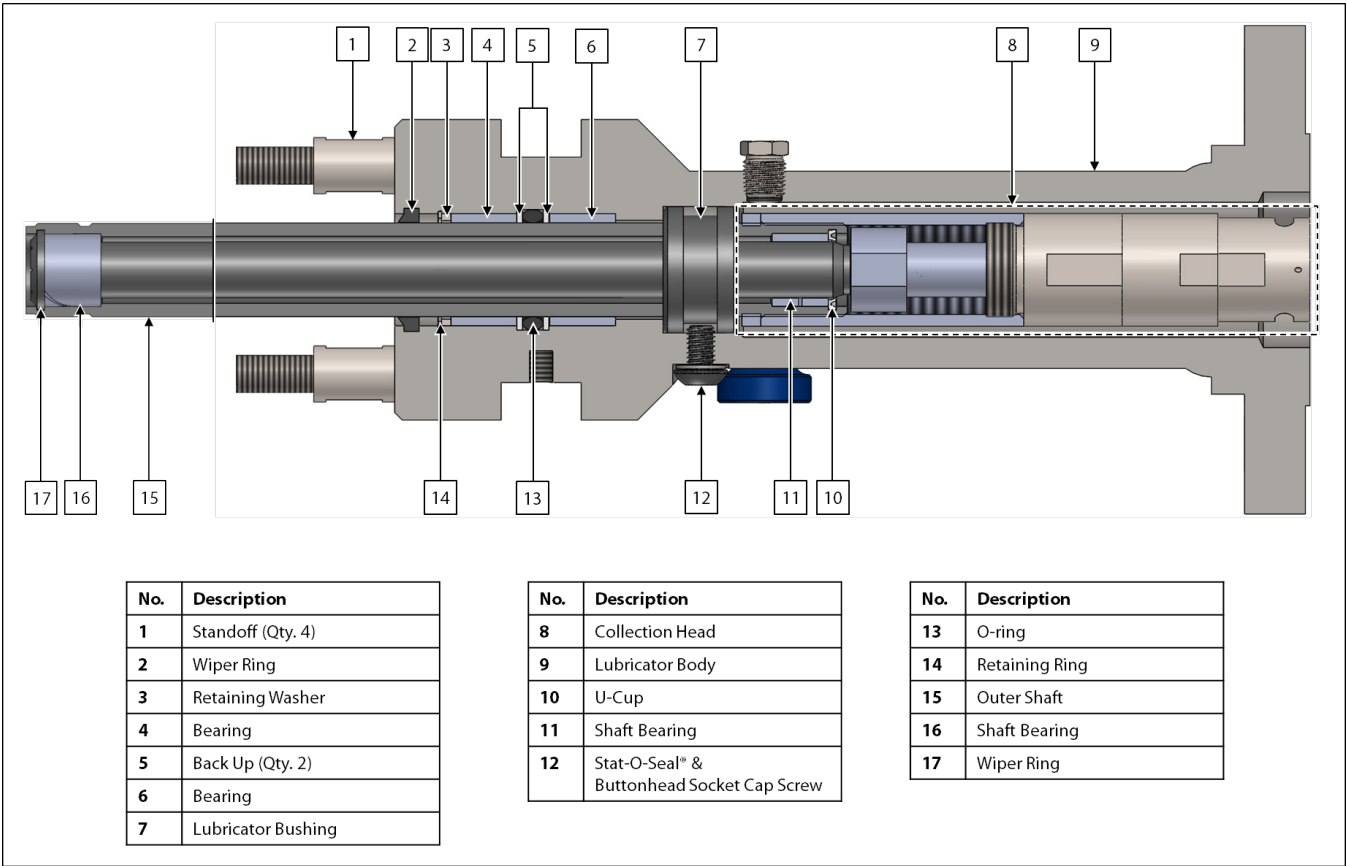
54. Following a cross-bolting sequence, install the cap screws to the top cap and secure the top cap to the motor housing.

Figure 23: Cross-Bolting Sequence



55. Screw the external adjustment body with external adjustment rings into the insertion shaft.
56. Return the motor top to the top cap, and then screw the motor top onto the top cap.
57. Set the upper housing and insertion shaft assembly aside.

