WELKER

INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

WELKER® INLOOP™ ACE CRUDE OIL SAMPLER

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MANUAL NUMBER
IOM-224

REVISION
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IMPORTANT SAFETY INFORMATION
READ ALL INSTRUCTIONS

Notes emphasize information and/or provide additional information to assist the user.

Caution messages appear before procedures that could result in damage to equipment if not observed.

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

This manual is intended to be used as a basic installation and operation guide for the Welker® inLoop™ 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 inLoop™ 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 inLoop™ ACE Crude Oil Sampler, please contact a Welker® representative immediately.

Phone: 281.491.2331
Address: 13839 West Bellfort Street
Sugar Land, TX 77498

1.1 Introduction

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

If you have any questions, please call Welker® at 1.281.491.2331.

**The following procedures have been written for use with standard Welker® parts and equipment. Assemblies that have been modified may have additional requirements and specifications that are not listed in this manual.*

1.2 Product Description

The Welker® *inLoop™ ACE* Crude Oil Sampler is a bypass sampler designed to extract a representative sample of liquid product from the flowing stream. With protection from internal check valves designed for sandy oils, this sampler is capable of sampling product containing sand.

The inLoop™ ACE was specifically designed to be installed as part of a fast loop, which will provide the sampler with a continuous supply of product. 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.

Designed with ease of use in mind, the external sample volume adjustment simplifies operation of the inLoop™ ACE even further. The external adjustment allows the operator to adjust the sample volume without having to remove the inLoop™ ACE from the fast loop.

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

1.3 Specifications

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

Table 1: inLoop™ ACE Specifications	
Application	Bypass Sampling
Products Sampled	Liquids Compatible With the Materials of Construction (See *Figure 1*)
Materials of Construction	316/316L Stainless Steel Wetted Parts, Anodized Aluminum Non-Wetted Parts, PTFE, and Viton® Others Available
Maximum Allowable Operating Pressure	**FNPT or VCO:** 1480 psig @ -20 °F to 100 °F (*102 barg @ -28 °C to 37 °C*) **150 ANSI Stainless Steel:** 275 psig @ -20 °F to 100 °F (*18 barg @ -28 °C to 37 °C*) **300 ANSI Stainless Steel:** 720 psig @ -20 °F to 100 °F (*49 barg @ -28 °C to 37 °C*) **600 ANSI Stainless Steel:** 1440 psig @ -20 °F to 100 °F (*99 barg @ -28 °C to 37 °C*)
Fast Loop Connection	1" FNPT (Standard) 1" VCO Fittings 1" – 150, 300, or 600 ANSI Flanges
Sample Outlet Connection	¼" FNPT
Motor Housing Actuation Ports	¼" FNPT ½" FNPT ⅜" FNPT (Standard)
Utility Requirement	**Hydraulic or Pneumatic Supply for Motor Operation:** 50–150 psig (*3.4–10.3 barg*)
Sample Volume	0.5–5 cc (Adjustable)
Features	External Sample Volume Adjustment Internal Inlet Check Valve Internal Outlet Check Valve
Options	External Sand Relief Panel Mounting Bracket Purge With Valve

