WELKER

INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

WELKER INFLOW™ ACE CRUDE OIL SAMPLER

WITH AI CONTROL™

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AD885BA

MANUAL NUMBER
IOM-161

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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 Bellfort Street
Sugar Land, TX 77498

SECTION 1: PRODUCT INFORMATION

1.1 Introduction

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

If you have any questions, please call Welker at 1-281-491-2331.

**The following procedures have been written for use with standard Welker parts and equipment. Assemblies that have been modified 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 with AI Control™ can be safely inserted and retracted 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 operator controls the insertion and retraction of the probe by manipulating valves and applying process or auxiliary pressure. 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 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 V-ring packing for emergency shutdown leak protection.

Designed with ease of use in mind, the external sample volume adjustment simplifies 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.

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 lubrication port should remained 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 Sealant™ into the lubrication port, the plug must be removed and an appropriately sized grease fitting installed.
3. After Welker Great Barrier Sealant™ has been injected into the lubrication 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 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

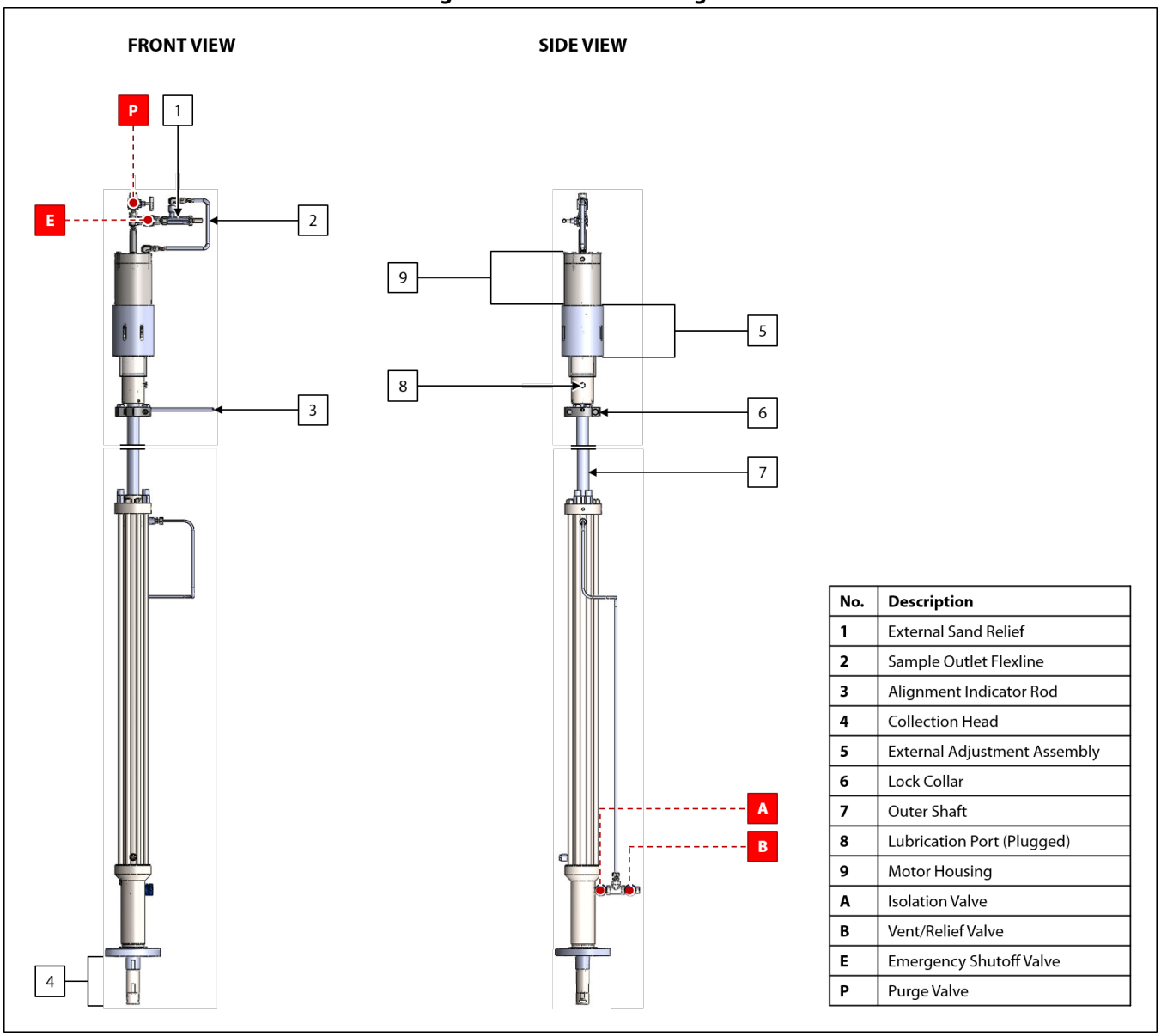
The specifications listed in this section are generalized for this equipment. Welker can modify the equipment according to your company's needs. **Please note that the specifications may vary depending on the customization of your equipment.**

Table 1: inFlow™ 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, Carbon Steel Lubricator Body, PTFE, Kalrez® Wetted Seals, 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*) **600 ANSI Carbon Steel:** 1480 psig @ -20 °F to 100 °F (*102 barg @ -28 °C to 37 °C*)
Pipeline Connection	**Size:** 2" **Rating:** 150 or 600 ANSI RF
Sample Outlet Connection	¼" FNPT
Motor Housing Actuation Ports	¼" FNPT ½" FNPT ⅜" FNPT (Standard)
Insertion Length	0–18" (*0–45 cm*) 0–24" (*0–60 cm*) 0–36" (*0–91 cm*)
Utility Requirements	**Hydraulic or Pneumatic Supply for Motor Operation:** 120 psig (*8 barg*) **Inert Gas Supply for Purge Operation:** ¼" FNPT Connection
Sample Volume	**D-Style Collection Head:** 0.5–10 cc
Features	External Adjustment External Sand Relief Purge Tube V-ring Packing
Options	Pre-Set Collection Head NACE Compliance