Figure 24: Lubricator Body Detail



- 58. Loosen and remove the lock collar from the outer shaft.
- 59. With the collection head and upper housing removed, carefully pull the outer shaft out of the lubricator body.
- 60. 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.
- 61. Inspect the wiper ring and shaft bearings in the outer shaft. Replace if they show signs of wear or damage.
- 62. Replace the U-cup in the outer shaft. The U-cup should be installed so that the "U" is open against the direction of product flow.
- 63. Replace the O-ring, back ups, and Stat-O-Seal® in the lubricator body.
- 64. Inspect the wiper ring, retaining ring, retaining washer, bearings, and lubricator bushing in the lubricator body. Replace if they show signs of wear or damage.

Reassembly

65. Liberally lubricate the outer shaft.
66. Slide the outer shaft into the lubricator body.
67. Carefully slide the lock collar onto the outer shaft, and then tighten the lock collar cap screws.
68. With the upper housing assembly attached to the insertion shaft, insert the insertion shaft into the outer shaft.
69. Screw the outer shaft into the packing gland body, and then tighten the setscrews in the base of the packing gland body to secure the upper housing assembly to the outer shaft.
70. Insert the purge tube into the insertion shaft or external adjustment body, and then screw the purge assembly into the insertion shaft or external adjustment body.
71. Reconnect the flexline at the sample outlet.
72. Tighten the collection head onto the outer shaft.
73. Remove the plug from the grease injection port, and then install an appropriately sized grease fitting (*Figure 22*).
74. Inject Welker® Great Barrier Grease™ into the grease fitting.
75. Once properly lubricated, remove the grease fitting, and then plug the port with the provided plug.
76. If the inFlow™ ACE is not equipped with the optional insertion tool, the unit is now ready for installation. If the inFlow™ ACE is equipped with the optional insertion tool, continue to step 77 for instructions on attaching the insertion tool.

Attaching the Insertion Tool

77. Prepare the upper bracket plate for attachment. Insert the fastener screws with lock washers into the back of the upper bracket plate, and then place the upper bracket plate behind the motor housing with the fastener screws pointing up (*Figure 15*).
78. Prepare the lower bracket plate for attachment. Insert the fastener screws with lock washers into the back of the lower bracket plate, and then place the lower bracket plate behind the lubricator body with the fastener screws pointing up (*Figure 15*).
79. Gently lay the assembled insertion tool on the inFlow™ ACE so that the upper bracket fits in the motor housing groove and the lower bracket fits in the lubricator body groove.
80. Screw the fastener screws into the upper and lower brackets to secure the upper and lower bracket plates to the inFlow™ ACE (*Figure 15*).
81. Screw the bracket bolts into the lower bracket plate (*Figure 15*).
82. The unit is now ready for installation.

3.4 Troubleshooting

Table 2: inFlow™ ACE Troubleshooting		
Issues	Possible Causes	Solutions
The inFlow™ ACE is not actuating properly.	The hydraulic supply may be too low or not operating.	Inspect the electro-hydraulic unit (EHUC). 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.
	The pneumatic supply may be too high, too low, or not operating.	Inspect the pneumatic supply and regulator to ensure that air is supplied at the appropriate pressure.
	The solenoid may not be operating properly.	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.
The sample container is not filling.	The inlet valve on the sample container may be closed.	Ensure that the sample inlet valve on the sample container is open during sampling.
	The outlet on the sample container may be open.	Ensure that the sample outlet valve on the sample container is closed during sampling.
	The inFlow™ ACE is not collecting the correct sample volume.	Welker recommends the Welker® Checkpoint™ Sample Bite Verification Panel for verifying the sample volume of the inFlow™ ACE. See <i>Section 2.2, Setting the Sample Volume</i> , for instructions on adjusting the sample volume.
	The inFlow™ ACE may be set at a slower sampling frequency than desired.	Adjust the inFlow™ ACE to sample at the desired rate. Ensure that the calculations used to determine the sample frequency are correct (<i>Figure 13</i>).
	The relief on the inFlow™ ACE may be set too high.	Check the setting on the relief and adjust as necessary.

