WELKER®

INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

WELKER® CONSTANT PRESSURE SAMPLE CONTAINER

MODEL
LS-14

DRAWING NUMBERS
AD245.HCRN
AD245CRN
AD245CV

MANUAL NUMBER
IOM-131

REVISION
Rev. D, 9/6/2016

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® Constant Pressure Sample Container, LS-14. 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 Constant Pressure Sample Container is of a mechanical and electrical 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 Constant Pressure Sample Container, 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® *LS-14* Constant Pressure Sample Container is designed to collect, retain, and mix large volumes of representative composite sample.

The LS-14 can be integrated into a system with a pneumatically driven sample pump that interfaces with a Programmable Logic Controller (PLC) or other signal control system for proportional to flow or timed collection of sample grabs. Product level can be visually verified on site by referring to the volume indicator with tracker magnet on the LS-14.

Engineered features ensure that the sample is retained and representative for laboratory analysis. The connected inert gas supply applies and maintains constant pressure on the sample in the LS-14 to prevent vaporization and the escape of entrained gases. An operator can manually actuate the mixing plate in the LS-14 to thoroughly mix the sample prior to transfer to a transportable container for laboratory analysis.

Optional equipment can be added to enable remote operation: a controller to take samples automatically, an electro-hyrdaulic supply to drive the incorporated sample pump, a magnetostrictive level indicator to communicate product level to the PLC, and a proximity switch to signal the PLC once the desired volume of sample has been collected.

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 LS-14 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 customizations of your equipment.**

Table 1: LS-14 Specifications	
Products Sampled	Condensate, Light Crude Oil, Light Liquid Hydrocarbons, Liquid Petroleum Gas, Natural Gas Liquids, and Refined Products
Materials of Construction	316/316L Stainless Steel, Aluminum, Carbon Steel, PTFE, and Viton® Others Available
Maximum Allowable Operating Pressure	2160 psig @ -20 °F to 100 °F (*148 barg @ -28 °C to 37 °C*) Others Available
Connections	**Composite Sample Draw Off:** ¼" FNPT **Inert Gas Supply Fill Inlet:** ¼" FNPT **Pneumatic Supply Inlet (Optional):** ¼" Tubing **Product Return:** ¼" FNPT **Sample Inlet:** ¼" FNPT
Utility Requirements	5 or 10 US Gallon Hydraulic Oil Reservoir (Optional) Inert Gas Supply
Electrical Connections	**Electro-hydraulic Unit (EHUC) (Optional):** AC 110 V, AC 220 V, or AC 480 V, ¾" FNPT **Magnetostrictive Level Indicator (Optional):** DC 24 V, 4–20 mA Output, ¾" FNPT **Solenoid(s):** AC 110 V, AC 240 V, DC 12 V, or DC 24 V
Volume	1½ US Gallons @ 80% 3 US Gallons @ 80% 5 US Gallons @ 80% 10 US Gallons @ 80%
Operation	Hydraulic or Pneumatic Mixer Actuation
Dimensions	12" x 12" Mounting Plate (Standard) 24" (Length) x 28" (Width) x 2" (Height) Painted Carbon Steel Skid 36" (Length) x 22" (Width) x 2" (Height) Painted Carbon Steel Skid With Center Post 42" (Length) x 20" (Width) x 2" (Height) Painted Carbon Steel Skid With Center Post
Features	Composite Sample Draw Off Port/Valve Inert Gas Supply Tank Inert Gas Supply Tank Port/Valve Manifold Block Mixer Actuation Solenoid Plate Mixer Pressure Gauges Product Return Port/Valve Sample Inlet Port / Check Valve Skid Weld Assembly Visual Magnetic Volume Indicator

Table 1: LS-14 Specifications (Continued)	
Options	Digital Controller Electro-hydraulic Unit Flow Switch Magnetostrictive Level Indicator Pneumatic Supply Conditioning System Proximity Switch Solenoid(s) Welker® AVA-2 Volume Analyzer Welker® inLoop™ Crude Oil Sampler Welker® MPS-2 Gas Sampler Welker® SSO-9M Mini Injection Pump Welker® SSO-9MED Injection Pump CRN Certification

