WELKER

INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

WELKER INLOOP™ ACE CRUDE OIL SAMPLER

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AD905BQ

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IOM-224

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TABLE OF CONTENTS

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

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 *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.

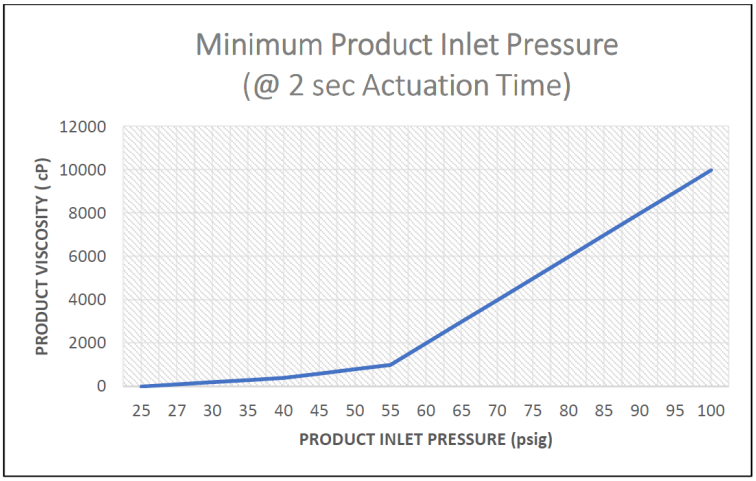
Welker may custom design the inLoop™ ACE to suit the particular application and specifications of each customer.

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.**

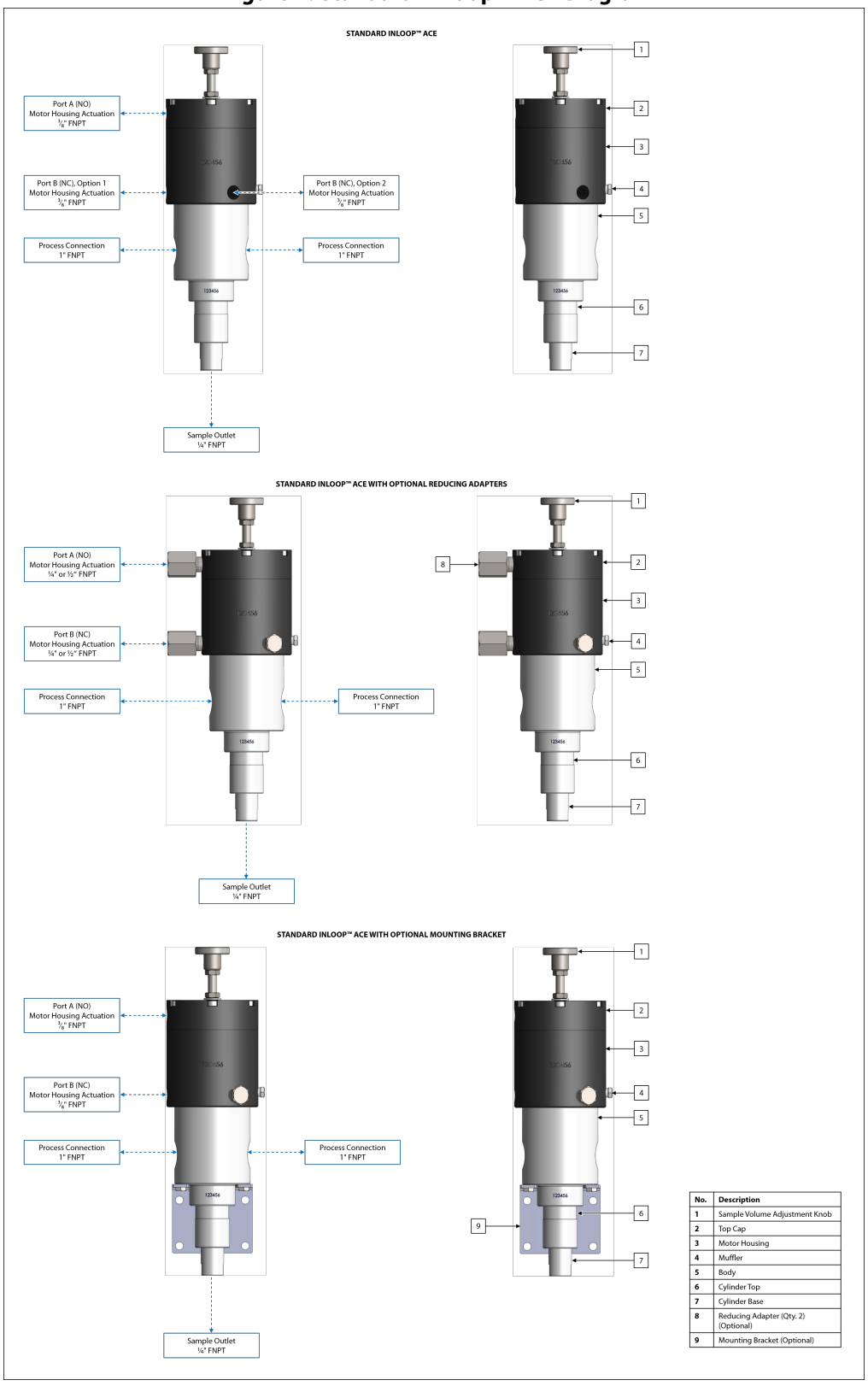
Table 1: inLoop™ ACE Specifications	
Application	Bypass Sampling
Products Sampled	Liquids Compatible With the Materials of Construction (See *Figure 1*)
Materials of Construction	316/316L Stainless Steel Wetted Parts, Anodized Aluminum Non-Wetted Parts, PTFE, and Viton® Others Available
Maximum Allowable 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:** 5–200 psig (*0.3–13.7 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