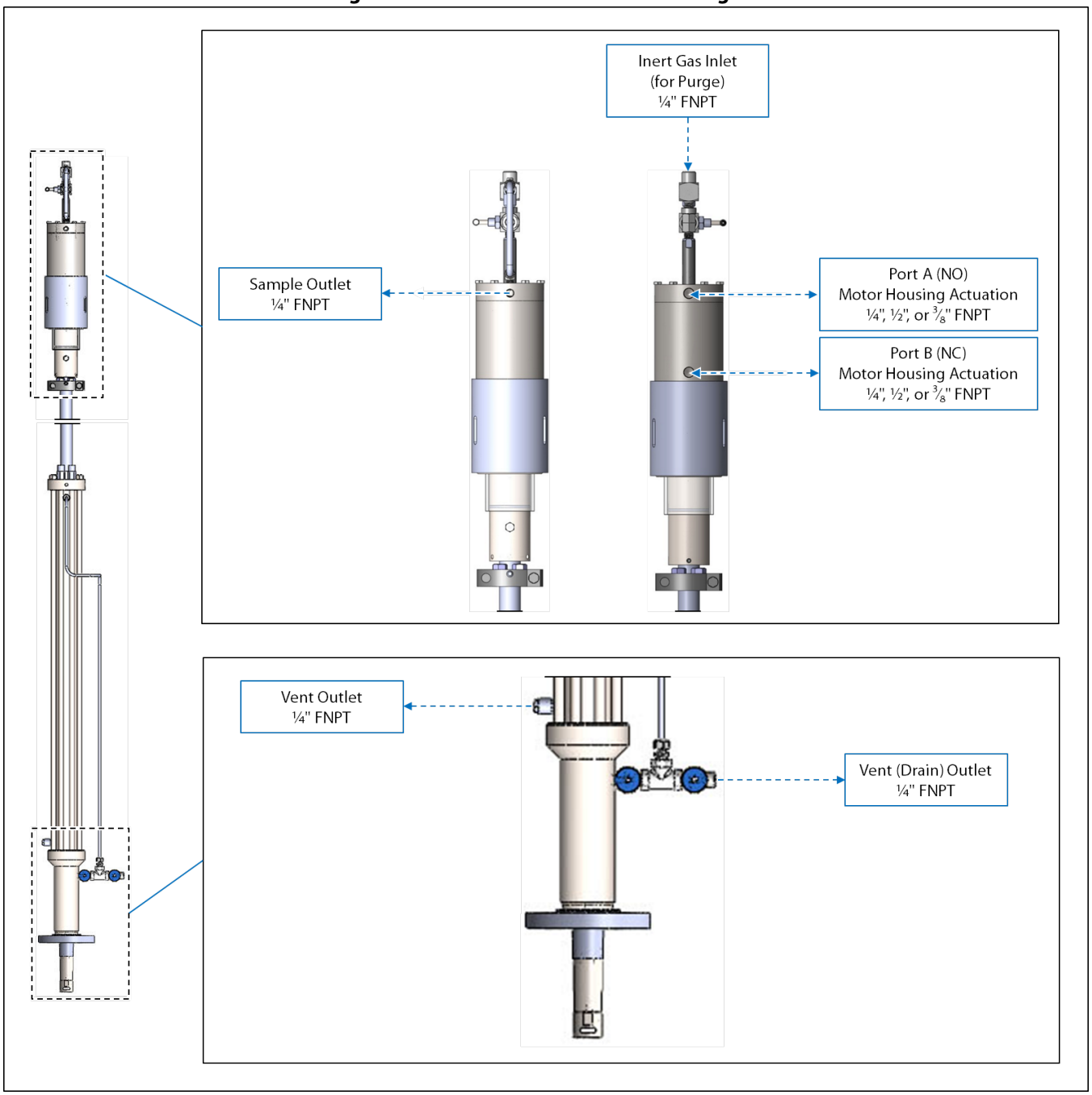
1.5 Equipment Diagrams

Figure 1: inFlow™ ACE Diagram



No.	Description
1	External Sand Relief
2	Sample Outlet Flexline
3	Alignment Indicator Rod
4	Collection Head
5	External Adjustment Assembly
6	Lock Collar
7	Outer Shaft
8	Lubrication Port (Plugged)
9	Motor Housing
A	Isolation Valve
B	Vent/Relief Valve
E	Emergency Shutoff Valve
P	Purge Valve

Figure 2: inFlow™ ACE 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.

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 (⅓) 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 Preparing the Unit for Installation

Aligning the Lock Collar

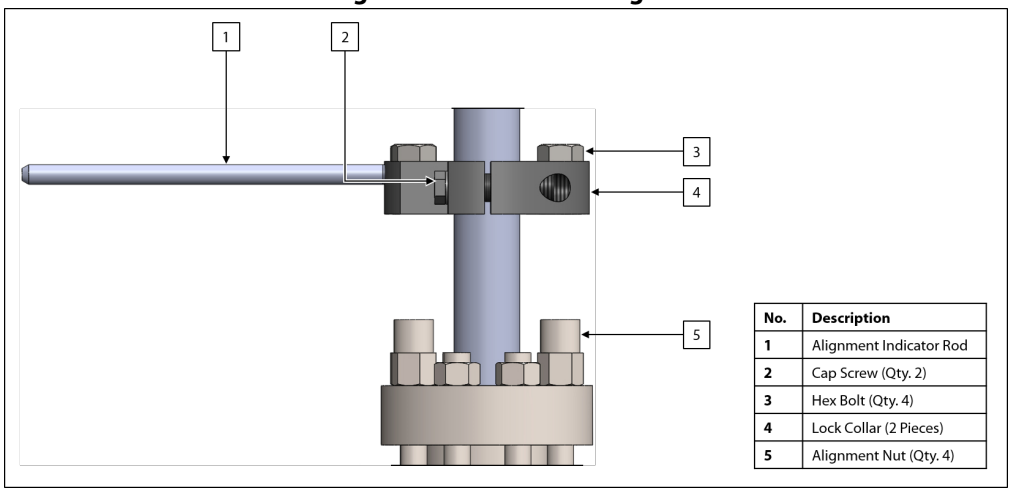
1. Determine the direction of product flow in the pipeline.
2. Lay the inFlow™ ACE on a smooth, clean surface.
3. If the collection head is not fully visible, gently pull the collection head out of the lubricator body.

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

4. Ensure that the lock collar is aligned with the alignment nuts (*Figure 3*). As necessary, loosen the cap screws on the sides of the lock collar and rotate the lock collar until it is aligned with the alignment nuts.

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

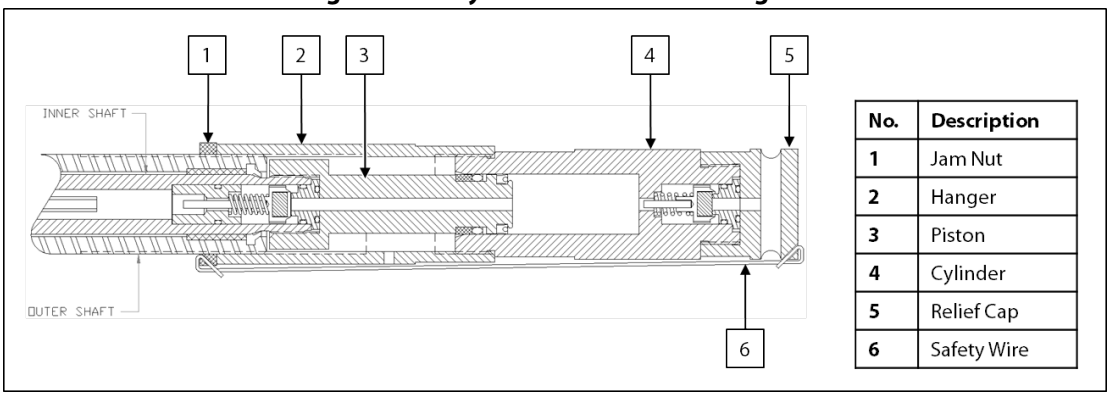
Figure 3: Lock Collar Diagram



No.	Description
1	Alignment Indicator Rod
2	Cap Screw (Qty. 2)
3	Hex Bolt (Qty. 4)
4	Lock Collar (2 Pieces)
5	Alignment Nut (Qty. 4)

5. Loosen the jam nut, and then turn the hanger until the opening in the collection head is aligned with the alignment indicator rod on the lock collar (*Figure 4*). The opening in the collection head should face the direction of product flow so that the flowing stream will pass through the opening.