1.4 Equipment Diagrams

Figure 1: Standard LS-14 Connections Diagram

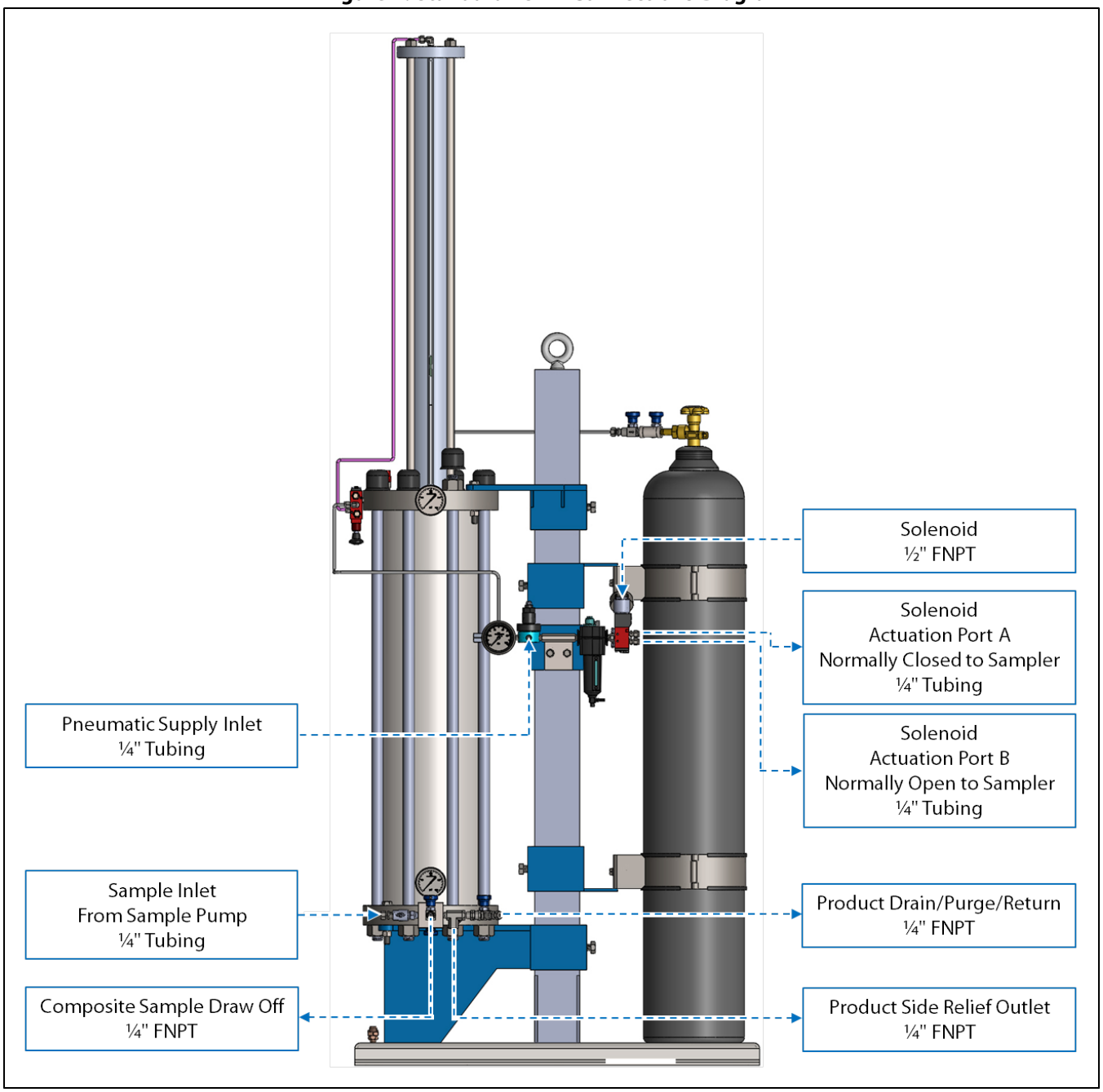


Figure 2: LS-14 With CRN Certification Connections Diagram