Figure 1: Minimum Product Inlet Pressure Graph



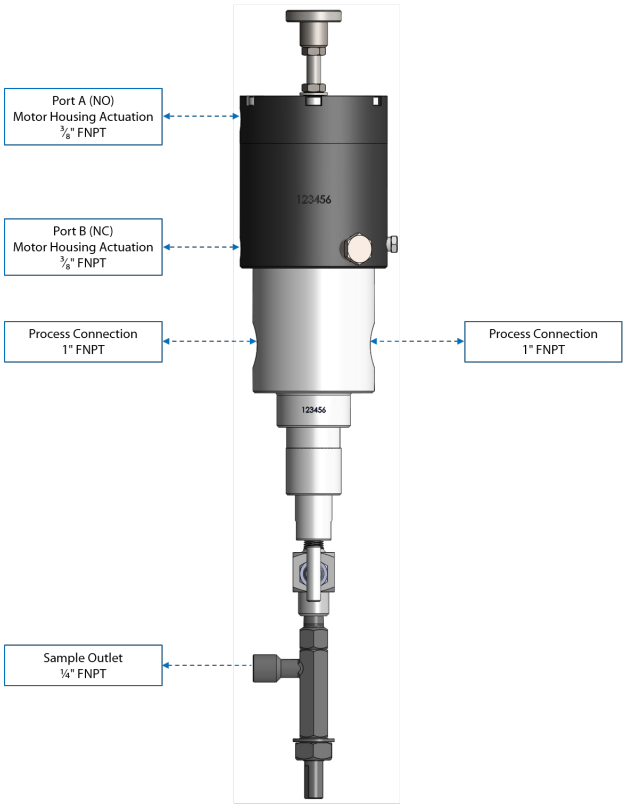
1.4 Equipment Diagrams

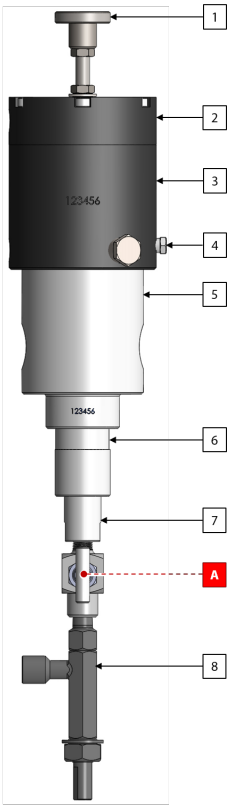
Figure 2: Standard inLoop™ ACE Diagram



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

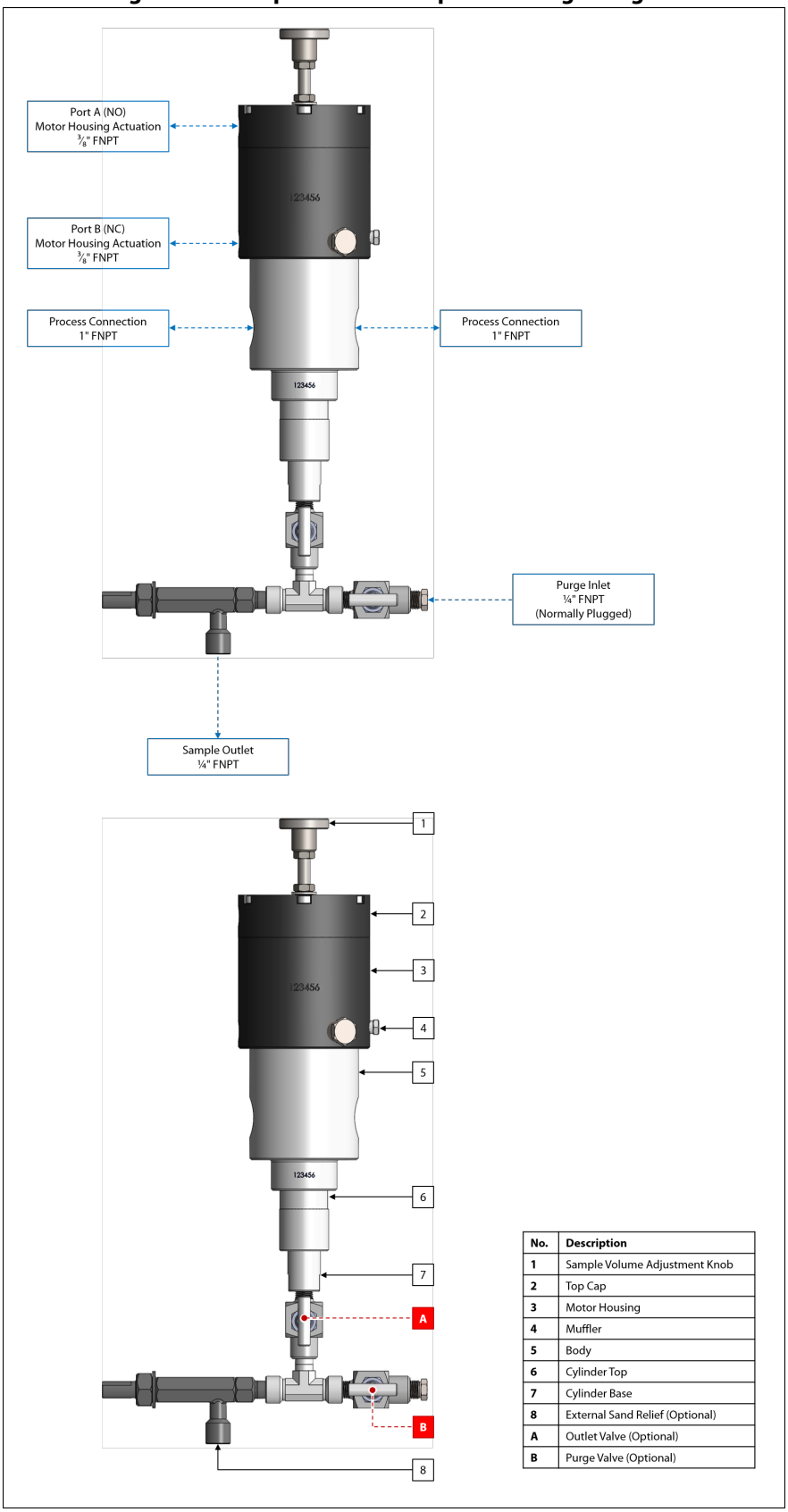
Figure 3: inLoop™ ACE With Optional External Sand Relief Diagram