1.4 Equipment Diagrams

Figure 1: Standard inLoop™ ACE Diagram

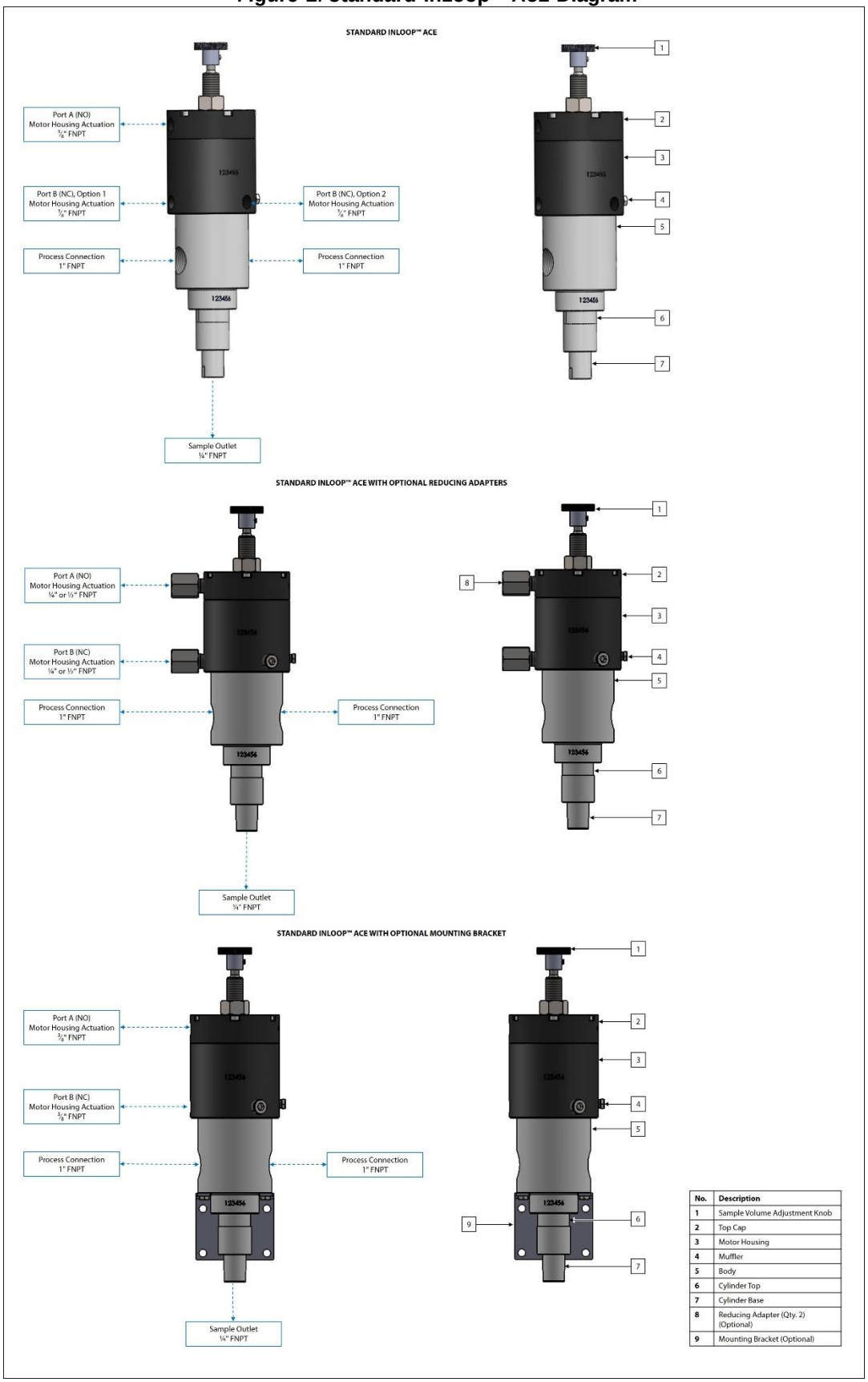
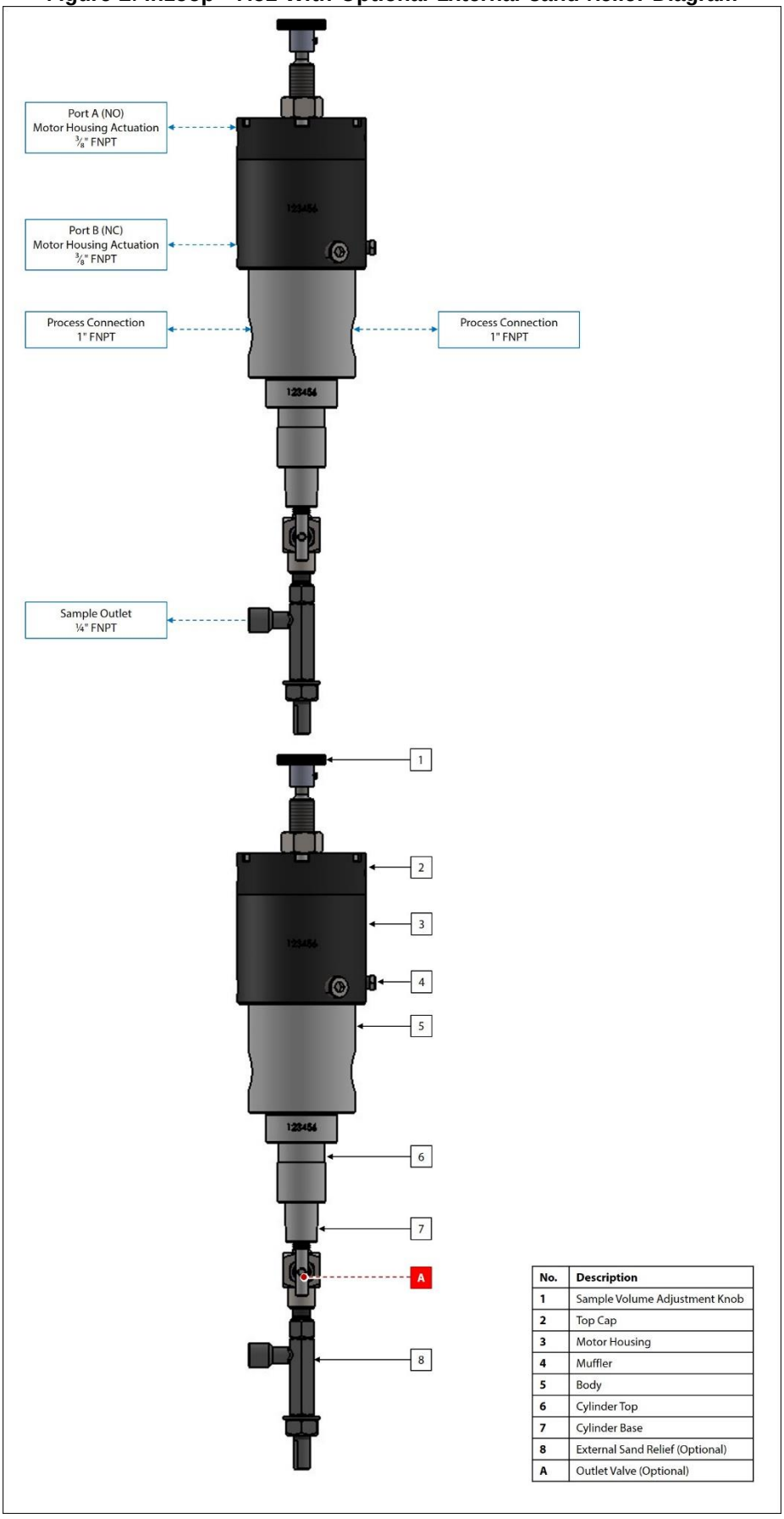
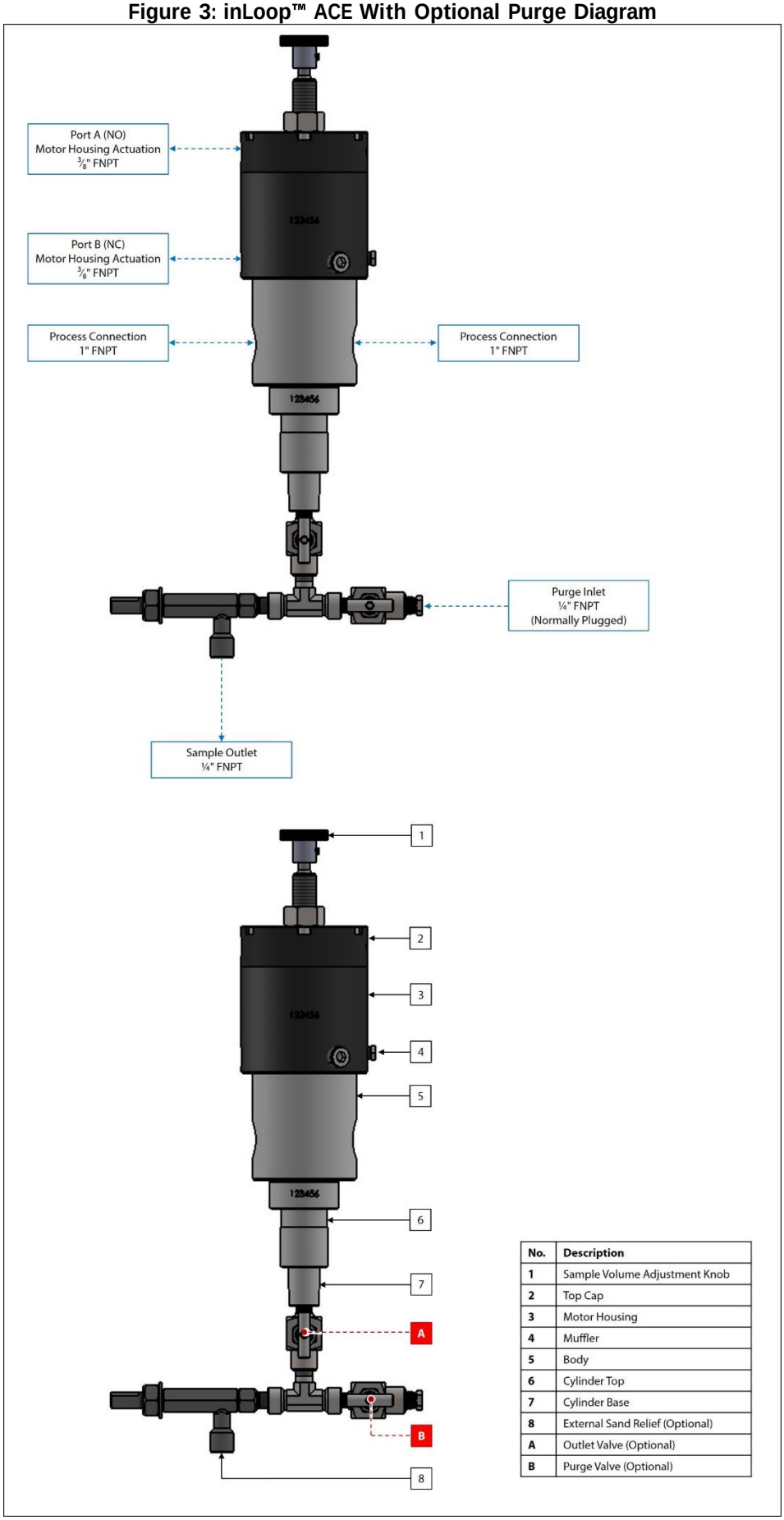