Figure 4: D-Style Collection Head Diagram



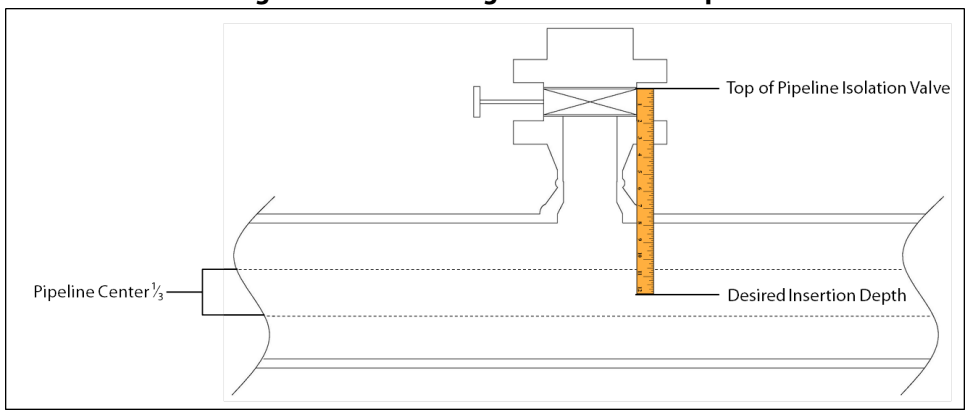
No.	Description
1	Jam Nut
2	Hanger
3	Piston
4	Cylinder
5	Relief Cap
6	Safety Wire

6. Tighten the jam nut on the collection head. The tightened jam nut and safety wire will prevent the collection head from turning.

Setting the Insertion Length

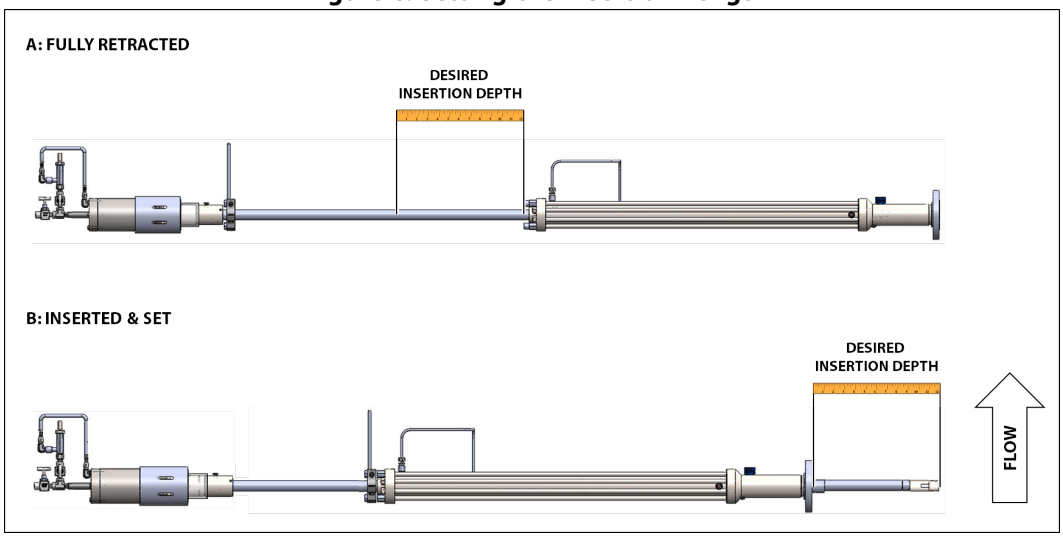
7. Prior to installing the inFlow™ ACE, the length the insertion shaft will need to travel inside the pipeline must be determined. Measure the distance the insertion shaft must travel from the top of the pipeline isolation valve to the desired insertion depth (e.g., the center one-third (⅓) of the pipeline) (*Figure 5*). This will be the shaft insertion length.

Figure 5: 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 6*).
9. Beginning at the top edge of the alignment nuts, measure along the insertion shaft to the desired insertion length (*Figure 6*). As needed, use a felt tip pen to mark this point.

Figure 6: Setting the Insertion Length



10. Remove the hex bolts from the alignment nuts (*Figure 3*).
11. Loosen the cap screws on the sides of the lock collar (*Figure 3*).
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 3*).

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.

2.3 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 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 alignment nuts on the top cap (*Figure 3*).
9. Once the lock collar seats on the alignment nuts, return the hex bolts to the alignment nuts and tighten firmly (*Figure 3*).

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

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 alignment nuts on the top cap (*Figure 3*).
20. Once the lock collar seats on the alignment nuts, return the hex bolts to the alignment nuts and tighten firmly (*Figure 3*).

STOP

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

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 alignment nuts on the top cap (*Figure 3*).
29. Once the lock collar seats on the alignment nuts, return the hex bolts to the alignment nuts and tighten firmly (*Figure 3*).

> STOP DO NOT stop applying pressure to the insertion shaft until the lock collar has been secured to the alignment nuts.

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™ 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 Transportable Crude Oil Container.

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

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

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

36. Open emergency shutoff valve E (*Figure 1*).
37. 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.

2.4 Setting the Sample Volume

1. To set or adjust the sample volume, locate the external adjustment assembly, and then slide the dustcover down to expose the external adjustment chamber (*Figure 7*).

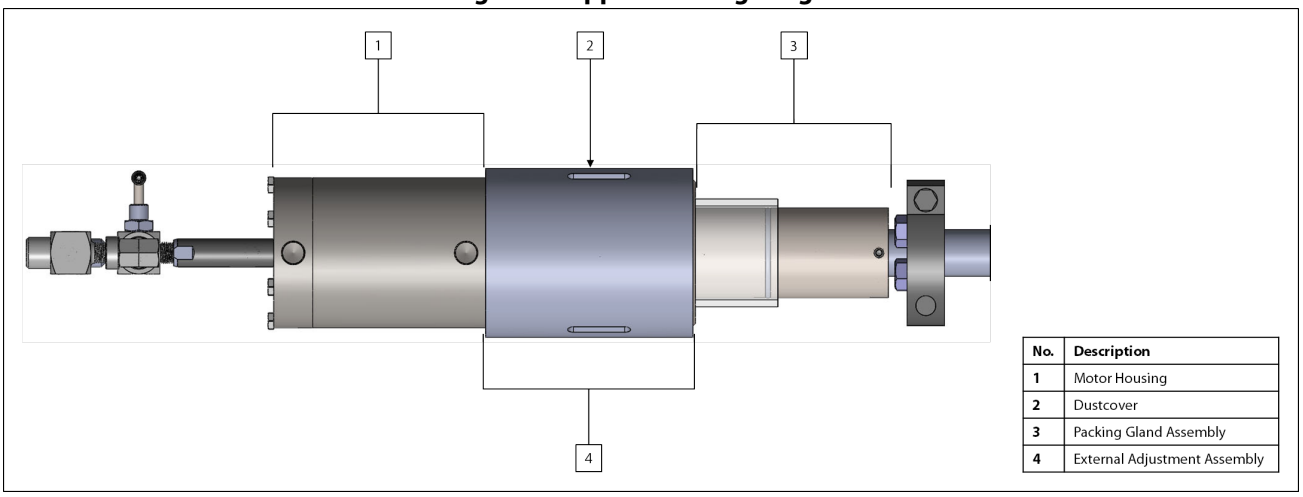
Setting the sample volume is accomplished by:

- determining where the adjustment pin will need to be placed to attain the desired sample volume,
- rotating the upper external adjustment ring in relation to the adjustment pin setting to attain the desired sample volume, and
- installing the adjustment pin to the predetermined slot.

The sample volume is determined by the distance between the upper external adjustment ring and the adjustment pin.