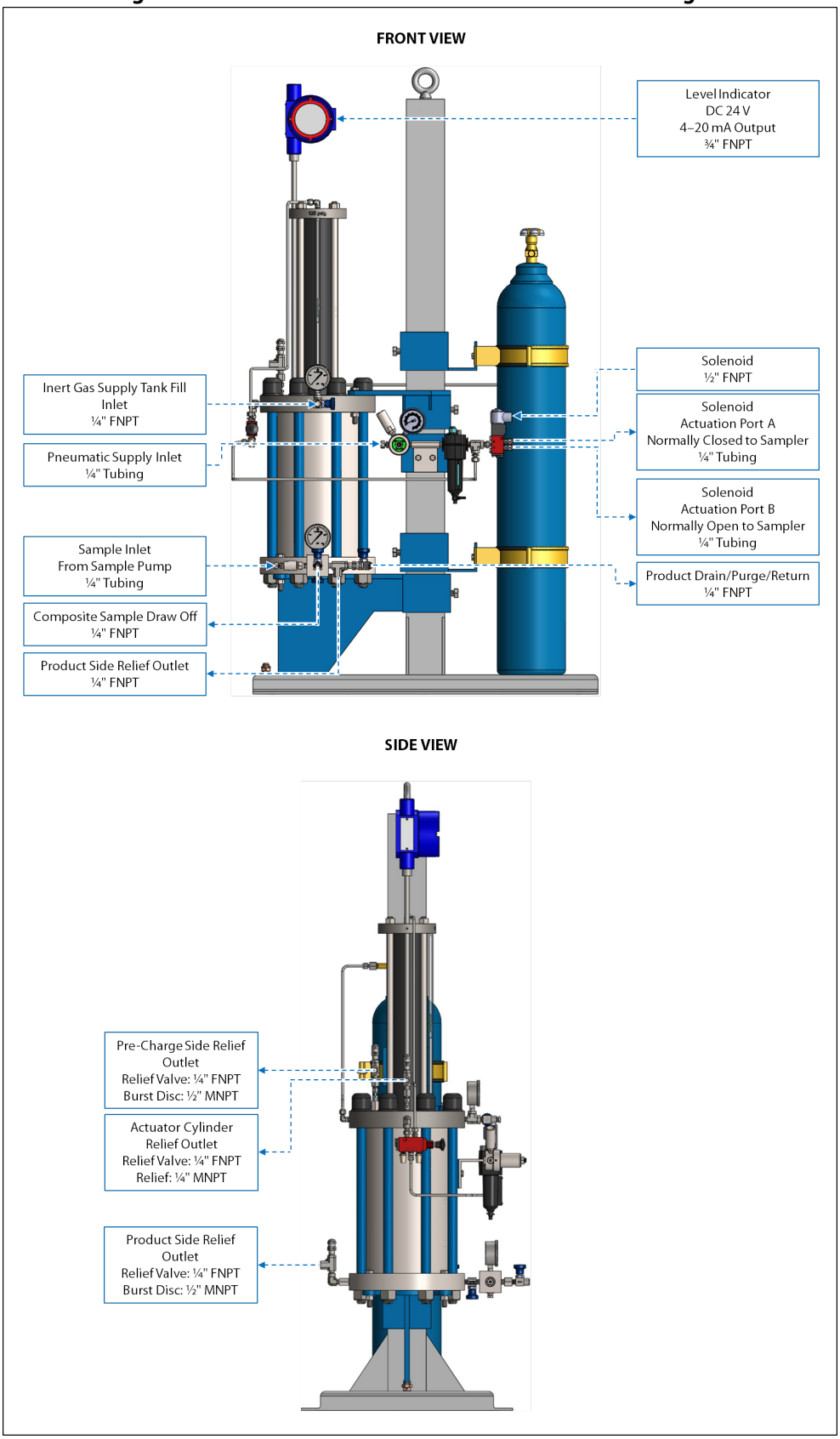


Figure 3: LS-14 With CRN Certification With Optional Hydraulic Mixer Actuation Connections Diagram