Figure 2: inLoop™ ACE With Optional External Sand Relief Diagram



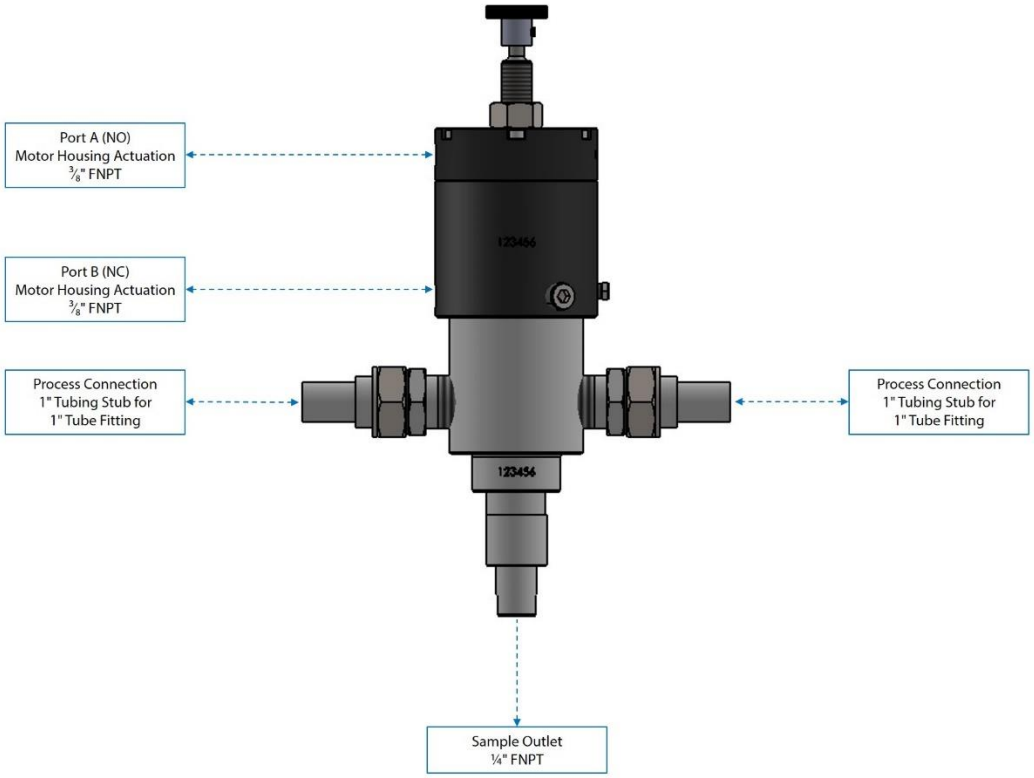
No.	Description
1	Sample Volume Adjustment Knob
2	Top Cap
3	Motor Housing
4	Muffler
5	Body
6	Cylinder Top
7	Cylinder Base
8	External Sand Relief (Optional)
A	Outlet Valve (Optional)

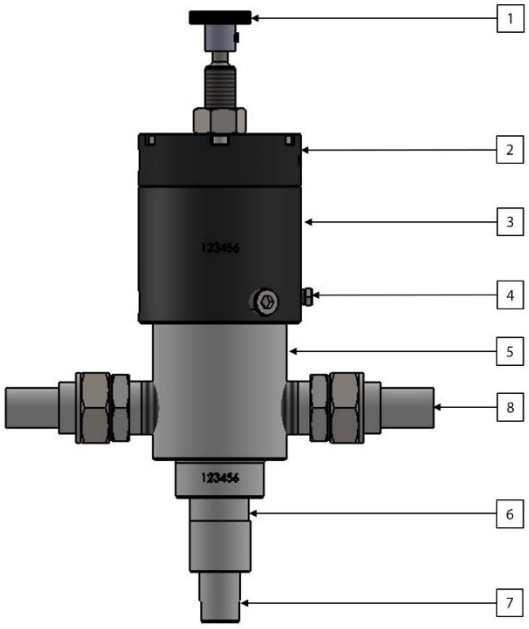
Figure 3: inLoop™ ACE With Optional Purge Diagram



No.	Description
1	Sample Volume Adjustment Knob
2	Top Cap
3	Motor Housing
4	Muffler
5	Body
6	Cylinder Top
7	Cylinder Base
8	External Sand Relief (Optional)
A	Outlet Valve (Optional)
B	Purge Valve (Optional)

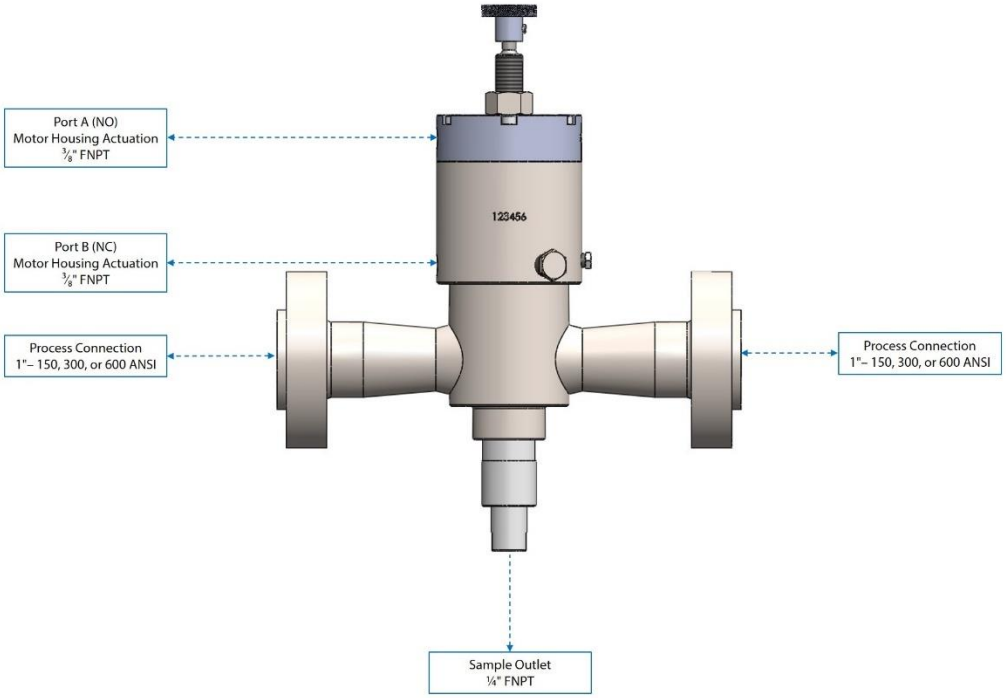
Figure 4: inLoop™ ACE With Optional VCO Connection Diagram

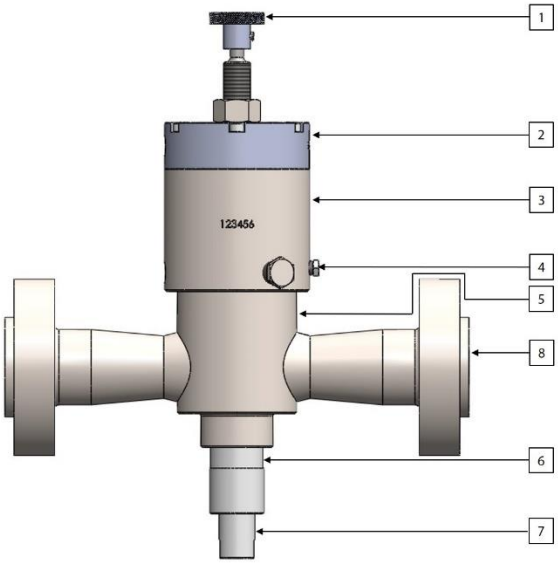




No.	Description
1	Sample Volume Adjustment Knob
2	Top Cap
3	Motor Housing
4	Muffler
5	Body
6	Cylinder Top
7	Cylinder Base
8	VCO Tube Adapter (Qty. 2) (Optional)