Table 2: inFlow™ ACE Troubleshooting (Continued)

Issues	Possible Causes	Solutions
The sample container is filling too quickly.	The inFlow™ ACE is not collecting the correct sample volume.	Welker recommends the Welker® Checkpoint™ Sample Bite Verification Panel for verifying the sample volume of the inFlow™ ACE. See <i>Section 2.2, Setting the Sample Volume</i> , for instructions on adjusting the sample volume.
	The inFlow™ ACE may be set at a faster sampling frequency than desired.	Adjust the inFlow™ ACE to sample at the desired rate. Ensure that the calculations used to determine the sample frequency are correct (<i>Figure 13</i>).
	The relief on the inFlow™ ACE may be set too low.	Check the setting on the relief and adjust as necessary.

APPENDIX A: REFERENCED OR ATTACHED DOCUMENTS

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

- IOM-036: Welker® Transportable Crude Oil Container (TCC) and Laboratory Mixing Skid (MSTCC) Models
- IOM-105: Welker® NV-1 and NV-2 Instrument Valves
- IOM-117: Welker® Transportable Crude Oil Container (TCC) Carbon Steel and Laboratory Mixing Skid (MSTCC) Models
- IOM-134: Welker® Checkpoint™ Sample Bite Verification Panel
- IOM-165: Welker® PNP Plug & Purge Panel
- IOM-186: Welker® TCC mini Transportable Crude Oil Container

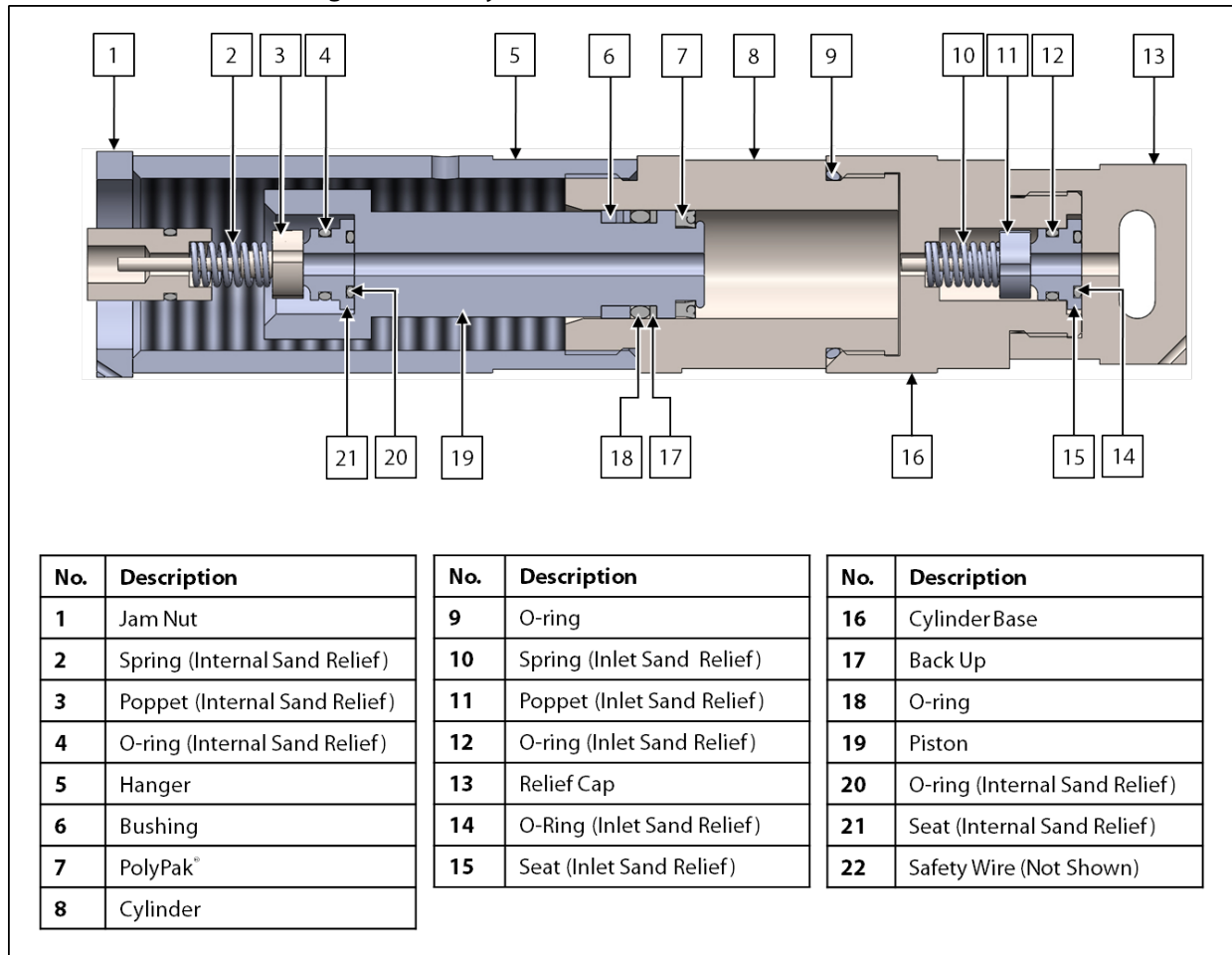
Other *Installation, Operation, and Maintenance* (IOM) *Manuals* suggested for use with this unit:

- Parker Fluoropolymer Hose (Welker® IOM-V174)
- Swagelok® Proportional Relief Valves R Series (Welker® IOM-V086)

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

- Assembly Drawing: AD905BE (Standard inFlow™ ACE)
- Assembly Drawing: AD905BO (inFlow™ ACE With Optional External Adjustment Assembly and Optional Insertion Tool)
- Collection Head Drawing: AD224BW.1K (D-Style Collection Head)
- Collection Head Drawing: AD168BS (C-Style Collection Head)

Figure B1: D-Style Collection Head With Sand Reliefs



1. Cut the safety wire connected from the relief cap to the jam nut, and then remove the safety wire.
2. Loosen the jam nut and unscrew the collection head assembly from the outer shaft.
3. Unscrew the piston from the insertion shaft to expose the internal sand relief. If wrenches are needed, place the wrenches on the wrench flats.

Internal Sand Relief

4. Examine the seat of the internal sand relief for damage or wear. Replace as necessary,
5. As necessary, replace the O-rings on the seat of the internal sand relief.
6. Examine the spring of the internal sand relief for damage or wear. Replace as necessary.
7. Examine the poppet of the internal sand relief for damage or wear. Replace as necessary.

Piston and Cylinder

8. Inspect the bushing for signs of wear. Replace as necessary.
9. Replace the O-ring, back up, and PolyPak® on the piston.
10. Inspect the nickel-plated cylinder for scratches or other damage. Polish or replace as necessary.
11. Unscrew the cylinder base and relief cap from the cylinder.
12. Replace the O-ring on the cylinder.

Inlet Sand Relief

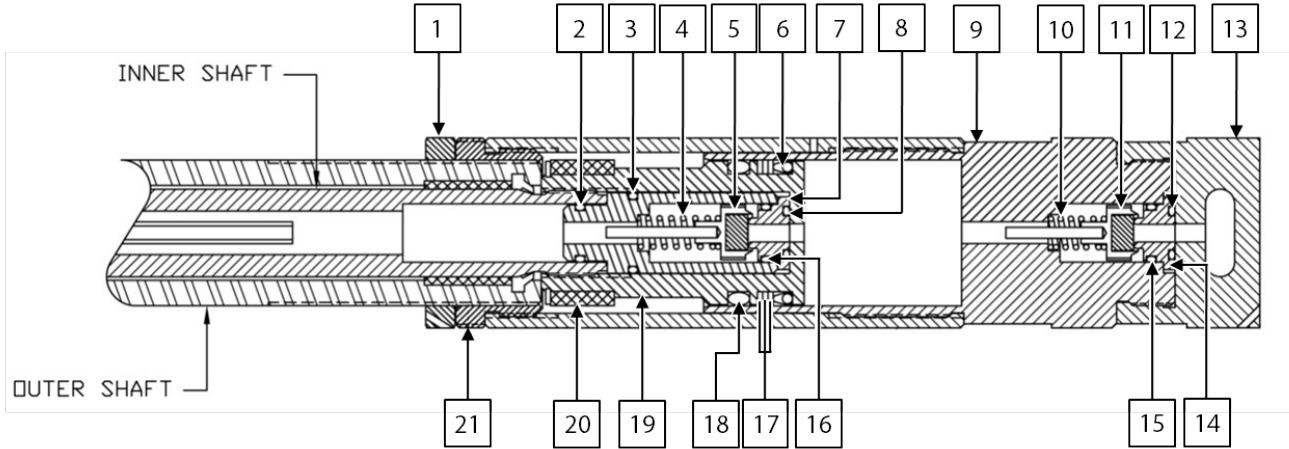
13. Unscrew the relief cap from the cylinder base to expose the inlet sand relief.
14. Examine the seat of the inlet sand relief for damage or wear. Replace as necessary,
15. As necessary, replace the O-rings on the seat of the inlet sand relief.
16. Examine the spring of the inlet sand relief for damage or wear. Replace as necessary.
17. Examine the poppet of the inlet sand relief for damage or wear. Replace as necessary.