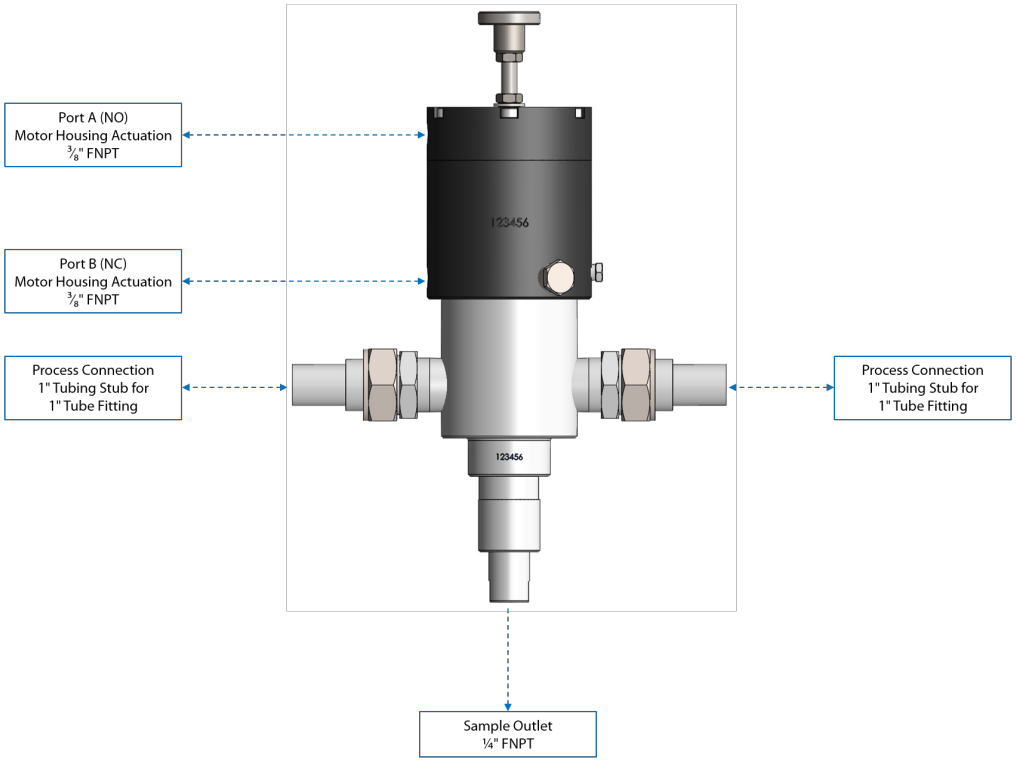
No.	Description
1	Sample Volume Adjustment Knob
2	Top Cap
3	Motor Housing
4	Muffler
5	Body
6	Cylinder Top
7	Cylinder Base
8	External Sand Relief (Optional)
A	Outlet Valve (Optional)

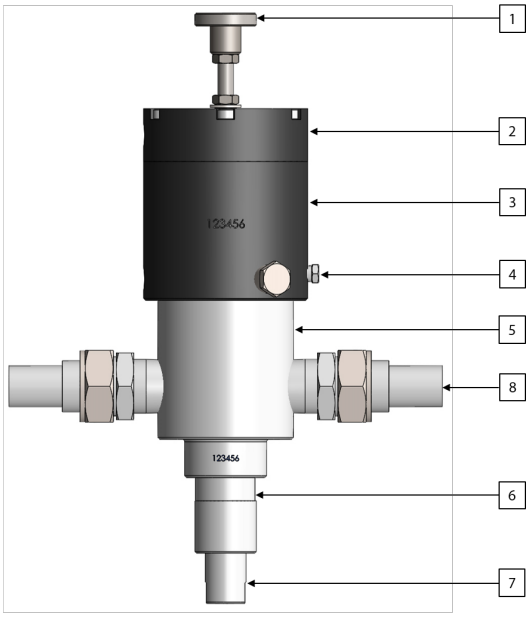
Figure 4: inLoop™ ACE With Optional Purge Diagram



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)

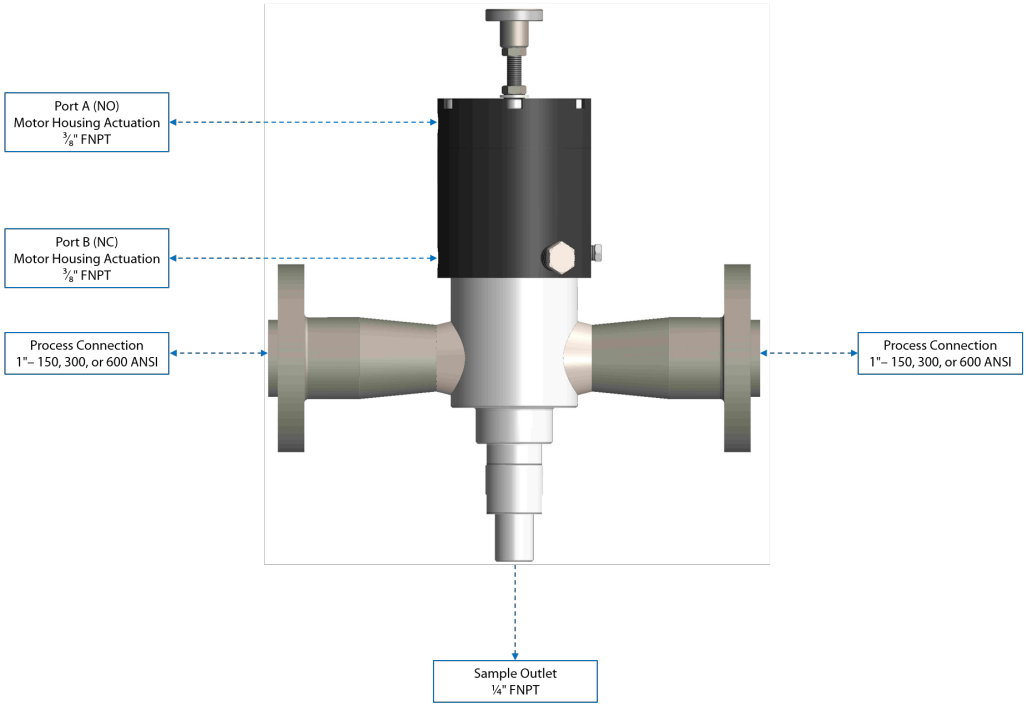
Figure 5: inLoop™ ACE With Optional VCO Connection Diagram

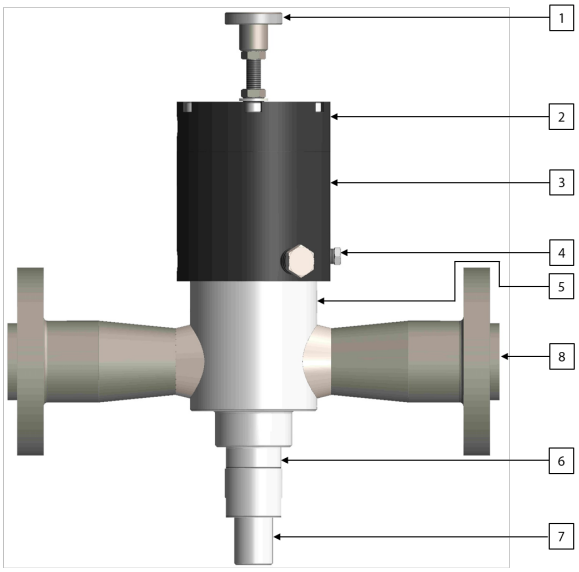




No.	Description
1	Sample Volume Adjustment Knob
2	Top Cap
3	Motor Housing
4	Muffler
5	Body
6	Cylinder Top
7	Cylinder Base
8	VCO Tube Adapter (Qty. 2) (Optional)

Figure 6: 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)

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.