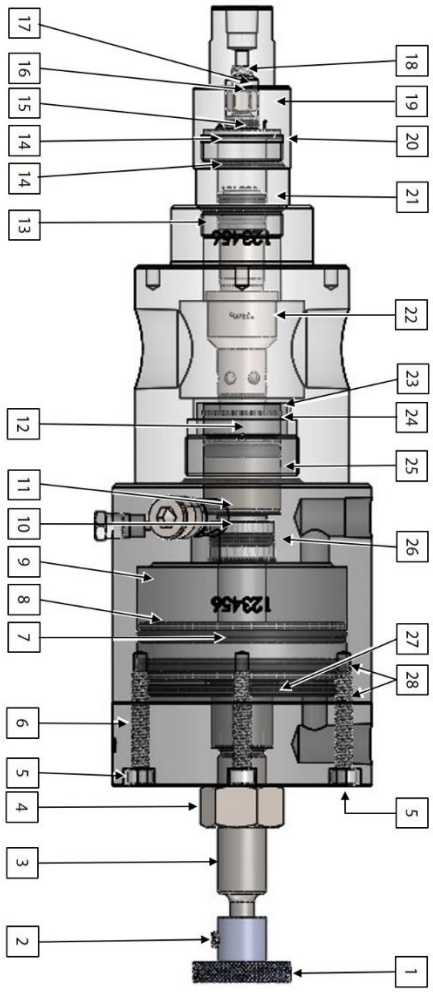
Figure 5: inLoop™ ACE With Optional Flanged Connection Diagram





No.	Description
1	Sample Volume Adjustment Knob
2	Top Cap
3	Motor Housing
4	Muffler
5	Body
6	Cylinder Top
7	Cylinder Base
8	Process Connection Flange (Qty. 2) (Optional)

Figure 6: inLoop™ ACE System Diagram



No.	Description
1	Sample Volume Adjustment Knob
2	Knob Set Screw
3	Adjustment Screw
4	Lock Nut
5	Cap Screws (Total = 6)
6	Top Cap
7	O-ring
8	O-ring
9	Motor Housing
10	Retaining Ring
11	Bearing for Shaft
12	Shaft
13	Body
14	O-ring (Total = 2)

No.	Description
15	O-ring
16	O-ring
17	Poppet
18	Spring
19	Cylinder Base
20	Seat
21	Cylinder Top
22	Shaft Adapter
23	O-ring
24	Retainer Ring
25	Cartridge Seal Body Assembly
26	O-ring
27	Actuator Piston
28	U-cup (Total = 2)

2.1 Before You Begin

After unpacking the unit, check the equipment for compliance and any damage that may have occurred during shipment. Immediately contact a Welker® representative if you received damaged equipment.

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

2.2 Installing the Unit

Note the inLoop™ ACE is bidirectional.

1. Depressurize the fast loop.

STOP The fast loop must be depressurized prior to installing and removing the unit.

2. If the inLoop™ ACE has an FNPT or VCO process connection, continue to step 3. If the inLoop™ ACE has a flanged process connection, proceed to step 6.

FNPT or VCO Process Connection

3. Using 1" tubing or pipe, connect from the fast loop to the process inlet on the inLoop™ ACE (*Figure 1*, *Figure 2*, *Figure 3*, or *Figure 4*).
4. Using 1" tubing or pipe, connect from the process outlet on the inLoop™ ACE to the fast loop (*Figure 1*, *Figure 2*, *Figure 3*, or *Figure 4*).
5. Proceed to step 15.

Flanged Process Connection

6. Position an appropriately sized gasket on one mating flange connection (*Figure 6*).
7. Install one flange of the inLoop™ ACE to the first mating flange connection.
8. Following a cross-bolting sequence, install bolts and nuts to the flanges.
9. Tighten all bolts to the appropriate torque.
10. Position an appropriately sized gasket on the other mating flange connection (*Figure 6*).
11. Install the other flange of the inLoop™ ACE to the second mating flange connection.
12. Following a cross-bolting sequence, install bolts and nuts to the flanges.
13. Tighten all bolts to the appropriate torque.
14. Continue to step 15.

Completing Installation

15. Using appropriately sized tubing, connect from the sample outlet to an appropriate customer-supplied sample container, such as a Welker® TCC Transportable Crude Oil Container for crude oil or a Welker® Constant Pressure Cylinder for light liquids (*Figure 1*, *Figure 2*, *Figure 3*, *Figure 4*, or *Figure 5* and *Table 2*).

If the inLoop™ ACE is not equipped with a valve on the sample outlet, Welker® recommends installing a valve to the sample outlet. This will be outlet valve A.

Table 2: Recommended Tubing Size – Sample Container

Product Sampled	Tubing Size
Light Liquids or Light Crude Oil	Minimum ¼"
Medium or Heavy Crude Oil	Minimum ⅜"

Customer-supplied tubing must slope downward from the inLoop™ ACE to the sample container.

16. Using appropriately sized tubing, connect from the normally open port on the solenoid to port A on the motor housing (*Figure 1*, *Figure 2*, *Figure 3*, *Figure 4*, or *Figure 5* and *Table 3*). Using appropriately sized tubing, connect from the normally closed port on the solenoid to port B on the motor housing (*Figure 1*, *Figure 2*, *Figure 3*, *Figure 4*, or *Figure 5* and *Table 3*).

Table 3: Recommended Tubing Size – Motor Operation

Utility Supply for Motor Operation	Tubing Size
Pneumatics	Minimum ¼"
Hydraulics	Minimum ⅜"

17. If applicable, ensure that outlet valve A is closed (*Figure 2* or *Figure 3*).
18. If applicable, ensure that the optional external sand relief has been set (*Figure 2* or *Figure 3*).
19. If applicable, ensure that the customer constant pressure cylinder has been pre-charged and that all cylinder valves are closed.

2.3 Commissioning / Verifying the Sample Volume

20. Pressurize the fast loop.
21. Check for leaks and repair as necessary.
22. Turn ON the hydraulic or pneumatic supply.
23. As, necessary, adjust the hydraulic or pneumatic supply to 75–100 psig.
24. Open valve A (*Figure 2* or *Figure 3*) – reverse of step 17.
25. Actuate the solenoid on/off and check grab (i.e., sample) volume.

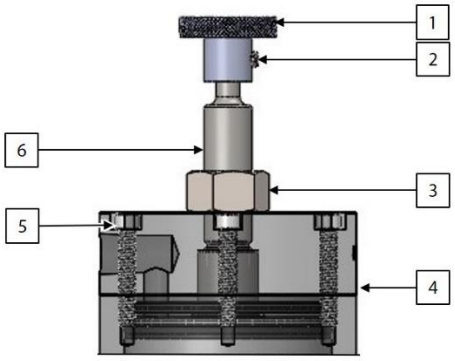
Welker® recommends the Welker® Checkpoint™ Sample Bite Verification Panel for use with this unit.

26. Ensure that the Welker® Checkpoint™ Sample Bite Verification Panel has been installed correctly. Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the Checkpoint™ for installation instructions.
27. Using appropriately sized customer-supplied tubing, connect from the sample outlet on the inLoop™ ACE to the sample inlet on the Checkpoint™ (*Figure 1*, *Figure 2*, *Figure 3*, *Figure 4*, or *Figure 5*).
28. Decide how many actuations will be made to verify the sample volume.

Welker® recommends a minimum of ten (10) actuations to verify the sample volume.

29. Follow the instructions in the *Installation, Operation, and Maintenance* (IOM) *Manual* for the Checkpoint™ to complete sample volume verification.
30. As necessary, adjust the sample volume of the inLoop™ ACE (*Figure 7*).
31. Check for leaks and repair as necessary.
32. Set the actuation time based on process conditions.

Figure 7: External Sample Volume Adjustment



No.	Description
1	Sample Volume Adjustment Knob
2	Knob Set Screw
3	Lock Nut
4	Top Cap
5	One of Six Top Cap Screws
6	Adjustment Screw

Loosen the Hex Nut on the Adjustment Screw.
To increase the volume, turn the Adjustment Knob clockwise.
To decrease the volume, turn the Adjustment Knob counterclockwise.
Tighten the Hex Nut on the Adjustment Screw to secure the Adjustment Screw at the desired volume.