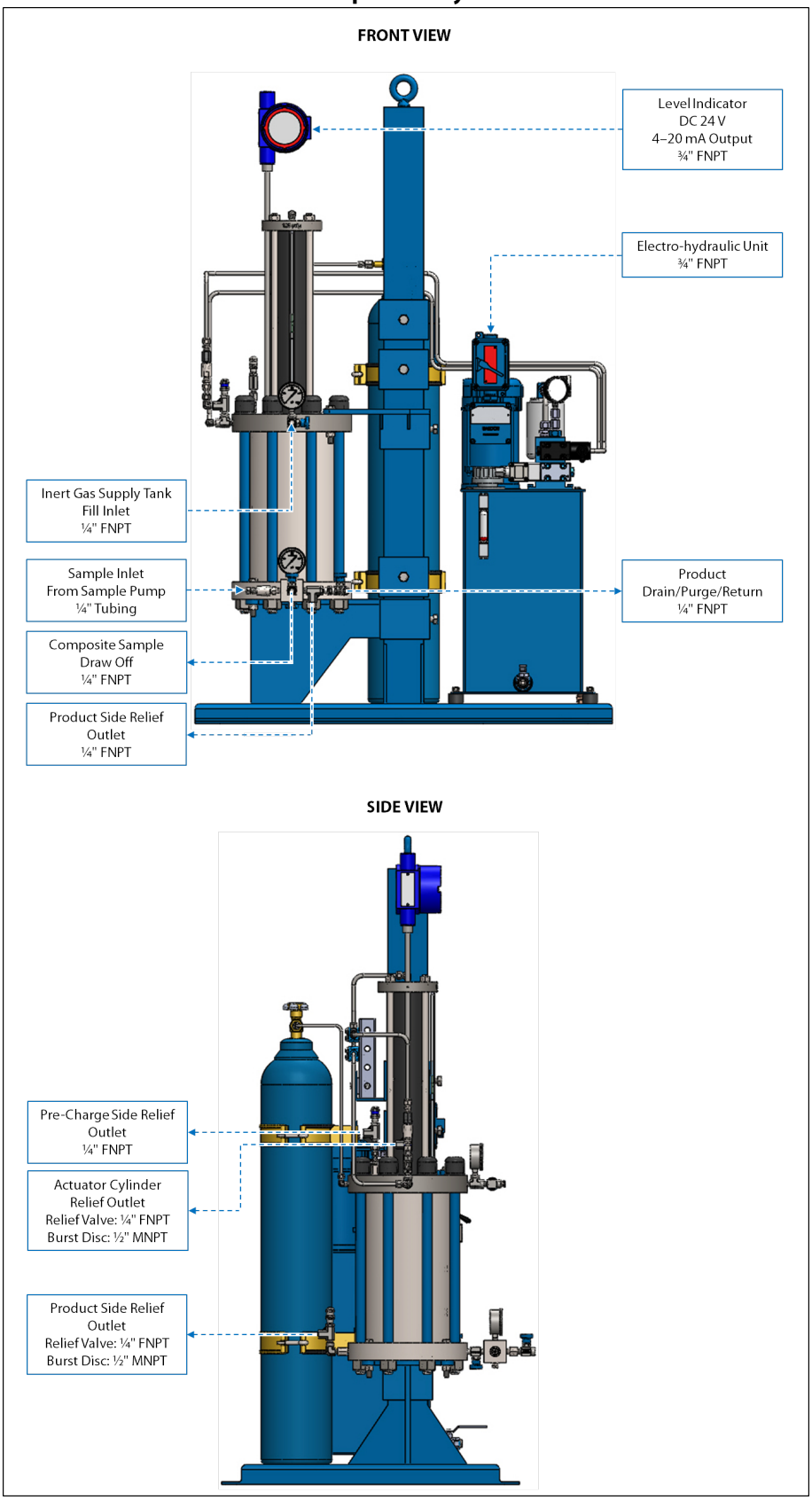
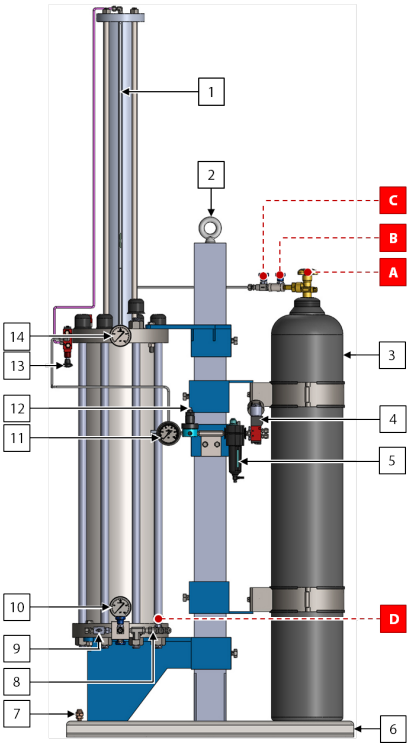
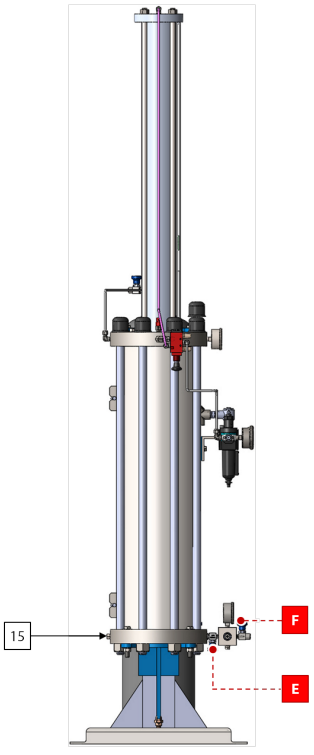


Figure 4: Standard LS-14 Diagram

FRONT VIEW



SIDE VIEW



No.	Description
1	Volume Indicator With Tracker Magnet
2	Lifting Lug / Eye Bolt (Optional)
3	Inert Gas Supply Tank
4	Solenoid (Optional)
5	Air Lubricator/Oiler (Optional)
6	Skid Weld Assembly
7	Grounding Lug
8	Relief Valve (Product Side)
9	Check Valve
10	Product Side Pressure Gauge
11	Regulator Pressure Gauge (Optional)
12	Regulator (Optional)
13	Mixer Button
14	Pre-Charge Side Pressure Gauge
15	Burst Relief Disc With Burst Relief Cap (Product Side)
16	Relief Valve (Actuator Cylinder)
17	Burst Relief Disc With Burst Relief Cap (Pre-Charge Side)
A	Inert Gas Supply Tank Valve
B	Inert Gas Supply Tank Fill Valve
C	Inert Gas Supply Tank Isolation Valve
D	Purge/Return Valve
E	Sample Container Isolation Valve
F	Composite Sample Draw Off Valve