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 2*, *Figure 3*, *Figure 4*, or *Figure 5*).
4. Using 1" tubing or pipe, connect from the process outlet on the inLoop™ ACE to the fast loop (*Figure 2*, *Figure 3*, *Figure 4*, or *Figure 5*).
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 2*, *Figure 3*, *Figure 4*, *Figure 5*, or *Figure 6* 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.

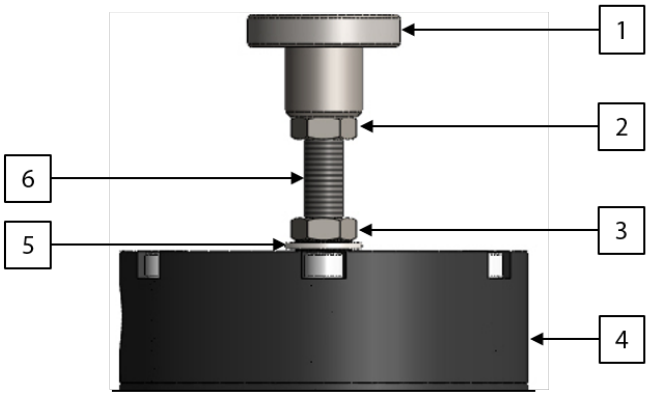
16. Using appropriately sized tubing, connect from the normally open port on the solenoid to port A on the motor housing (*Figure 2*, *Figure 3*, *Figure 4*, *Figure 5*, or *Figure 6* and *Table 3*). Using appropriately sized tubing, connect from the normally closed port on the solenoid to port B on the motor housing (*Figure 2*, *Figure 3*, *Figure 4*, *Figure 5*, or *Figure 6* 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 3* or *Figure 4*).
18. If applicable, ensure that the optional external sand relief has been set (*Figure 3* or *Figure 4*).
19. If applicable, ensure that the customer constant pressure cylinder has been pre-charged and that all cylinder valves are closed.
20. Pressurize the fast loop.
21. Check for leaks and repair as necessary.

22. As necessary, adjust the sample volume of the inLoop™ ACE (*Figure 7*).

Figure 7: External Sample Volume Adjustment



No.	Description
1	Sample Volume Adjustment Knob
2	Jam Nut, Top
3	Jam Nut, Bottom
4	Top Cap
5	Thread Seal
6	Adjustment Screw

Loosen the jam 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 jam nut on the adjusting screw to secure the adjusting screw at the desired volume.

Two (2) full rotations of the adjustment knob is approximately 1 cc.

Ensure that the jam nut is tightened to the fastener seal prior to beginning operation, as the pump will not operate correctly unless the jam nut is properly tightened. A leak check may be performed to verify that the jam nut has been properly tightened.

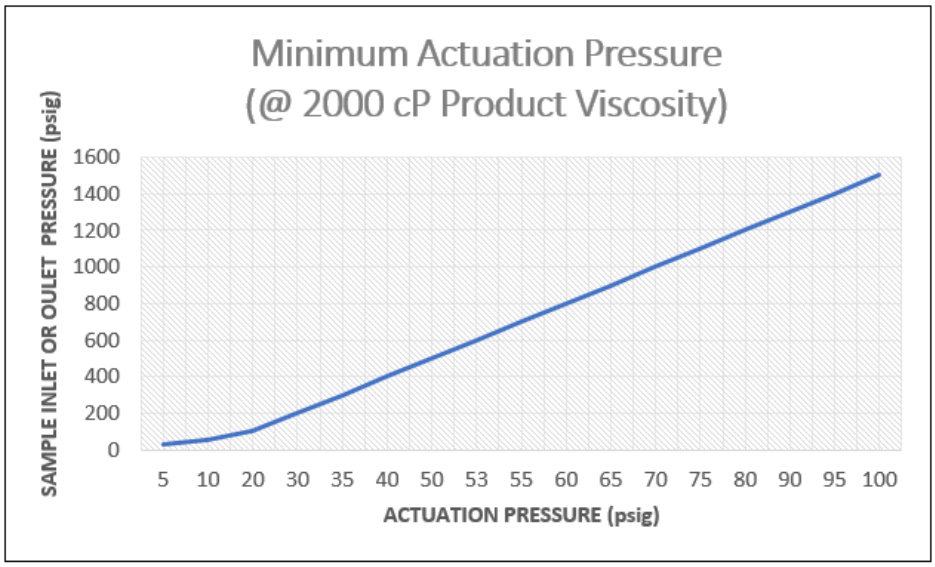
Once the desired volume is set, the sample volume can be changed at any time externally without removing the inLoop™ ACE from the fast loop.

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

2.3 Operating the Unit

1. Turn ON the hydraulic or pneumatic supply.
2. As necessary, adjust the hydraulic or pneumatic supply to 5–200 psig (*Figure 8*).

Figure 8: Minimum Actuation Pressure Graph



3. Set the actuation time based on process conditions (*Table 4* or *Table 5*).

Table 4: Sample Outlet Pressure and Minimum Actuation Time	
Minimum Actuation Time for 1 Stroke	**Sample Outlet Pressure (psig)**
2 Seconds	25 50 100 200 300 400 500 600 700 800 900 1000
3 Seconds	1100 1200 1300 1400 1500

Table 5: Product Viscosity and Minimum Actuation Time	
Minimum Actuation Time for 1 Stroke	**Product Viscosity (cP)**
2 Seconds	1 100 200 300 400 600 800 1000 2000 3000 4000
3 Seconds	5000 6000 7000 8000 9000 10,000

4. 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 $Number\ of\ Samples\ Needed\ to\ Fill\ to\ 80\% = \frac{(Container\ Size\ (cc) * 0.8)}{Bite\ Size\ (cc)}$ ***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.

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

5. As necessary, turn on electrical power and activate the hydraulic or pneumatic supply to actuate the solenoid at the set sampling frequency.
6. 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.

2.4 Verifying the Sample Volume

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

1. 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.
2. Using appropriately sized customer-supplied tubing, connect from the sample outlet on the inLoop™ ACE to the sample inlet on the Checkpoint™ (*Figure 2*, *Figure 3*, *Figure 4*, *Figure 5*, or *Figure 6*).
3. 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.

4. Follow the instructions in the *Installation, Operation, and Maintenance* (IOM) *Manual* for the Checkpoint™ to complete sample volume verification.
5. As necessary, adjust the sample volume (*Figure 7*).

Loosen the jam 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 jam nut on the adjusting screw to secure the adjusting screw at the desired volume.

Two (2) full rotations of the adjustment knob is approximately 1 cc.

Ensure that the jam nut is tightened to the fastener seal prior to beginning operation, as the pump will not operate correctly unless the jam nut is properly tightened. A leak check may be performed to verify that the jam nut has been properly tightened.