Two (2) full rotations of the Sample Volume Adjustment Knob is **approximately** 1 cc.

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

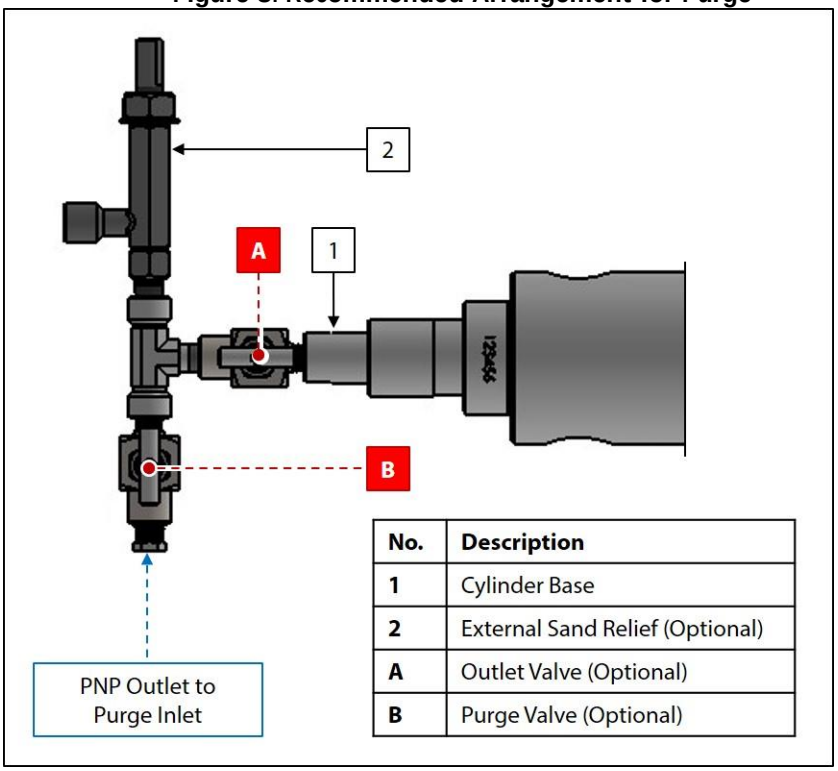
2.4 Purging the Unit

Welker® recommends the Welker® PNP Plug & Purge Panel for use with this unit.

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

33. If the inLoop™ ACE is not equipped with the optional purge, Welker® recommends installing a customer-supplied tee fitting with valve(s) to the sample outlet so that the inLoop™ ACE can be purged (*Figure 8*).

Figure 8: Recommended Arrangement for Purge



No.	Description
1	Cylinder Base
2	External Sand Relief (Optional)
A	Outlet Valve (Optional)
B	Purge Valve (Optional)

34. Ensure that the Welker® PNP Plug & Purge Panel has been installed correctly. Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the PNP for installation instructions.
35. Using ¼" tubing, connect from the purge outlet on the PNP to purge valve B (*Figure 8*).
36. Ensure that an appropriate inert gas supply is connected to the PNP. As necessary, refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the PNP for instructions.
37. If applicable, ensure that the PNP pressure transmitter has been configured. As necessary, refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the PNP for instructions.
38. Set the purge pressure to a pressure appropriate for the sampling system. Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the PNP for instructions.
39. Open purge valve B (*Figure 8*).
40. Follow the instructions in the *Installation, Operation, and Maintenance* (IOM) *Manual* for the PNP to complete the purge.

2.5 Operating the Unit

41. Set the timer or controller to actuate the solenoid at the desired sampling actuation frequency based on the sampling equations provided (*Figure 9*).

Figure 9: Sampling Frequency Equations

Liquid Sampling, Proportional-to-Flow Collection
Equation 1: Number of Samples Needed $\text{Number of Samples Needed to Fill to 80\%} = \frac{(\text{Container Size (cc)} * 0.8)}{\text{Bite Size (cc)}}$ ***Equation 2: Proportional-to-Flow*** $\text{Volume of Flow Between Sample Grabs} = \frac{\text{Batch Size (Total Volume to Be Sampled)}}{\text{Number of Samples Needed (Eq. 1)}}$
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 $\text{Number of Samples Needed to Fill to 80\%} = \frac{(\text{Container Size (cc)} * 0.8)}{\text{Bite Size (cc)}}$ ***Equation 2: Timed Sampling*** $\text{Time Between Sample Grabs} = \frac{\text{Total Time in Sample Period}}{\text{Number of Samples Needed (Eq. 1)}}$
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 thermal expansion.

Note that the sample volume of the inLoop™ ACE is adjustable between 0.5–5 cc per actuation.

42. As necessary, turn on electrical power and activate the hydraulic or pneumatic supply to actuate the solenoid at the set sampling frequency.

Note: Actuation should be on for approximately 2 seconds and, at minimum, off for approximately 2 seconds to complete the cycle.

43. Collect a sample from the sample outlet to ensure that the sample volume collected is the same as the desired sample volume. See *Section 2.4, Verifying the Sample Volume,* for instructions.

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

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. Welker® recommends inspecting the poppets in the internal check valves semi-annually, depending on sample outlet pressure. Note that sample rate and product abrasiveness also impact the frequency of poppet replacement.
3. 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.

Straight threaded parts without lock washers have the potential to loosen over time due to vibration and/or other factors. Welker recommends applying a medium strength thread-locking fluid to such parts during reassembly.

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 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.

4. All maintenance and cleaning of the unit should be performed on a smooth, clean surface.
5. Welker® recommends having the following tools available for maintenance. Please note that the exact tools required may vary by model.
    a. 6"–8" Crescent Wrench (Qty. 2)
    b. 14" Crescent Wrench
    c. Hex Key Set
    d. Medium Strength Thread-locking Fluid
    e. Needle Nose Pliers
    f. Seal Pick
    g. Long Phillips Screwdriver (Approximately 10")
    h. Rubber Mallet

3.2 Maintenance

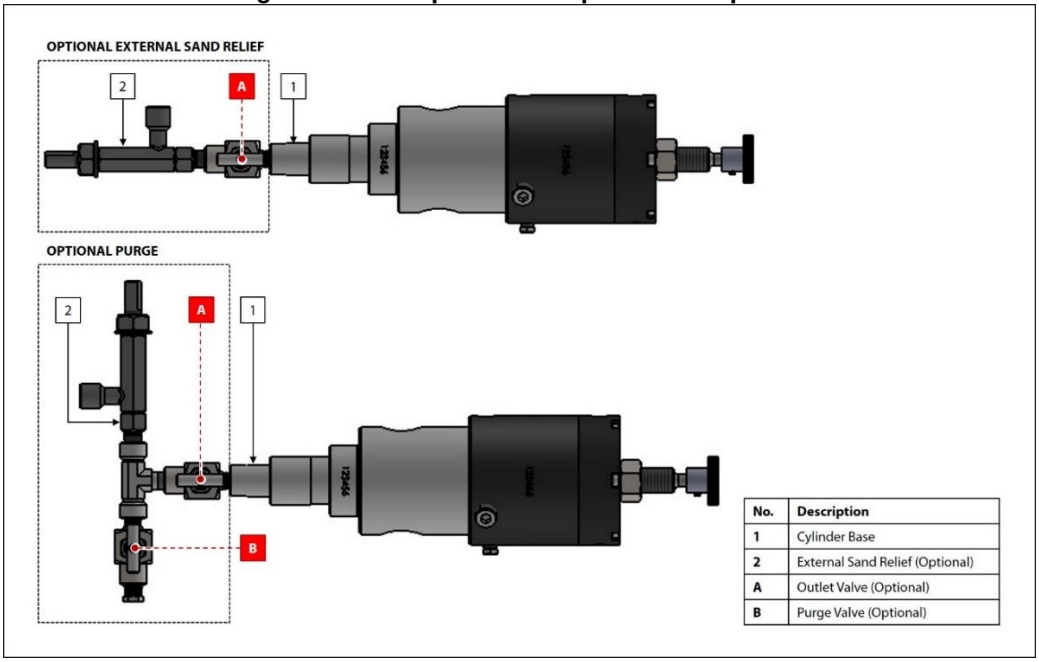
The fast loop must be depressurized prior to installing and removing the unit.