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

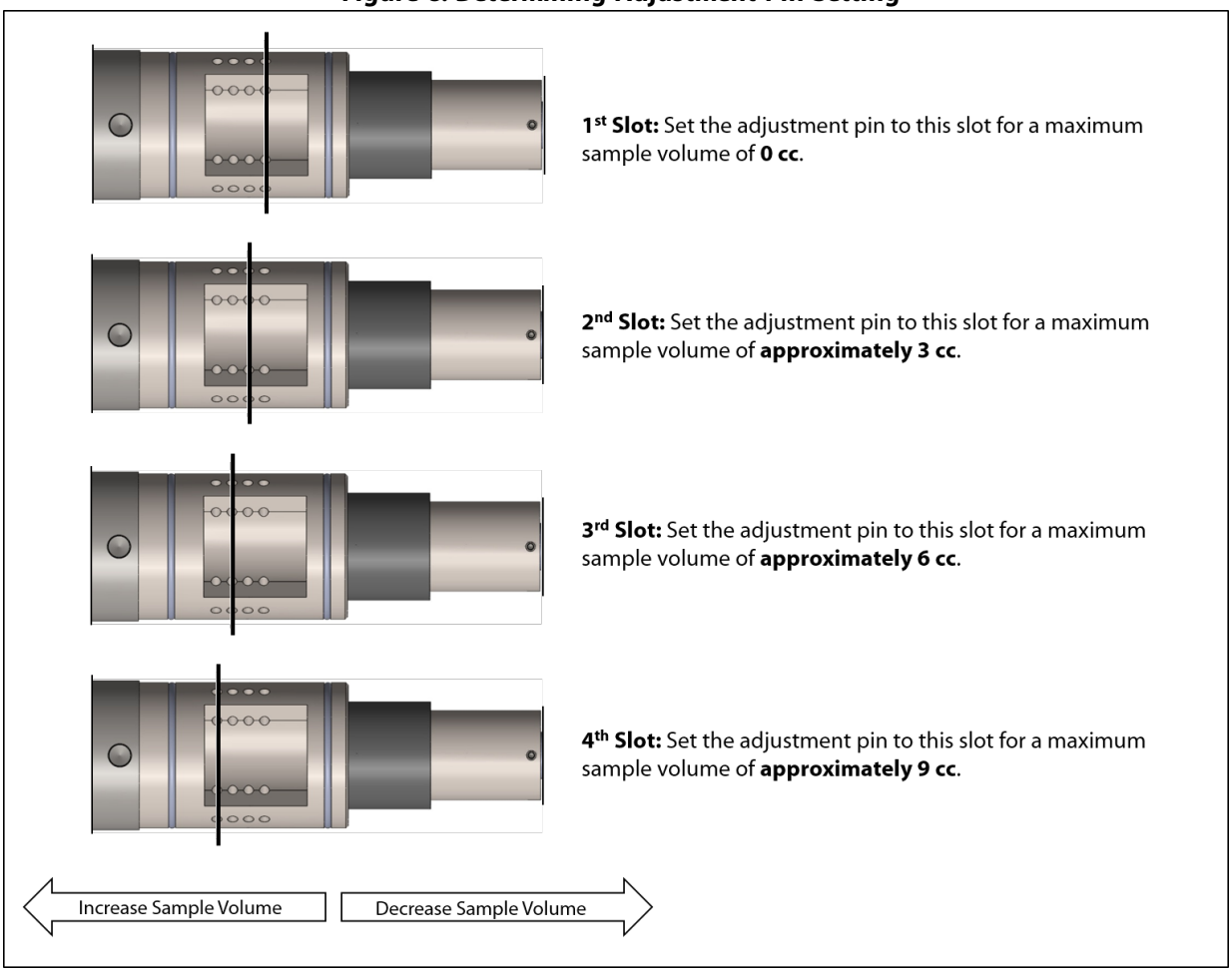
Figure 7: Upper Housing Diagram



No.	Description
1	Motor Housing
2	Dustcover
3	Packing Gland Assembly
4	External Adjustment Assembly

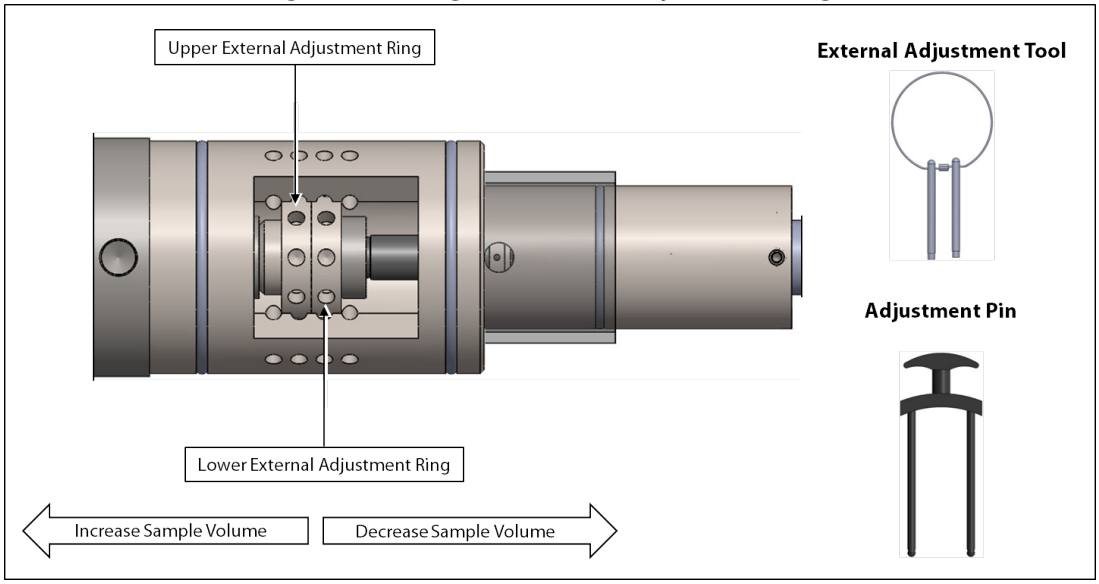
2. Determine to which slot the adjustment pin will be installed after the external adjustment rings have been set (*Figure 8*).

Figure 8: Determining Adjustment Pin Setting



3. Begin with the lower external adjustment ring at the bottom of the external adjustment chamber and the upper external adjustment ring tightened down on top of it (*Figure 9*).

Figure 9: Setting the External Adjustment Rings



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.

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

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.

5. 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 the sample volume during sampling.

6. Slide the dustcover up to cover the external adjustment chamber (*Figure 7*).
7. Install the adjustment pin through the dustcover to the appropriate slot.
8. 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.

9. As necessary, repeat steps 1–8 to further adjust the sample volume.

2.5 Operating the Unit

1. Turn ON the hydraulic or pneumatic supply.
2. As necessary, adjust the hydraulic or pneumatic supply to 120 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
Equation 1: Number of Samples Needed $$Number\ of\ Samples\ Needed\ to\ Fill\ to\ 80\% = \frac{(Container\ Size\ (cc) * 0.8)}{Bite\ Size\ (cc)}$$ ***Equation 2: Proportional-to-Flow*** $$Volume\ of\ Flow\ Between\ Sample\ Grabs = \frac{Batch\ Size\ (Total\ Volume\ to\ be\ Sampled)}{Number\ of\ Samples\ Needed\ (Eq.1)}$$
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.*
Liquid Sampling, Timed Collection
Equation 1: Number of Samples Needed $$Number\ of\ Samples\ Needed\ to\ Fill\ to\ 80\% = \frac{(ContainerSize\ (cc) * 0.8)}{Bite\ Size\ (cc)}$$ ***Equation 2: Timed Sampling*** $$Time\ Between\ Sample\ Grabs = \frac{Total\ Time\ in\ Sample\ Period}{Number\ of\ Samples\ Needed\ (Eq.1)}$$
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.*

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

> 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 1*).