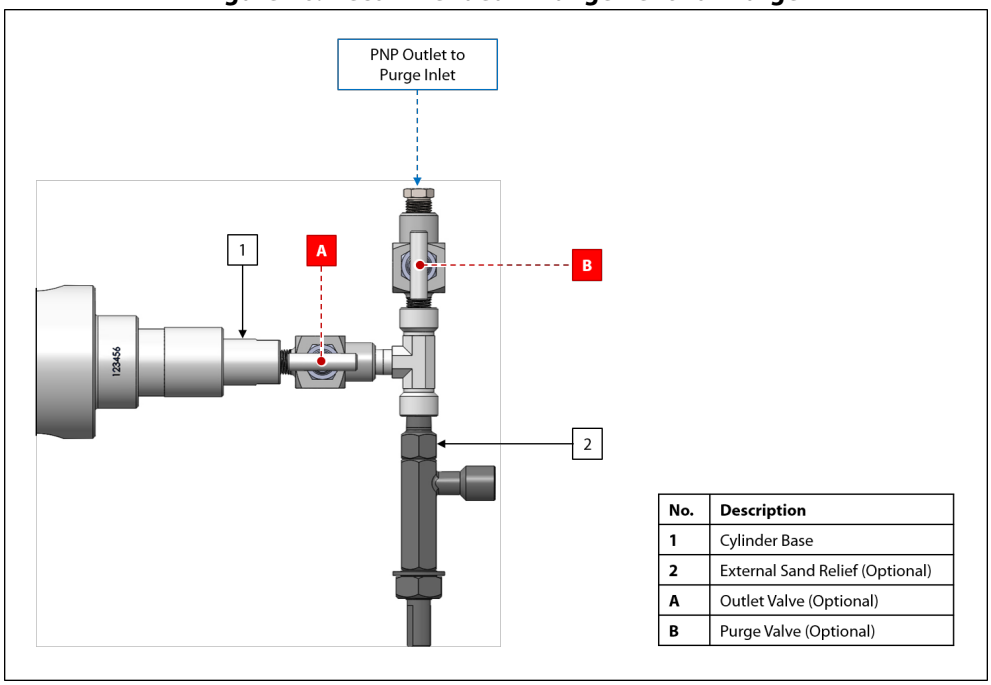
2.5 Purging the Unit

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 into the sample container.

1. 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 10*).

Figure 10: Recommended Arrangement for Purge



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

2. 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.
3. Using ¼" tubing, connect from the purge outlet on the PNP to purge valve B (*Figure 10*).
4. 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.
5. 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.
6. 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.
7. Open purge valve B (*Figure 10*).
8. Follow the instructions in the *Installation, Operation, and Maintenance* (IOM) *Manual* for the PNP to complete the purge.

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 replacing the poppets in the internal check valves weekly or semi-annually, depending on sample outlet pressure (*Table 6*). Note that sample rate and product abrasiveness also impact the frequency of poppet replacement.

Table 6: Recommended Replacement Frequency – Poppets

Replacement Frequency	Sample Outlet Pressure
Semi-annually	25–700 psig
Weekly	800–1500 psig

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 unions 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 unions 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 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.

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. Pipe Wrench
    g. Rubber Mallet
    h. Seal Pick
    i. Snap Ring Pliers

3.2 Maintenance

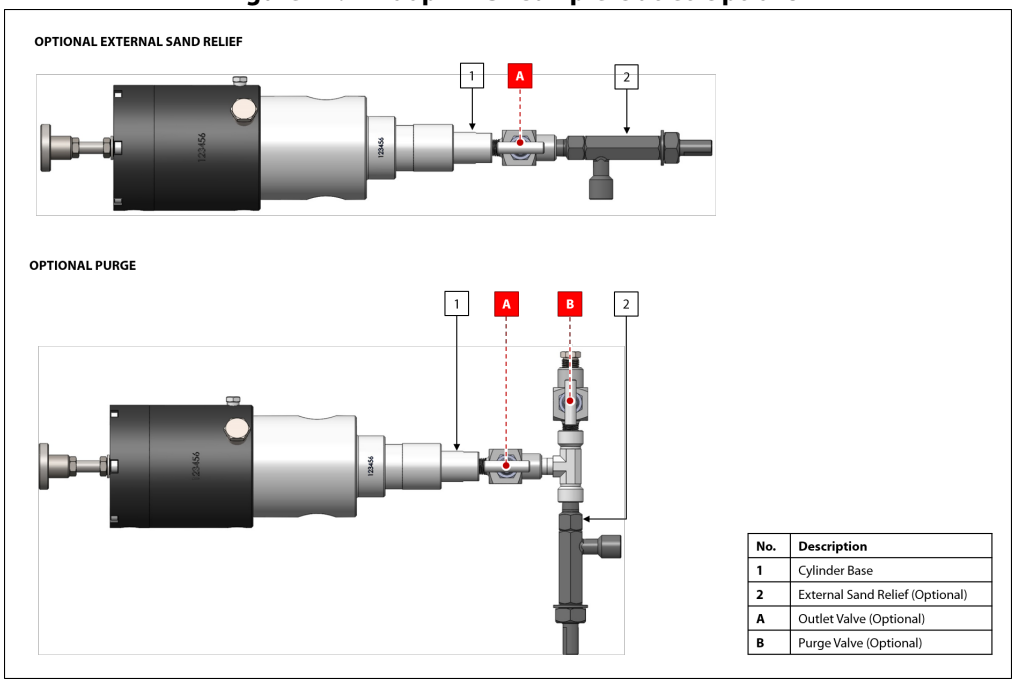
The fast loop must be depressurized prior to installing and removing the unit.

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. Lay the inLoop™ ACE on a smooth, clean surface.
8. If the inLoop™ ACE is not equipped with optional equipment at the sample outlet, proceed to step 17. If the inLoop™ ACE is equipped with optional equipment at the sample outlet, continue to step 9.

Optional Equipment

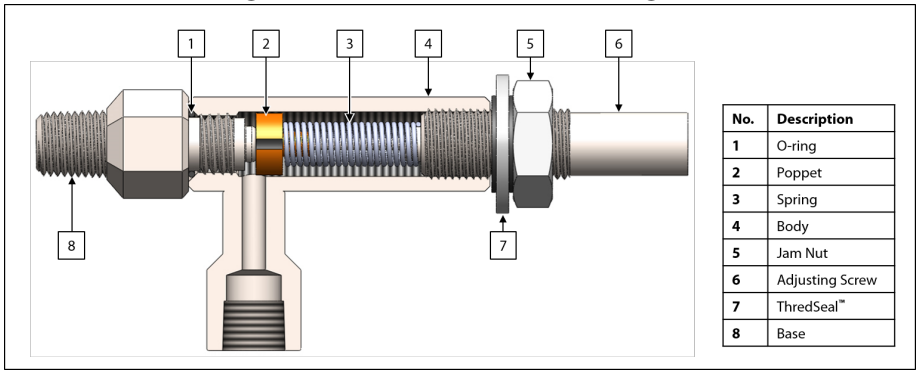
Figure 11: inLoop™ ACE Sample Outlet Options



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

9. Remove the optional equipment from the sample outlet by unscrewing the assembly from the cylinder base (*Figure 11*).
10. Unscrew the external sand relief from the valve(s) (*Figure 11*).
11. Replace the O-ring on the base of the external sand relief (*Figure 12*).