If maintenance is to be performed on the fast loop, the inLoop™ ACE must first be removed from the fast loop. Failure to remove the unit from the fast loop prior to performing maintenance could damage the unit.

1. Depressurize the fast loop.
2. Deactivate or turn OFF the hydraulic or pneumatic supply.
3. Depressurize, drain, and disconnect the hydraulic or pneumatic supply lines.
4. Disconnect the customer-supplied sample container from the sample outlet.
5. Disconnect the inLoop™ ACE from the fast loop.
6. As necessary, drain any remaining hydraulic oil from the motor housing.
7. If contaminated with anything corrosive, toxic, or dirty, the inLoop™ ACE needs to be thoroughly cleaned and decontaminated.
8. Lay the inLoop™ ACE on a smooth, clean surface.
9. If the inLoop™ ACE is equipped with optional equipment at the sample outlet, continue to step 1 in the "Optional Equipment" section. If the inLoop™ ACE is not equipped with optional equipment at the sample outlet, please proceed to step 1 in the "Collection Head (Bottom) Assembly Maintenance" section.

Optional Equipment Maintenance

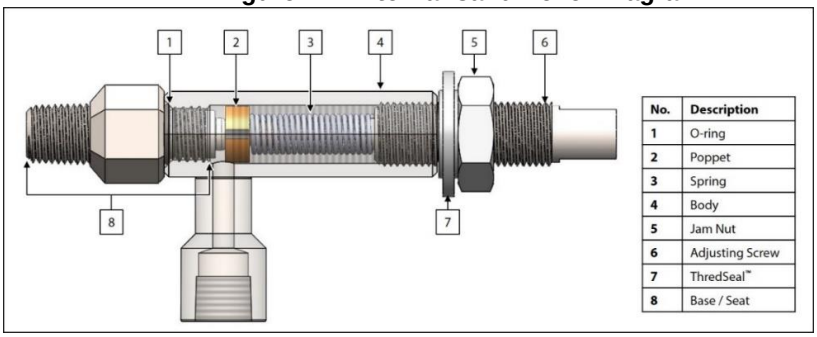
Figure 10: inLoop™ ACE Sample Outlet Options



No.	Description
1	Cylinder Base
2	External Sand Relief (Optional)
A	Outlet Valve (Optional)
B	Purge Valve (Optional)

1. Remove the optional equipment from the sample outlet by unscrewing the assembly from the cylinder base (*Figure 10*).
2. When removing and maintaining the optional purge, please refer to *IOM-165* (*Welker® PNP Plug & Purge Panel*). For external sand relief maintenance, please complete the following steps.
3. Unscrew the external sand relief (*Figure 10*).
4. Unscrew the base / seat from the body (*Figure 11*).
5. Replace the O-ring on the base of the external sand relief (*Figure 11*).

Figure 11: External Sand Relief Diagram

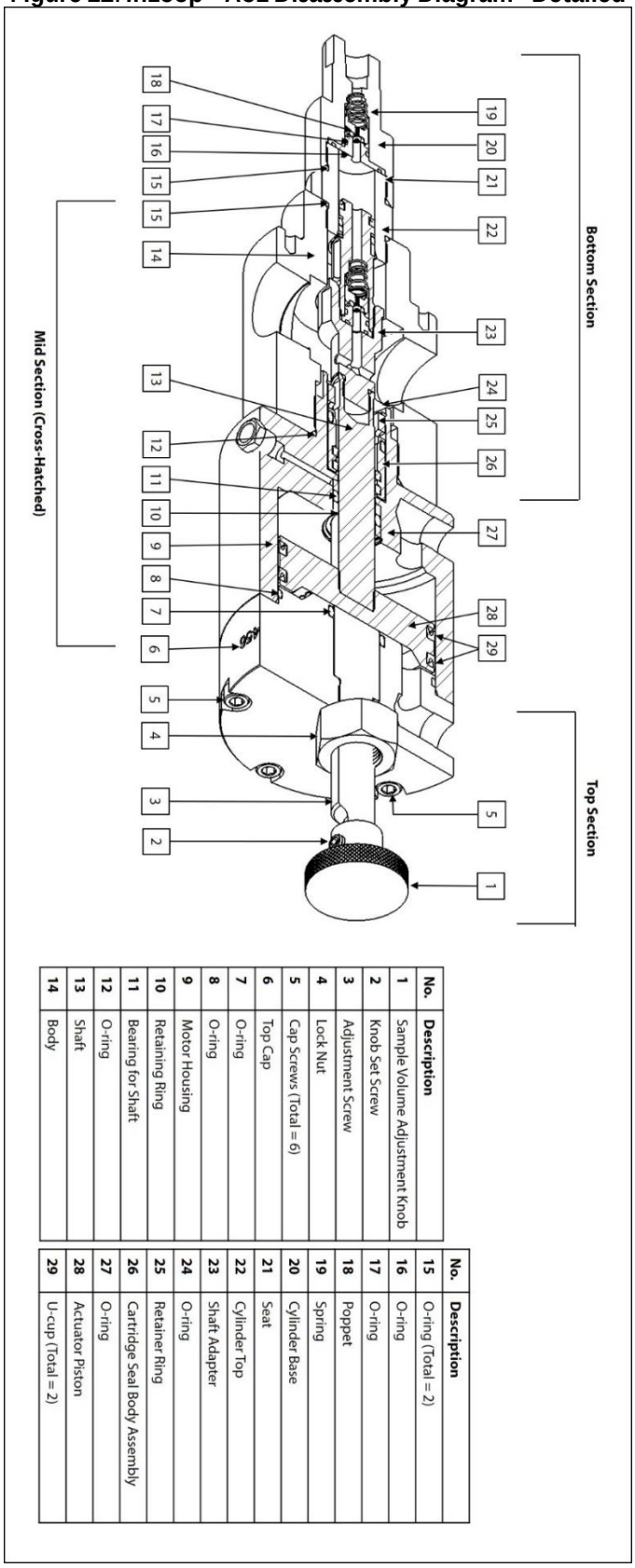


No.	Description
1	O-ring
2	Poppet
3	Spring
4	Body
5	Jam Nut
6	Adjusting Screw
7	ThredSeal™
8	Base / Seat

6. Unscrew the jam nut from the adjusting screw (*Figure 11*).
7. Inspect the seat for scratches or other damage (*Figure 11*). If scratches or other damage are present on the seat, replace the seat.
8. Inspect the elastomer on the poppet. If it is damaged, replace the poppet.
9. Inspect the ThredSeal™ and replace as needed.
10. Reassemble the external sand relief (*Figure 11*).
11. After inspection or replacement, bench test or adjust setting and tighten the jam nut.