> 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.

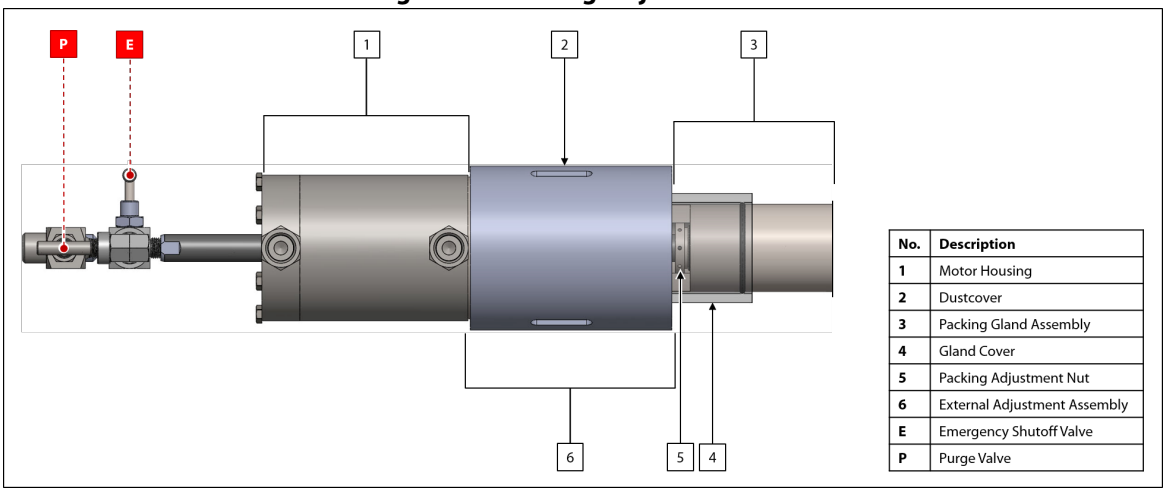
3. Turn ON the inert gas supply.
4. Open purge valve P (*Figure 1*).
5. Allow product in the inFlow™ ACE to drain. Monitor the sample container for under- or over-purging.

> 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*).
8. Disconnect the inert gas supply from purge valve P (*Figure 1*).

2.7 Emergency Shutoff

Figure 11: Packing Adjustment Nut



No.	Description
1	Motor Housing
2	Dustcover
3	Packing Gland Assembly
4	Gland Cover
5	Packing Adjustment Nut
6	External Adjustment Assembly
E	Emergency Shutoff Valve
P	Purge Valve

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.

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.

2.8 Retracting the Unit

To avoid injury, DO NOT stand over the sampler motor housing 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*).
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*).

STOP

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 3*).
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 3*).
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*).

> **STOP** 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 3*).
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™ ACE from the pipeline is desired, the inFlow™ ACE is now ready to be removed from the pipeline isolation valve for maintenance or to be relocated.
36. If the inFlow™ ACE 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
    i. Welker Great Barrier Sealant™

3.2 Maintenance

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. Relieve any trapped pressure by loosening the jam nut and turning the adjusting screw on the external sand relief counterclockwise and opening purge valve P (*Figure 12* and *Figure 13*).
3. Lay the inFlow™ ACE on a smooth, clean surface

Collection Head Assembly

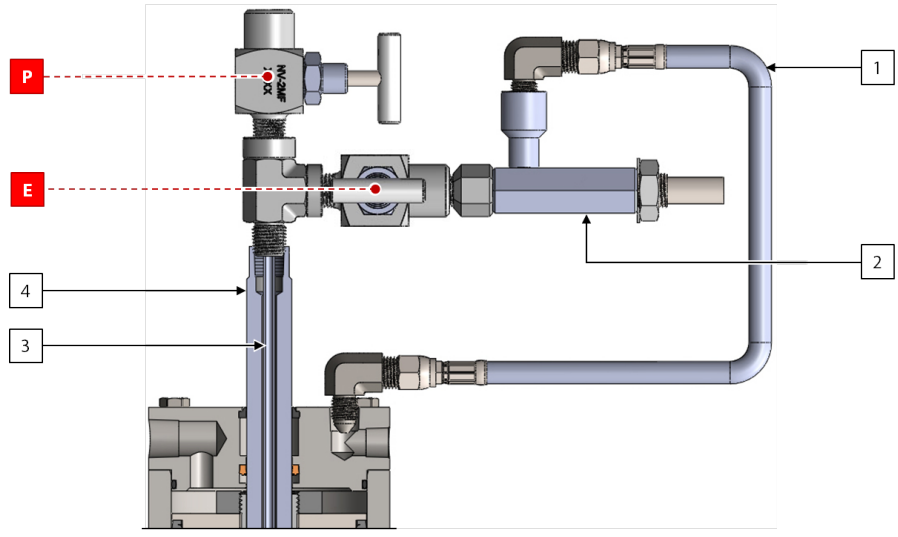
Welker recommends noting the position of the jam nut on the outer shaft to ease reassembly.

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, D-Style Collection Head Maintenance,* for instructions on performing maintenance on the collection head.

Purge Assembly

8. Unscrew the sample outlet flexline from the elbow above the sample outlet (*Figure 12*).

Figure 12: Outlet Assembly With Purge

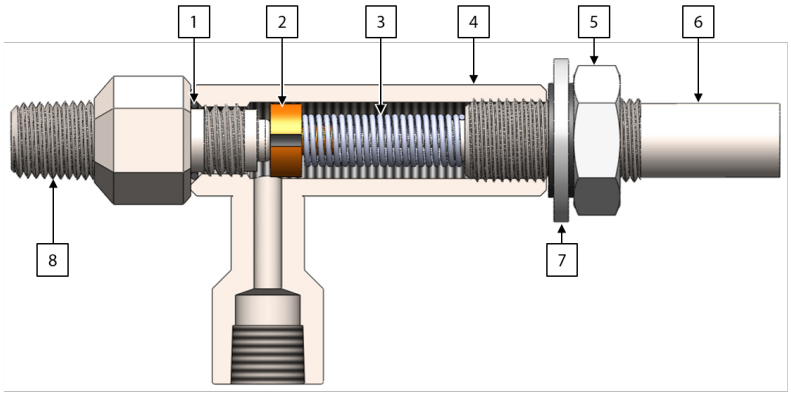


No.	Description
1	Sample Outlet Flexline
2	External Adjustable Sand Relief
3	Purge Tube
4	Insertion Shaft
E	Emergency Shutoff Valve
P	Purge Valve

9. 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.
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 13*).