Figure 12: External Sand Relief Diagram

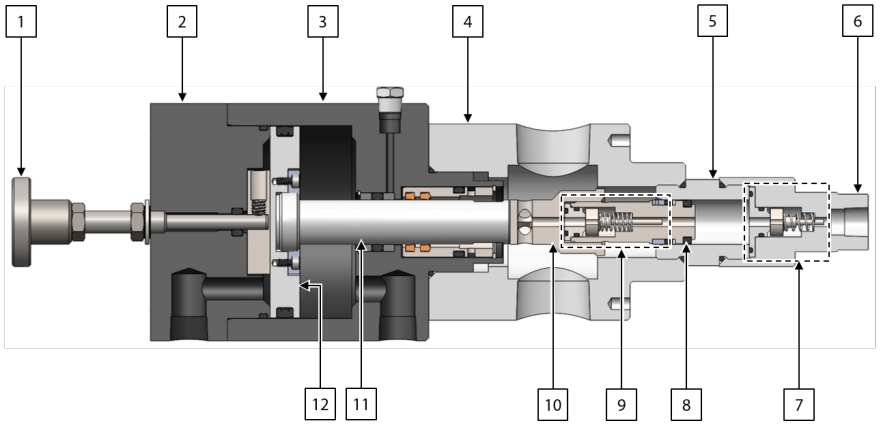


No.	Description
1	O-ring
2	Poppet
3	Spring
4	Body
5	Jam Nut
6	Adjusting Screw
7	ThredSeal™
8	Base

12. Unscrew the jam nut from the adjusting screw (*Figure 12*).
13. Inspect the poppet for scratches or other damage (*Figure 12*). If scratches or other damage are present on the poppet (face) seat, replace the poppet.
14. Reassemble the external sand relief (*Figure 12*).
15. As necessary, maintain the valve(s) (*Figure 11*). Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the valve(s) for maintenance instructions.
16. Reassemble the optional equipment, and then set the assembly aside.

Collection Head Assembly Maintenance

Figure 13: inLoop™ ACE Disassembly Diagram

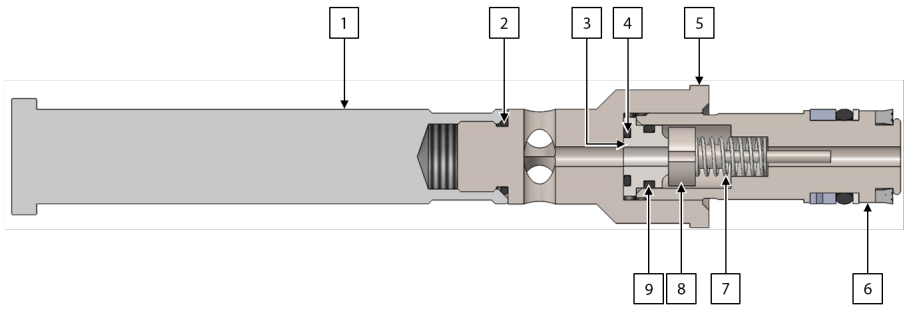


No.	Description
1	Sample Volume Adjustment Knob
2	Top Cap
3	Motor Housing
4	Body
5	Cylinder Top
6	Cylinder Base
7	Internal Outlet Check Valve
8	Piston
9	Internal Inlet Check Valve
10	Shaft Adapter
11	Actuation Shaft
12	Actuation Piston

17. Unscrew the cylinder base from the cylinder top and set the cylinder base aside. Note the internal outlet check valve will be removed at this time.
18. Unscrew the cylinder top from the body.
19. Unscrew the body from the motor housing. Note the actuation shaft assembly will be exposed.
20. 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

Figure 14: Internal Inlet Check Valve Diagram

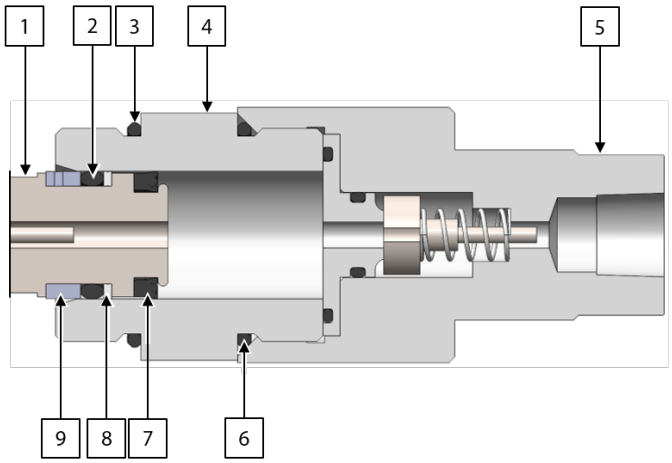


No.	Description
1	Shaft
2	O-ring
3	Seat*
4	O-ring*
5	Shaft Adapter
6	Piston
7	Spring*
8	Poppet*
9	O-ring*
Parts With an Asterisk (*) Are Included in the Internal Inlet Check Valve.	

21. Unscrew the piston from the shaft adapter.
22. Unscrew the shaft adapter from the shaft.
23. Replace the O-ring on the shaft adapter, and then screw the shaft adapter back onto the shaft.
24. Remove the seat, poppet, and spring from the piston.
25. Examine the seat for damage or wear. Replace as necessary.
26. As necessary, replace the O-rings on the seat.
27. Examine the spring for damage or wear. Replace as necessary.
28. Examine the poppet for damage or wear. Replace as necessary.