Bottom, Top, and Midsection Assembly Maintenance

Figure 12: inLoop™ ACE Disassembly Diagram - Detailed



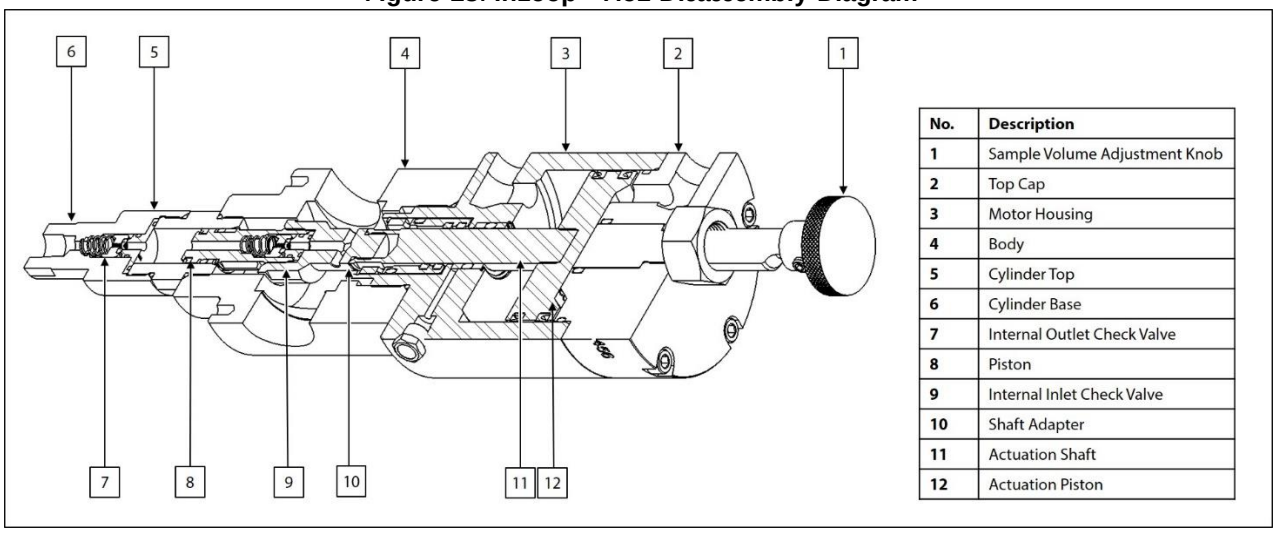
No.	Description
1	Sample Volume Adjustment Knob
2	Knob Set Screw
3	Adjustment Screw
4	Lock Nut
5	Cap Screws (Total = 6)
6	Top Cap
7	O-ring
8	O-ring
9	Motor Housing
10	Retaining Ring
11	Bearing for Shaft
12	O-ring
13	Shaft
14	Body

No.	Description
15	O-ring (Total = 2)
16	O-ring
17	O-ring
18	Poppet
19	Spring
20	Cylinder Base
21	Seat
22	Cylinder Top
23	Shaft Adapter
24	O-ring
25	Retainer Ring
26	Cartridge Seal Body Assembly
27	O-ring
28	Actuator Piston
29	U-cup (Total = 2)

Throughout the Maintenance Section, refer to *Figure 12* as necessary. As can be seen, the inLoop™ ACE consists of three (3) subassemblies—the bottom (collection head), top (upper housing), and midsection (motor housing) assemblies. NOTE: To expose the midsection, both the top and bottom assemblies need to be removed.

Collection Head (Bottom Section) Assembly Maintenance

Figure 13: inLoop™ ACE Disassembly Diagram

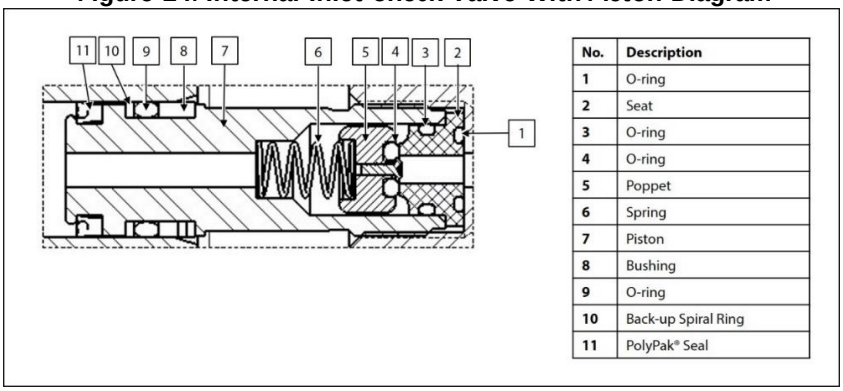


No.	Description
1	Sample Volume Adjustment Knob
2	Top Cap
3	Motor Housing
4	Body
5	Cylinder Top
6	Cylinder Base
7	Internal Outlet Check Valve
8	Piston
9	Internal Inlet Check Valve
10	Shaft Adapter
11	Actuation Shaft
12	Actuation Piston

1. Unscrew the cylinder base from the cylinder top and set the cylinder base aside. Note that by doing so, the internal outlet check valve will be removed.
1. Unscrew the cylinder top from the body.
2. Unscrew the body from the motor housing. Note the actuation shaft assembly will be exposed.
3. While holding the actuation shaft with a wrench at the wrench flats, use a second wrench to unscrew the shaft adapter and piston. Note the internal inlet check valve will be exposed.

Internal Inlet Check Valve Maintenance

Figure 14: Internal Inlet Check Valve With Piston Diagram



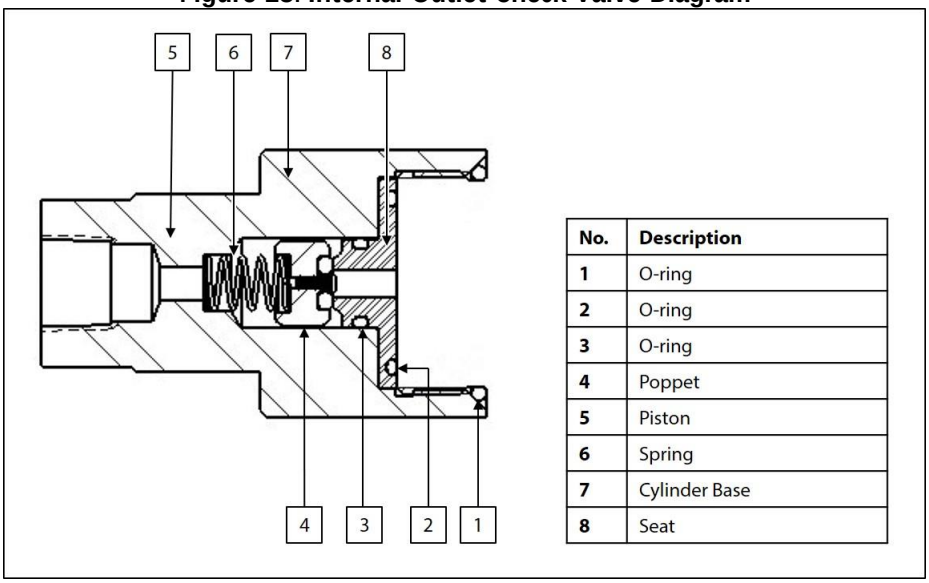
No.	Description
1	O-ring
2	Seat
3	O-ring
4	O-ring
5	Poppet
6	Spring
7	Piston
8	Bushing
9	O-ring
10	Back-up Spiral Ring
11	PolyPak® Seal

4. Unscrew the piston from the shaft adapter.
5. Unscrew the shaft adapter from the shaft.
6. Replace the O-ring on the shaft adapter.
7. Remove the seat, poppet, and spring from the piston.
8. Examine the seat for damage or wear. Replace as necessary.
9. As necessary, replace the two (2) O-rings on the seat and the O-ring on the poppet.
10. Examine the spring for damage or wear. Replace as necessary.

11. Inspect the bushing for signs of wear. Replace as necessary.
12. Replace the O-ring and PolyPak® seal on the piston.
13. Inspect the piston shaft adapter and cylinder top for scratches or other damage. Polish or replace as necessary.
14. Replace the O-ring on the cylinder top.