TOP VIEW

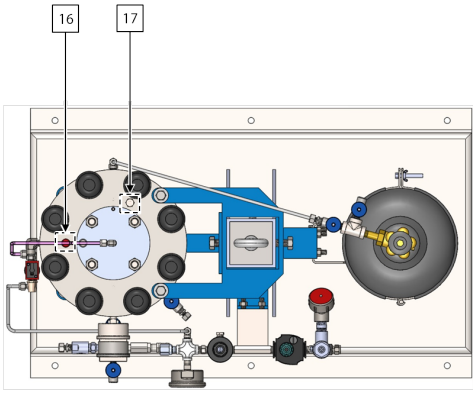
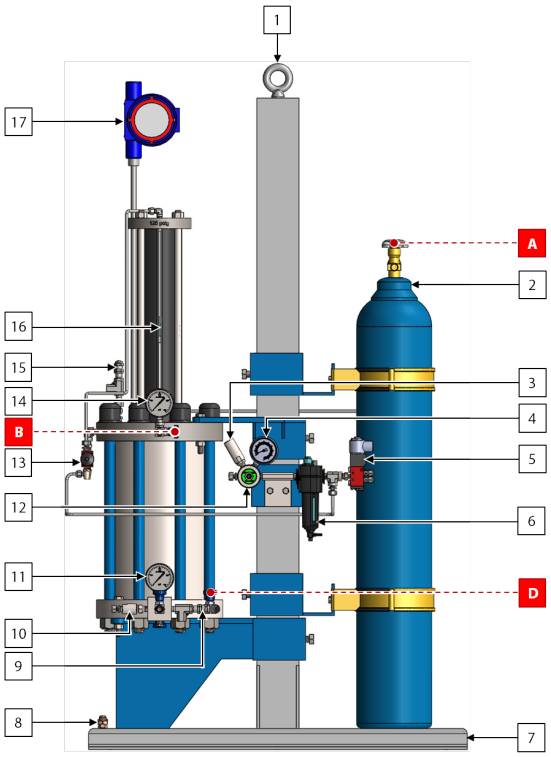
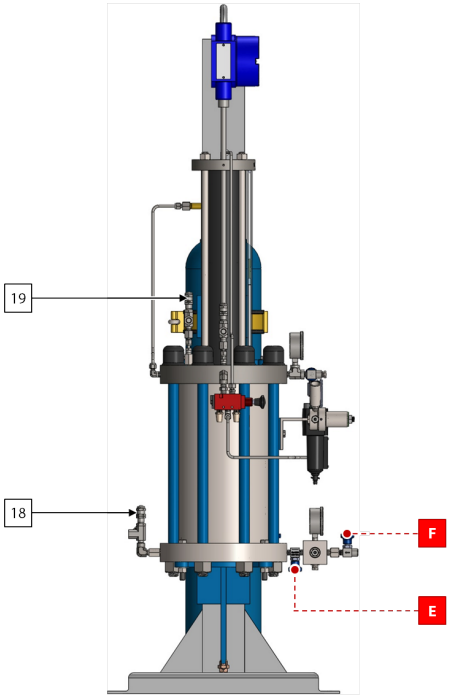