Piston and Cylinder

Figure 15: Piston and Cylinder Diagram

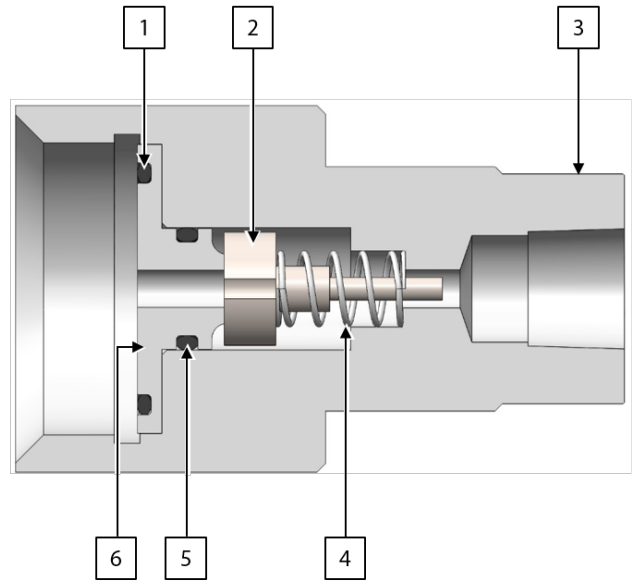


No.	Description
1	Piston
2	O-ring
3	O-ring
4	Cylinder Top
5	Cylinder Base
6	O-ring
7	PolyPak®
8	Back Up Ring
9	Bushing

29. Inspect the bushing for signs of wear. Replace as necessary.
30. Replace the O-ring, back up ring, and PolyPak® on the piston.
31. Inspect the cylinder base and cylinder top for scratches or other damage. Polish or replace as necessary.
32. Replace the O-ring on the cylinder top.

Internal Outlet Check Valve

Figure 16: Internal Outlet Check Valve Diagram

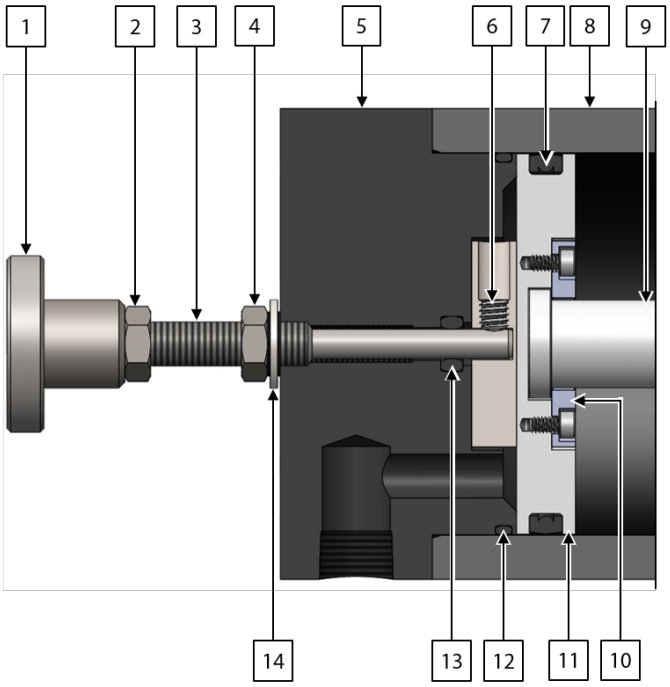


No.	Description
1	O-ring
2	Poppet
3	Cylinder Base
4	Spring
5	O-ring
6	Seat

33. Examine the seat for damage or wear. Replace as necessary.
34. As necessary, replace the O-rings on the seat.
35. Examine the spring for damage or wear. Replace as necessary.
36. Examine the poppet for damage or wear. Replace as necessary.

Disassembling the Upper Housing

Figure 17: External Sample Volume Adjustment Assembly



No.	Description
1	Adjustment Knob
2	Jam Nut, Top
3	Adjustment Screw
4	Jam Nut, Bottom
5	Top Cap
6	Adjustment Piston With Setscrew
7	Crown Seal
8	Motor Housing
9	Shaft
10	Retaining Plate With 4 Lock Screws
11	Actuation Piston
12	O-ring
13	O-ring
14	Thread Seal

37. Using a hex key, unscrew and remove the cap screws from the top cap.
38. Remove the top cap from the motor housing.
39. Carefully push the actuation piston up away from the motor housing.

As necessary, 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.

40. Insert a ¼" shaft into the bottom of the motor housing, and then carefully tap the shaft with a rubber mallet until the actuation piston has been extended far enough from the motor housing to be removed manually.
41. Using a hex key, remove the four (4) lock screws to separate the retaining plate and floating shaft from the actuation piston (*Figure 17*). Take care not to misplace the lock screws.

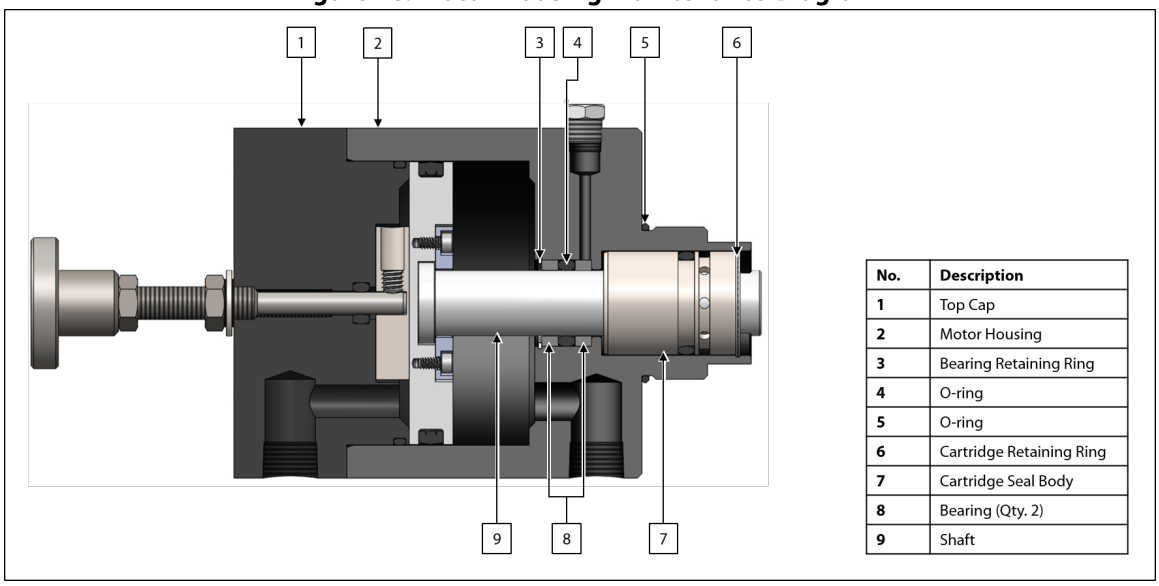
Upper Housing Maintenance

Top Cap

42. As necessary, screw the adjustment screw down to expose the adjustment piston.
43. Loosen the setscrew in the adjustment piston, and then separate the adjustment piston from the adjustment screw.
44. Unscrew the adjustment screw from the top cap.
45. Replace the O-rings on the top cap.