Internal Outlet Check Valve Maintenance

Figure 15: Internal Outlet Check Valve Diagram



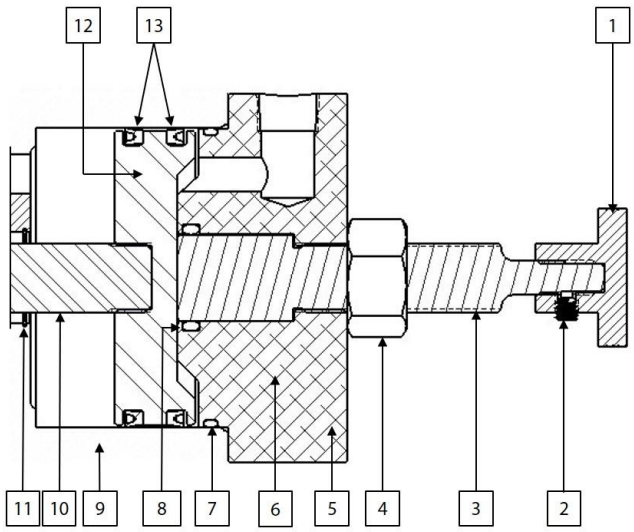
No.	Description
1	O-ring
2	O-ring
3	O-ring
4	Poppet
5	Piston
6	Spring
7	Cylinder Base
8	Seat

15. Examine the seat for damage or wear. Replace as necessary.
16. As necessary, replace the O-rings on the seat.
17. Examine the spring for damage or wear. Replace as necessary.
18. Examine the poppet for damage or wear. Replace as necessary.

Upper Housing (Top Section) Assembly Maintenance

Disassembling the Upper Housing

Figure 16: External Sample Volume Adjustment Assembly



No.	Description
1	Sample Volume Adjustment Knob
2	Set Screw
3	Adjustment Screw
4	Lock Nut
5	Cap Screws (Total = 6; Not Shown)
6	Top Cap
7	O-ring
8	O-ring
9	Motor Housing (Not Shown)
10	Shaft
11	Retaining Ring
12	Actuator Piston
13	U-cup (Total = 2)

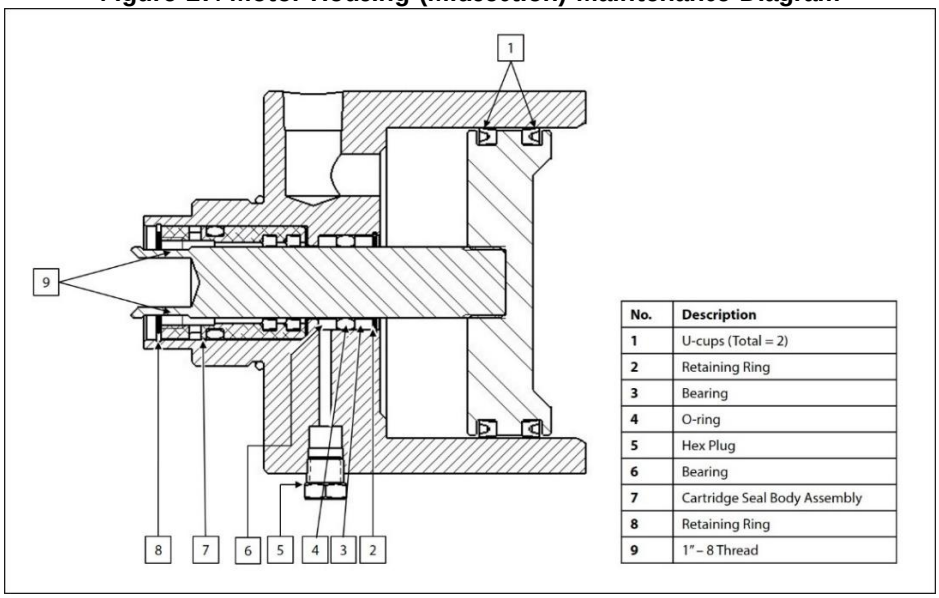
1. Using a hex key, unscrew and remove the six (6) cap screws from the top cap.
2. Remove the top cap from the motor housing.

Top Cap Maintenance

3. Remove set screw and remove the sample volume adjustment knob.
4. Remove lock nut.
5. Unscrew the adjustment screw until it comes out of the bottom of the top cap.
6. Replace the O-ring on the top cap (#8 in *Figure 16*).
7. Replace the other O-ring on the top cap (#7 in *Figure 16*).
8. Reassemble the top cap and set it aside.

Motor Housing (Midsection) Maintenance

Figure 17: Motor Housing (Midsection) Maintenance Diagram



No.	Description
1	U-cups (Total = 2)
2	Retaining Ring
3	Bearing
4	O-ring
5	Hex Plug
6	Bearing
7	Cartridge Seal Body Assembly
8	Retaining Ring
9	1" – 8 Thread

1. Insert a 10"-long Phillips screwdriver into the bottom of the motor housing, and then carefully tap it with a rubber mallet until the actuation piston has been extended far enough from the motor housing to be removed manually.

NOTE: With both the bottom section and the top cap (i.e., top section) removed, what remains is the midsection. Maintenance on the midsection can only proceed with the other two sections removed. Please see *Figure 12*.

As necessary, instead of the 10"-long Phillips screwdriver, use a clean wooden dowel or PVC pipe to gently push the actuation piston out of the motor housing. DO NOT use metal objects, as they may scratch and damage the unit.

2. Replace the two U-cups (see *Figure 17*).
3. Inspect the shaft for scratches, dings, wear marks, etc., and set aside.
4. Remove retaining ring (see *Figure 17*) at the base of the shaft.
5. Replace bearings and O-ring.
6. Remove retaining ring at the base of the shaft.
7. Remove cartridge seal body by screwing in to the 1" – 8 thread at the base of the cartridge. Or hook it with a small hex head or Allen wrench and pull it out.
8. Push in the new cartridge seal body and replace the retaining ring.
9. Remove the hex plug, put in lubricant, and put hex plug back in.
10. Put the actuator piston and shaft back in.
11. Put the top cap back on and screw in the six screws.
12. Reassemble the bottom portion of the inLoop™ ACE system and screw it into the shaft.
13. Attach either the external sand relief or the purge units into the bottom portion of the system (*Figure 10*).
14. Return to *Section 2.3, Commissioning / Verifying the Sample Volume* and follow the steps there.

3.3 Troubleshooting Guidelines

Table 4: inLoop™ ACE Troubleshooting Guidelines		
Issues	**Possible Causes**	**Solutions**
The inLoop™ ACE is not getting sample or is not getting enough sample.	Not enough pressure.	Set pressure to 75–125 psig.
	Solenoid is not cycling properly.	Check dwell time when actuated to assure enough time to obtain full supply pressure and full exhaust before starting the next cycle.
	Wrong grab size.	Adjust grab size to match the anticipated grab size.
	Low line pressure.	Unit requires 30–40 psig with the standard inlet check spring.
	Solenoid is short cycling.	Check batch size/time and maximum flow rate calculations against total volume and grab size.
	Damaged check valve or piston seat.	Inspect the sampler for possible maintenance or repair issues.
	Obstruction.	Verify that the flow valve is open and the external relief is adjusted to within operating range or spring.
The inLoop™ ACE is producing too much sample.	Grab size has changed from that anticipated.	Adjust the grab size and tighten the lock nut on the External Sample Volume Adjustment Assembly.
	External relief adjustment or operation.	Test the external relief for proper setting and no leakage.
	Miscalculation of total grabs per batch size.	Check calculations and total batch size received.
	Container was not fully emptied from the last operation.	Make certain you start with a clean empty container.

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:

- Swagelok Company VCO® O-Ring Face Seal Fittings (Welker® IOM V430)

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

- Assembly Drawing: AD905BQ.1
- Assembly Drawing: AD089BB.1

NOTES

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