Figure 5: LS-14 With CRN Certification Diagram

FRONT VIEW



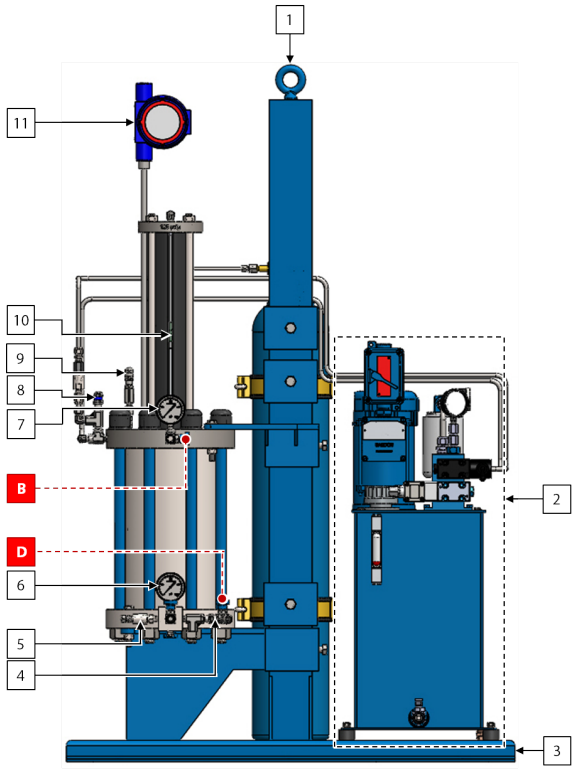
SIDE VIEW



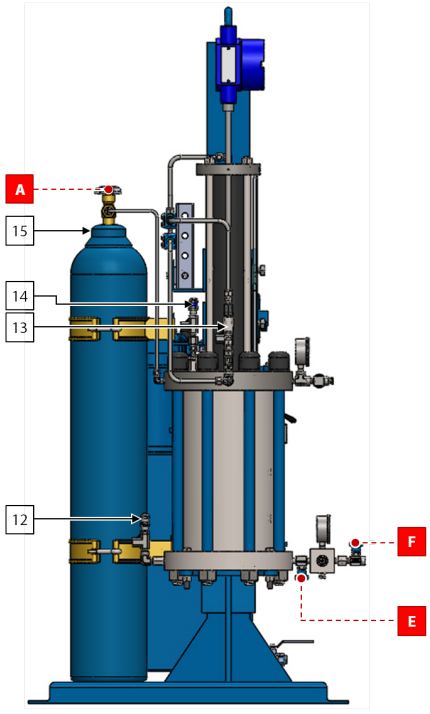
No.	Description
1	Lifting Lug / Eye Bolt
2	Inert Gas Supply Tank
3	Welker® RV-1 Relief Valve (Optional)
4	Regulator Pressure Gauge (Optional)
5	Solenoid (Optional)
6	Air Lubricator/Oiler (Optional)
7	Skid Weld Assembly
8	Grounding Lug
9	Relief Valve (Product Side)
10	Check Valve
11	Product Side Pressure Gauge
12	Welker® IR-4 Instrument Regulator (Optional)
13	Mixer Button
14	Pre-Charge Side Pressure Gauge
15	Relief Valve (Actuator Cylinder)
16	Volume Indicator With Tracker Magnet
17	Magnetostrictive Level Indicator (Optional)
18	Relief Valve (Product Side)
19	Relief Valve (Pre-Charge Side)
A	Inert Gas Supply Tank Valve
B	Inert Gas Supply Tank Fill Valve
D	Purge/Return Valve
E	Sample Container Isolation Valve
F	Composite Sample Draw Off Valve

Figure 6: LS-14 With CRN Certification With Optional Hydraulic Mixer Actuation Diagram

FRONT VIEW



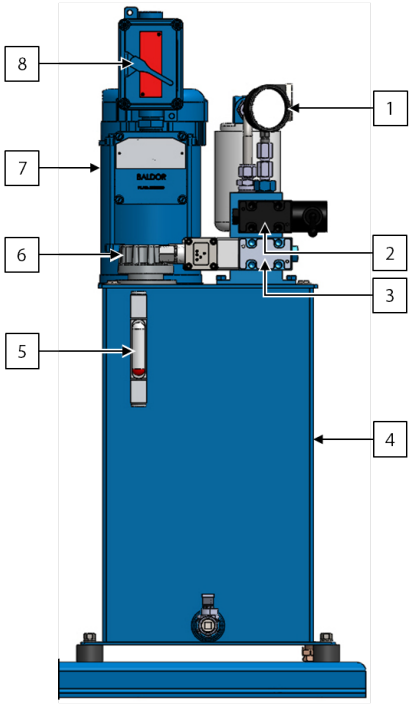
SIDE VIEW



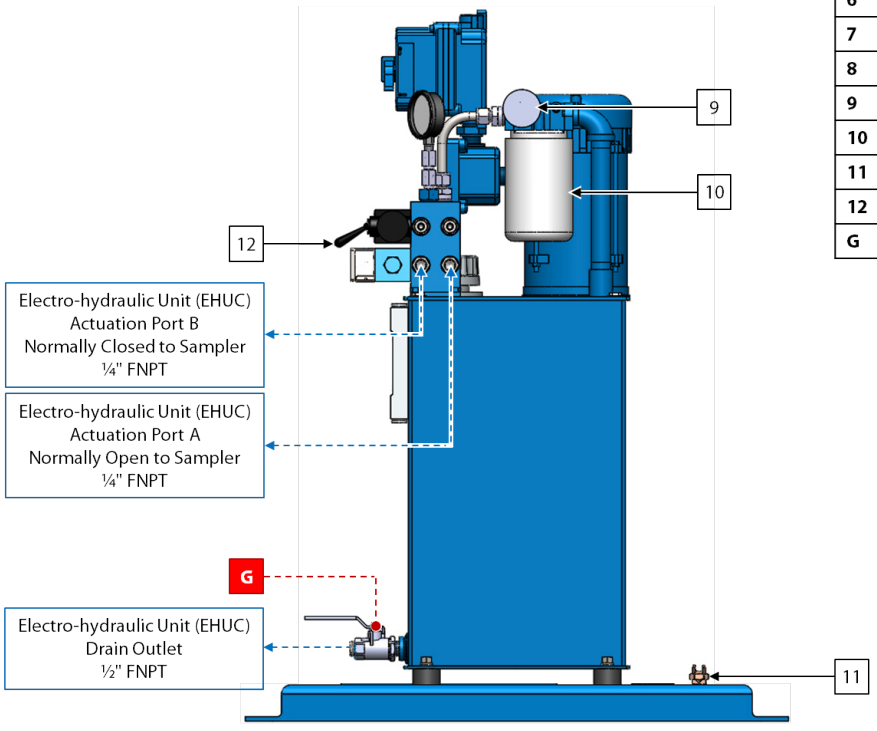
No.	Description
1	Lifting Lug / Eye Bolt
2	Electro-hydraulic Unit (Optional; See *Figure 7*)
3	Skid Weld Assembly
4	Relief Valve (Product Side)
5	Check Valve
6	Product Side Pressure Gauge
7	Pre-Charge Side Pressure Gauge
8	Relief Valve (Hydraulic Line)
9	Relief Valve (Actuator Cylinder)
10	Volume Indicator With Tracker Magnet
11	Magnetostrictive Level Indicator (Optional)
12	Relief Valve (Product Side)
13	Check Valve
14	Relief Valve (Pre-Charge)
15	Inert Gas Supply Tank
A	Inert Gas Supply Tank Valve
B	Inert Gas Supply Tank Fill Valve
D	Purge/Return Valve
E	Sample Container Isolation Valve
F	Composite Sample Draw Off Valve