Motor Housing

Figure 18: Motor Housing Maintenance Diagram



No.	Description
1	Top Cap
2	Motor Housing
3	Bearing Retaining Ring
4	O-ring
5	O-ring
6	Cartridge Retaining Ring
7	Cartridge Seal Body
8	Bearing (Qty. 2)
9	Shaft

46. Remove the bearing retaining ring from inside the motor housing
47. Replace the O-ring and bearing in the motor housing.
48. Inspect the bearing retaining ring for damage or wear. Replace as necessary.
49. Install the bearing retaining ring to the inside of the motor housing.
50. Remove the cartridge retaining ring from the bottom of the motor housing.
51. Remove the cartridge seal body from the motor housing and discard.
52. Install a replacement cartridge seal body to the motor housing.
53. Inspect the cartridge retaining ring for damage or wear. Replace as necessary.
54. Install the cartridge retaining ring to the motor housing below the cartridge seal body.
55. Replace the O-ring on the motor housing.

Shaft and Actuation Piston

56. Inspect the shaft for damage or wear. Replace as necessary.
57. Replace the crown seal on the actuation piston (*Figure 17*).
58. Return the retaining plate to the shaft and align the holes in the plate with the holes in the actuation piston (*Figure 17*).
59. Apply medium strength thread-locking fluid to the lock screws, and then secure the retaining plate to the piston using the lock screws.
60. Set the actuation piston subassembly aside.

Reassembly

Top Cap

61. Return the adjustment screw with jam nuts and thread seal to the top cap, and then screw the adjustment screw down to expose the unthreaded portion of the adjustment screw (*Figure 17*).
62. Install the adjustment piston to the adjustment screw. Ensure that the setscrew hole in the adjustment piston aligns with the pin hole in the adjustment screw.
63. Apply medium strength thread-locking fluid to the setscrew, and then tighten the setscrew to secure the adjustment piston to the adjustment screw.

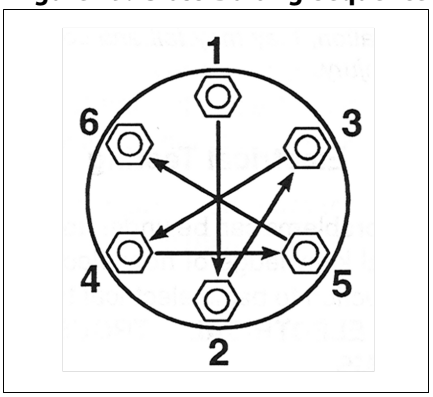
Motor Housing

64. Liberally lubricate inside the motor housing.

> Welker recommends a silicone-based lubricant, such as Molykote® 111, for use with this unit.

65. Insert the actuation piston assembly into the motor housing, and then use a rubber mallet to gently tap the piston assembly down into the motor housing.
66. Install the top cap to the motor housing. Align the actuation port on the top cap with the actuation port on the motor housing, and then push the top cap down. Note that aligning the actuation ports will also bring the cap screw holes into alignment.
67. Apply Never-Seez® to the cap screws.
68. Following a cross-bolting sequence, install the cap screws to the top cap and tighten to 6.3 ft•lb (*Figure 19*).

Figure 19: Cross-Bolting Sequence



Check Valves

69. Screw down the adjustment screw to expose the wrench flats on the shaft.
70. Apply medium strength thread-locking fluid to the shaft adapter threads, and then screw the shaft adapter into the shaft (*Figure 14*). While holding the shaft with a wrench, use a second wrench to screw the shaft adapter into the shaft.
71. Insert the internal inlet check valve into the piston (*Figure 14*). Ensure that the correct poppet and spring are installed.
72. Apply medium strength thread-locking fluid to the piston threads, and then screw the piston into the shaft adapter (*Figure 14*). While holding the shaft with a wrench, use a second wrench to screw the piston into the shaft adapter.
73. Insert the internal outlet check valve into the cylinder base (*Figure 15*). Ensure that the correct poppet and spring are installed.
74. Screw the cylinder base onto the cylinder top (*Figure 15*).

Completing Reassembly

75. Screw the cylinder top into the bottom of the body (*Figure 13*).
76. Carefully install the body with cylinder base and top to the motor housing (*Figure 15*). Use two (2) wrenches to tighten.
77. Tighten all mating bodies to ensure there are no gaps.
78. If the inLoop™ ACE is equipped with optional equipment, install the assembly to the cylinder base (*Figure 11*).
79. If applicable, replace the O-ring in each VCO connection.
80. The unit is now ready for installation.

3.3 Troubleshooting

Table 7: inLoop™ ACE Troubleshooting		
Issues	**Possible Causes**	**Solutions**
The inLoop™ ACE is not actuating properly.	The hydraulic supply may be too low or not operating.	Refer to *Figure 8* to determine the appropriate setting for the supply. 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 (*Figure 8*).
	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 inLoop™ ACE is not collecting the correct sample volume.	Welker recommends the Welker Checkpoint™ Sample Bite Verification Panel for verifying the sample volume of the inLoop™ ACE. See *Section 2.2, Installing the Unit,* for instructions on adjusting the sample volume.
	The inLoop™ ACE may be set at a slower sampling frequency than desired.	Adjust the inLoop™ ACE to sample at the desired rate. Ensure that the calculations used to determine the sample frequency are correct (*Figure 9*).

Table 7: inLoop™ ACE Troubleshooting (Continued)		
Issues	**Possible Causes**	**Solutions**
The sample container is not filling.	The external sand relief on the inLoop™ ACE may be set too high.	Check the setting on the external sand relief and adjust as necessary. Note the external sand relief should be set 50–100 psig above operating pressure.
	The poppet of the internal inlet and/or outlet check valve may be damaged.	Replace the poppet(s). See *Section 3.2, Maintenance,* for instructions.
	The sample inlet and/or outlet pressure is inadequate for the actuation pressure.	Ensure the sample inlet and/or outlet pressure is appropriate for the actuation pressure (*Figure 8*).
	The actuation pressure is inadequate for the sample inlet and/or outlet pressure.	Ensure the actuation pressure is appropriate for the sample inlet and/or outlet pressure (*Figure 8*).
The sample container is filling too quickly.	The inLoop™ ACE is not collecting the correct sample volume.	Welker recommends the Welker Checkpoint™ Sample Bite Verification Panel for verifying the sample volume of the inLoop™ ACE. See *Section 2.2, Installing the Unit,* for instructions on adjusting the sample volume.
	The inLoop™ ACE may be set at a faster sampling frequency than desired.	Adjust the inLoop™ ACE to sample at the desired rate. Ensure that the calculations used to determine the sample frequency are correct (*Figure 9*).
	The external sand relief on the inLoop™ ACE may be set too low.	Check the setting on the external sand relief and adjust as necessary. Note the external sand relief should be set 50–100 psig above operating pressure.

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

NOTES

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