Figure 13: External Sand Relief Maintenance Diagram



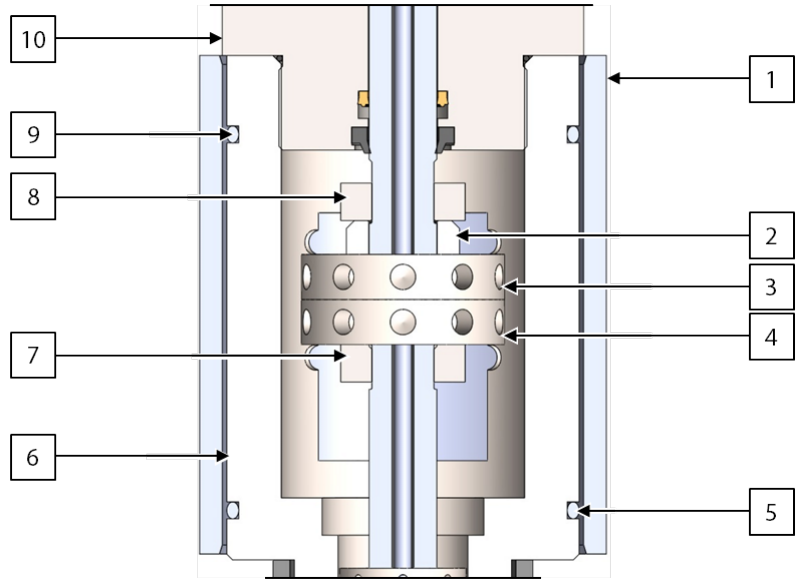
No.	Description
1	O-ring
2	Poppet
3	Spring
4	Body
5	Jam Nut
6	Adjusting Screw
7	ThredSeal™
8	Base

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 12*).
18. Screw the flexline into the elbow in the external sand relief (*Figure 12*).

Disassembling the Upper Housing

19. Unscrew the machine screws from the top cap and carefully remove the top cap from the motor housing (*Figure 15*).
20. Unscrew the setscrews from the base of the packing gland body (*Figure 16*).
21. Unscrew the packing gland body from the outer shaft.
22. 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 assembly.
23. Remove the dustcover from the packing gland body.
24. Loosen the setscrews in the upper and lower lock collars on the external adjustment body, and then remove the lock collars from the insertion shaft assembly (*Figure 14*). Take care not to misplace the pins that align the lock collars with the external adjustment body.

Figure 14: External Adjustment Assembly

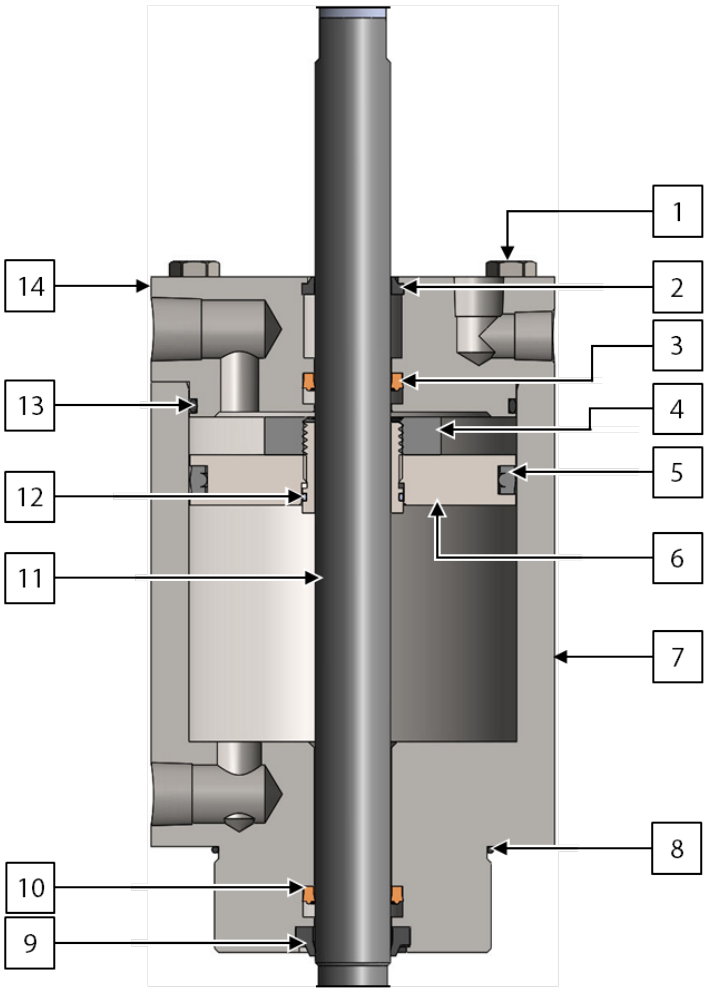


No.	Description
1	Dustcover
2	External Adjustment Body
3	Upper Adjustment Ring
4	Lower Adjustment Ring
5	O-ring
6	Packing Gland Body
7	Lower Lock Collar (2 Pieces)
8	Upper Lock Collar (2 Pieces)
9	O-ring
10	Motor Housing

25. Carefully slide the external adjustment body off the insertion shaft. Take care not to scratch or otherwise damage the insertion shaft assembly.
26. Carefully pull the insertion shaft out through the motor housing.

Motor Housing Assembly

Figure 15: Motor Housing Assembly

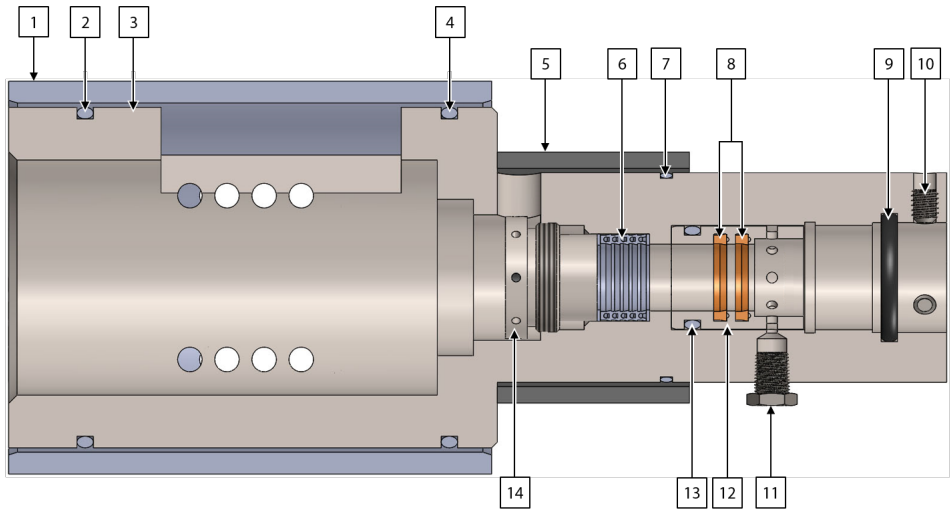


No.	Description
1	Hex Machine Screw (Qty. 6)
2	Wiper Ring
3	PolyPak®
4	Lock Collar
5	Crown Seal
6	Motor Piston
7	Motor Housing
8	O-ring
9	Wiper Ring
10	PolyPak®
11	Insertion Shaft
12	O-ring
13	O-ring
14	Top Cap

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

Packing Gland Body

Figure 16: Packing Gland Assembly



No.	Description
1	Dustcover
2	O-ring
3	Packing Gland Body
4	O-ring
5	Gland Cover
6	V-ring Packing
7	O-ring
8	PolyPak® (Qty. 2)
9	O-ring
10	Setscrew (Qty. 3)
11	Lubrication Port (Plugged)
12	Cartridge Seal Body
13	O-ring
14	Packing Adjustment Nut

33. Replace the O-rings on the packing gland body.
34. Remove the plug from the lubrication port, and then slide the gland cover off the packing gland body.
35. Unscrew the packing adjustment nut from the packing gland body.
36. Inspect the wiper ring in the packing adjustment nut. Replace it if it shows signs of wear or damage.
37. Replace the V-ring packing in the packing gland body. The V-ring packing should be installed so that the "V" is open to the product pressure.
38. Remove the cartridge seal body from the packing gland body.
39. Install a replacement cartridge seal body to the packing gland body.
40. Screw the packing adjustment nut into the packing gland body.
41. Replace the O-ring in the packing gland body.