Figure 7: Electro-hydraulic Unit (EHUC) Diagram (Optional)

FRONT VIEW



SIDE VIEW



No.	Description
1	Pressure Gauge
2	Mixer Actuation Valve
3	Sampler Actuation Solenoid
4	Hydraulic Oil Reservoir
5	Hydraulic Oil Level & Temperature Gauge
6	Electro-hydraulic Unit (EHUC) Reservoir Cap
7	Electric Motor
8	Motor Starter Switch
9	Filter Indicator Gauge
10	Filter
11	Grounding Lug
12	Mixer Lever (for LS-14 Mixer Actuation)
G	Electro-hydraulic Unit (EHUC) Drain Valve

2.1 Before You Begin

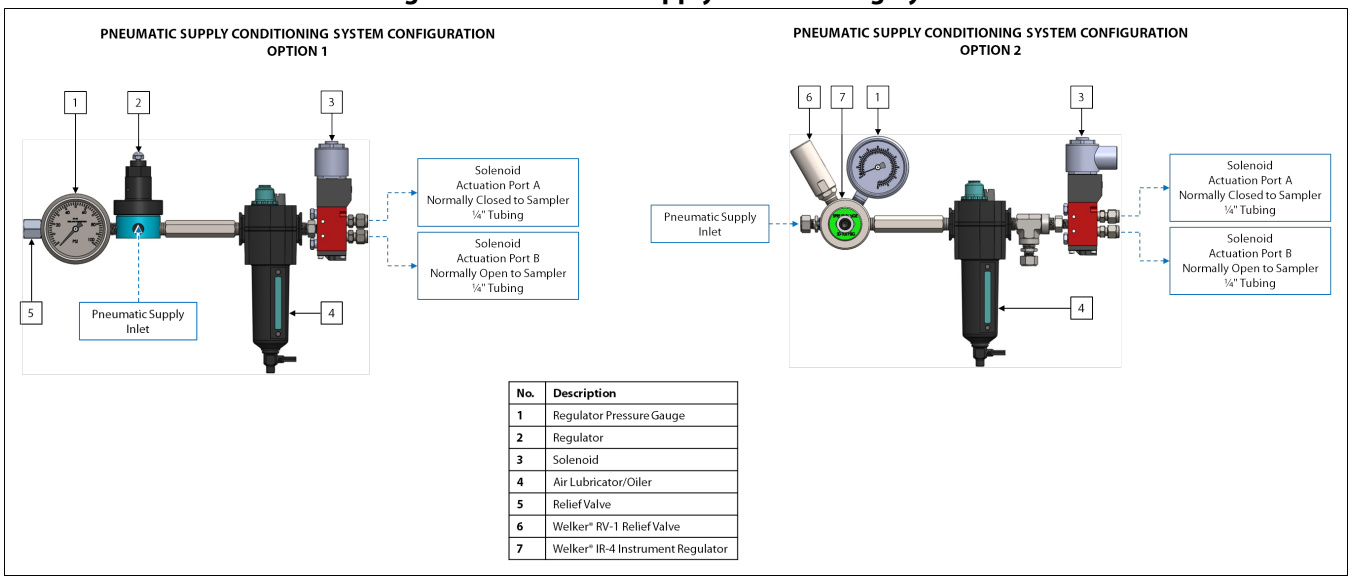
After unpacking the unit, check the equipment for compliance and any damage that may have occurred during shipment. Immediately contact a Welker® representative if you received damaged equipment.

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

2.2 Installation

1. Locate the skid as close as possible to the sample point.
2. Mount the skid to a flat, level surface, such as a concrete slab.
3. Connect a grounding wire to the grounding lug on the skid to safely ground the system (*Figure 4*, *Figure 5*, or *Figure 7*).
4. Ensure that all valves on the LS-14 are closed (*Figure 4*, *Figure 5*, or *Figure 6*).
5. Using appropriately sized tubing, connect from purge/return valve D to the pipeline (*Figure 4*, *Figure 5*, or *Figure 6*).
6. As necessary, connect a sampler to the sample inlet on the manifold block (*Figure 1*, *Figure 2*, or *Figure 3*).
7. As necessary, connect from the solenoid to the sampler (*Figure 1*, *Figure 2*, or *Figure 7*).
8. Apply pressure from the sampler to the manifold block. Check for leaks and repair as necessary.
9. As necessary, fill the reservoir of the air lubricator/oiler to the maximum fill line with oil compatible with the seal material (*Figure 8*). Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the air lubricator/oiler for instructions on filling the reservoir and for recommendations on the type of oil to use.