Reassembly

18. Insert the inlet sand relief into the cylinder base, and then screw the relief cap onto the cylinder base.
19. Screw the cylinder base with relief cap onto the collection head.
20. Insert the internal sand relief into the piston.
21. If performing full maintenance on the inFlow™ ACE, set the collection head aside and continue to the next step in *Section 3.3, Maintenance: inFlow™ ACE*. If maintenance is only being performed on the collection head, screw the piston into the insertion shaft, and then screw the collection head onto the outer shaft. Tighten the jam nut to lock the collection head in place. For maximum sample volume, ensure that the bottom of the jam nut is flush with the bottom of the outer shaft.
22. 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.

Figure C1: C-Style Collection Head With Sand Reliefs


No.	Description
1	Jam Nut
2	O-ring
3	O-ring
4	Spring (Internal Sand Relief)
5	Poppet (Internal Sand Relief)
6	PolyPak®
7	Seat (Internal Sand Relief)

No.	Description
8	O-ring (Internal Sand Relief)
9	Cylinder
10	Spring (Inlet Sand Relief)
11	Poppet (Inlet Sand Relief)
12	O-ring (Inlet Sand Relief)
13	Relief Cap
14	Seat (Inlet Sand Relief)

No.	Description
15	O-ring (Inlet Sand Relief)
16	O-ring (Internal Sand Relief)
17	Back Up (Qty. 3)
18	O-ring
19	Piston
20	Bearing
21	Adapter

1. As necessary, cut the safety wire connected from the relief cap to the jam nut, and then remove the safety wire.
2. Loosen the jam nut and adapter and unscrew the collection head assembly from the outer shaft.
3. Unscrew the piston from the insertion shaft to expose the internal sand relief. If wrenches are needed, place the wrenches on the wrench flats.

Internal Sand Relief

4. Examine the seat of the internal sand relief for damage or wear. Replace as necessary.
5. As necessary, replace the O-rings on the seat of the internal sand relief.
6. Examine the spring of the internal sand relief for damage or wear. Replace as necessary.
7. Examine the poppet of the internal sand relief for damage or wear. Replace as necessary.

Piston and Cylinder

8. Inspect the bearing for signs of wear. Replace as necessary.
9. Replace the O-ring, back ups, and PolyPak® on the piston.
10. Inspect the nickel-plated cylinder for scratches or other damage. Polish or replace as necessary.

Inlet Sand Relief

11. Unscrew the relief cap from the cylinder base to expose the inlet sand relief.
12. Examine the seat of the inlet sand relief for damage or wear. Replace as necessary.
13. As necessary, replace the O-rings on the seat of the inlet sand relief.
14. Examine the spring of the inlet sand relief for damage or wear. Replace as necessary.
15. Examine the poppet of the inlet sand relief for damage or wear. Replace as necessary.

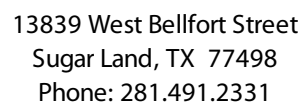
Reassembly

16. Insert the inlet sand relief into the cylinder base and screw the relief cap onto the cylinder base.
17. Screw the cylinder base with relief cap into the hanger.
18. Insert the internal sand relief into the piston.
19. Screw the cylinder base with relief cap onto the collection head.
20. If performing full maintenance on the inFlow™ ACE, set the collection head aside and continue to the next step in *Section 3.3, Maintenance: inFlow™ ACE*. If maintenance is only being performed on the collection head, screw the collection head onto the adapter and tighten the jam nut to lock the collection head in place. For maximum sample volume, ensure that the bottom of the adapter is flush with the bottom of the insertion shaft.
21. 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.

NOTES

This image shows a single sheet of white paper with horizontal blue ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

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