Reassembling the Upper Housing

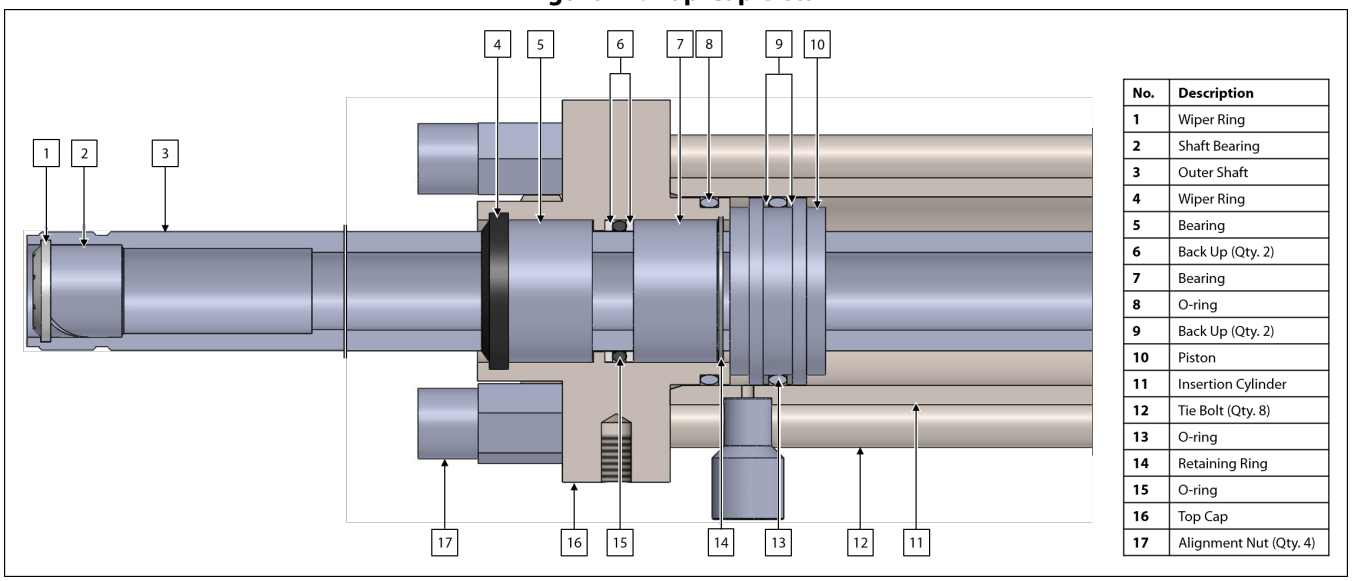
42. Carefully slide the external adjustment body onto the insertion shaft. The lock collar grooves in the insertion shaft should be accessible on both sides of the external adjustment body.
43. Install the lower lock collar to the groove below the external adjustment body and align the pin hole in the lock collar with the pin in the external adjustment body.

> ⚠ The lower lock collar must be installed to the insertion shaft assembly before the upper lock collar.

44. Install the upper lock collar to the groove above the external adjustment body and align the pin hole in the lock collar with the pin in the external adjustment body.
45. Tighten the setscrews in the upper and lower lock collars to secure the adjustment assembly to the insertion shaft.
46. Carefully insert the insertion shaft assembly through the packing gland body, taking care not to scratch the shaft.
47. Slide the gland cover onto the packing gland body, and then return the plug to the lubrication port.
48. Slide the dustcover onto the packing gland body.
49. Carefully slide the motor housing onto the insertion shaft, taking care not to scratch the shaft.
50. Carefully screw the motor housing into the packing gland body.
51. Return the top cap to the top of the insertion shaft and carefully slide the top cap down to the motor housing.
52. Bolt the top cap in place.
53. Set the upper housing and insertion shaft assembly aside.

Top Cap and Shaft Maintenance

Figure 17: Top Cap Detail

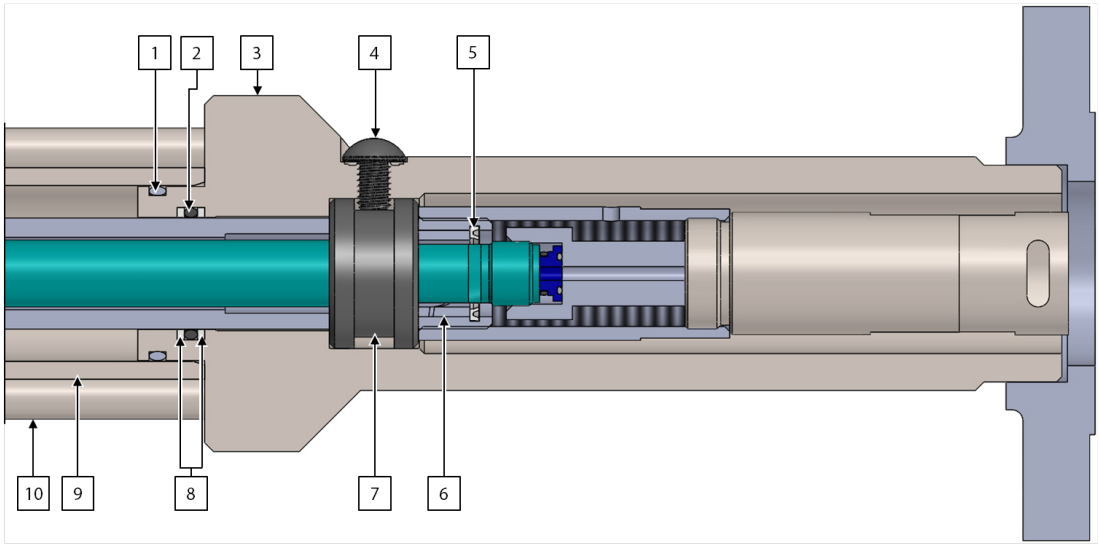


No.	Description
1	Wiper Ring
2	Shaft Bearing
3	Outer Shaft
4	Wiper Ring
5	Bearing
6	Back Up (Qty. 2)
7	Bearing
8	O-ring
9	Back Up (Qty. 2)
10	Piston
11	Insertion Cylinder
12	Tie Bolt (Qty. 8)
13	O-ring
14	Retaining Ring
15	O-ring
16	Top Cap
17	Alignment Nut (Qty. 4)

54. Loosen and remove the lock collar from the outer shaft (*Figure 3*).
55. Remove the heavy hex nuts and alignments nuts, and then slide the top cap off the outer shaft.
56. Inspect the retaining ring, bearing, and wiper ring in the top cap. Replace them if they show signs of wear or damage.
57. Replace the O-rings and back ups in the top cap.
58. Remove the outer shaft from the insertion cylinder.
59. Inspect the wiper ring and shaft bearing in the outer shaft. Replace them if they show signs of wear or damage.
60. Replace the O-ring and back ups on the piston.

Lubricator Body Maintenance

Figure 18: Lubricator Body Detail



No.	Description
1	O-ring
2	O-ring
3	Lubricator Body
4	Stat-O-Seal® & Buttonhead Socket Cap Screw
5	U-cup

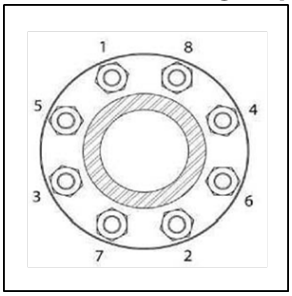
No.	Description
6	Shaft Bearing
7	Lubricator Bushing
8	Back Up (Qty. 2)
9	Insertion Cylinder
10	Tie Bolt (Qty. 8)

61. With the collection head and upper housing removed, carefully pull the outer shaft out of and the insertion cylinder off the lubricator body. As necessary, remove the tie bolts.
62. Inspect the insertion cylinder for scratches or damage. If scratches or damage are present, repair or replace as necessary.
63. 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.
64. Inspect the shaft bearing in the outer shaft. Replace it if it shows signs of wear or damage.
65. Replace the U-cup in the outer shaft. The U-cup should be installed so that the "U" is open to the product pressure.
66. Replace the O-rings, back ups, and Stat-O-Seal® in the lubricator body.
67. Inspect the lubricator bushing in the lubricator body. Replace it if it shows signs of wear or damage.

Reassembly

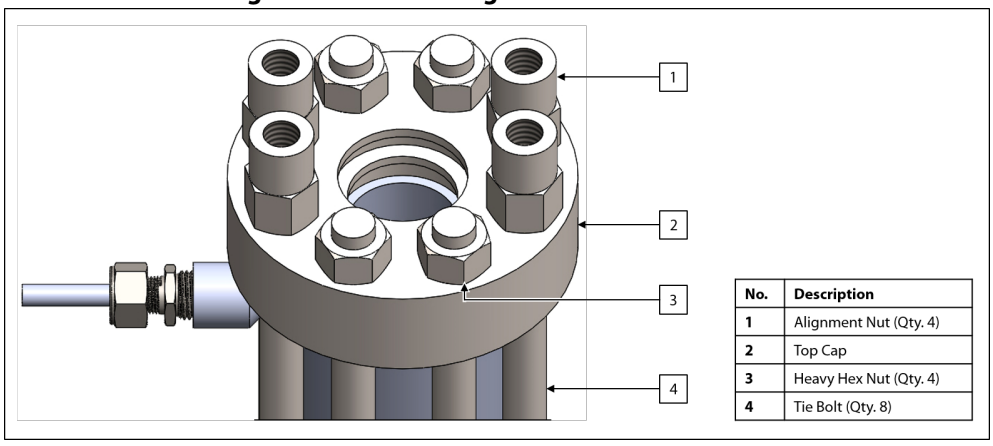
68. Carefully slide the insertion cylinder onto the lubricator body.
69. Coat the inside of the top end of the insertion cylinder with lubricant. The bottom of the insertion cylinder can be identified by its vent port.
70. Lightly lubricate the outer shaft.
71. Slide the outer shaft into the lubricator body.
72. Carefully slide the top cap onto the top end of the outer shaft and down to the insertion cylinder.
73. As necessary, install the tie bolts following a cross-bolting sequence (*Figure 19*).

Figure 19: Cross-Bolting Sequence



74. Install the four (4) alignment nuts 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 20*). Location of the four (4) alignment nuts is critical.

Figure 20: Correct Alignment Nut Installation



No.	Description
1	Alignment Nut (Qty. 4)
2	Top Cap
3	Heavy Hex Nut (Qty. 4)
4	Tie Bolt (Qty. 8)

75. Following a cross-bolting sequence, tighten the alignment nuts and heavy hex nuts to the appropriate torque (*Figure 19*, *Figure 20*, 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

76. Carefully slide the lock collar onto the outer shaft, and then tighten the lock collar cap screws.
77. With the upper housing assembly attached to the insertion shaft, insert the insertion shaft into the outer shaft.
78. 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.
79. Insert the purge tube into the insertion shaft, and then screw the purge assembly into the insertion shaft.

80. Reconnect the flexline at the sample outlet.
81. Remove the plug from the lubrication port, and then install an appropriately sized grease fitting (*Figure 1*).
82. Inject Welker Great Barrier Sealant™ into the grease fitting until the outer shaft is full of Welker Great Barrier Sealant™.
83. Once properly lubricated, remove the grease fitting, and then return the plug to the lubrication port.
84. Tighten the collection head onto the outer shaft.
85. The unit is now ready for installation.

3.3 Troubleshooting

Table 3: 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 *Installation, Operation, and Maintenance* (IOM) *Manual* 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 *Installation, Operation, and Maintenance* (IOM) *Manual* 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 *Section 2.4, Setting the Sample Volume,* 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 (*Figure 10*).
	The relief on the inFlow™ ACE may be set too high.	Check the setting on the relief and adjust as necessary.

Table 3: 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 *Section 2.4, Setting the Sample Volume,* 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 (*Figure 10*).
	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-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

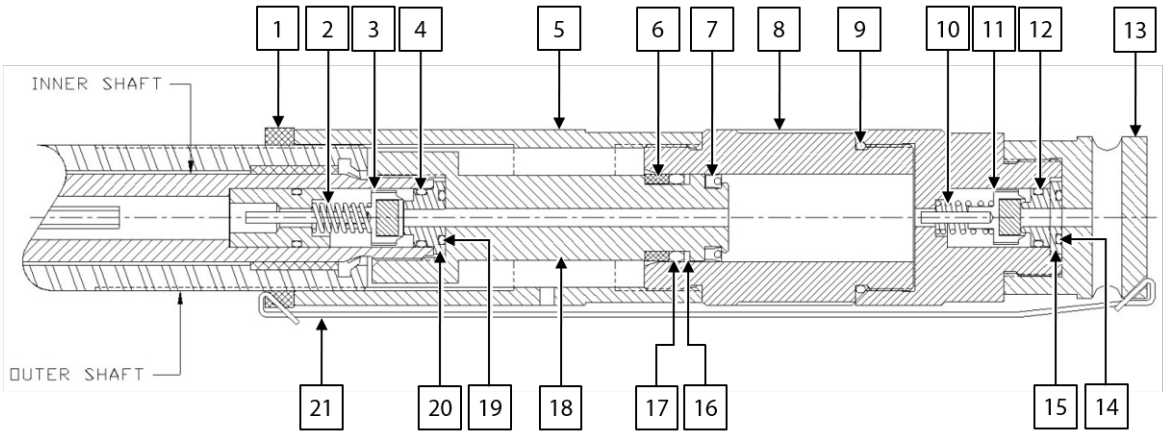
Other *Installation, Operation, and Maintenance* (IOM) *Manuals* suggested for use with this unit:

- 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: AD885BA (Standard inFlow™ ACE With AI Control™)
- Collection Head Drawing: AD168BS (C-Style Collection Head)
- Collection Head Drawing: AD224BW (D-Style Collection Head)

Figure B1: D-Style Collection Head With Sand Reliefs



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

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

No.	Description
15	Seat (Inlet Sand Relief)
16	Back Up
17	O-ring
18	Piston
19	O-ring (Internal Sand Relief)
20	Seat (Internal Sand Relief)
21	Safety Wire

1. Loosen the jam nut and unscrew the collection head assembly from the outer shaft.
2. 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

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

Piston and Cylinder

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

Inlet Sand Relief

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

Reassembly

17. Insert the inlet sand relief into the cylinder base, and then screw the relief cap onto the cylinder base.
18. Screw the cylinder base with relief cap onto the collection head.
19. Insert the internal sand relief into the piston.
20. If performing full maintenance on the inFlow™ ACE, set the collection head aside and continue to the next step in *Section 3.2, Maintenance*. If maintenance is only being performed on the collection head, screw the piston onto 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.
21. 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

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