Figure 8: Pneumatic Supply Conditioning System



No.	Description
1	Regulator Pressure Gauge
2	Regulator
3	Solenoid
4	Air Lubricator/Oiler
5	Relief Valve
6	Welker® RV-1 Relief Valve
7	Welker® IR-4 Instrument Regulator

10. As necessary, connect a clean, dry pneumatic supply to the pneumatic supply inlet on the regulator (*Figure 8*).
11. As necessary, open the reservoir cap on the EHUC, and then fill the EHUC with the appropriate volume of ISO 46 hydraulic oil (*Figure 7*).

12. As necessary, connect an appropriate electrical supply to the EHUC (*Figure 3*).
13. As necessary, connect a DC 24 V electrical supply to the level indicator (*Figure 2* or *Figure 3*).
14. As necessary, connect the solenoid to the PLC. Refer to industry standards for appropriate electrical connections to interface with the PLC.
15. As necessary, set the PLC to the desired proportional to flow sampling frequency based on the sampling actuation equations provided (*Figure 9*).

Figure 9: Sampling Frequency Equations

Liquid Sampling, Proportional to Flow Collection
Equation 1: Number of Samples Needed $Number\ of\ Samples\ Needed\ to\ Fill\ to\ 80\% = \frac{(Cylinder\ Size\ (cc) * 0.8)}{Bite\ Size\ (cc)}$ ***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.*

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

Note that there are 3,785 cc in 1 US gallon. The LS-14 may be 1½, 3, 5, or 10 US gallons at 80%.

Filling the Inert Gas Supply Tank

The inert gas being used to pre-charge the LS-14 must be compatible with the seals in the LS-14. Welker recommends using nitrogen or helium as the inert gas supply.

The relief valves and gauges must be adequate for the pressure used to pre-charge the LS-14.

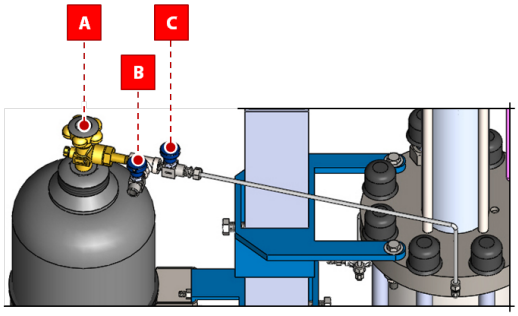
Pre-charging must be complete before product is supplied to the system.

Inert gas tanks are shipped empty from the manufacturer.

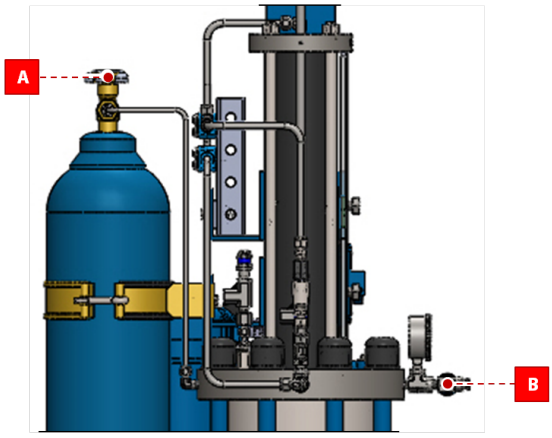
16. Determine the configuration of the inert gas supply valves on the LS-14 (*Figure 10*). If the LS-14 is equipped with option 1, continue to step 17. If the LS-14 is equipped with option 2, proceed to step 27.

Figure 10: Inert Gas Supply Valve Configuration Options

INERT GAS SUPPLY VALVE CONFIGURATION OPTION 1



INERT GAS SUPPLY VALVE CONFIGURATION OPTION 2

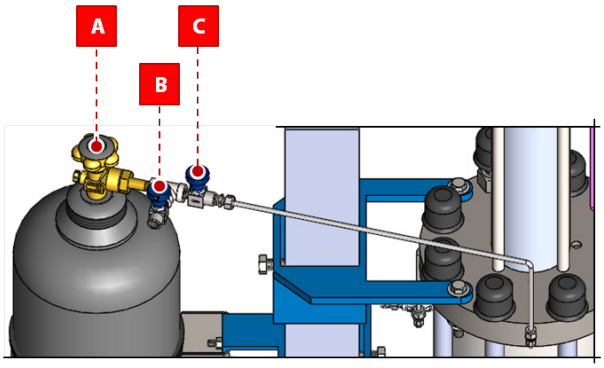


No.	Description
A	Inert Gas Supply Tank Valve
B	Inert Gas Supply Tank Fill Valve
C	Inert Gas Supply Tank Isolation Valve

Inert Gas Supply Valve Configuration Option 1

Filling the inert gas supply tank with inert gas supply tank isolation valve C open also pre-charges the LS-14.

Figure 11: Inert Gas Supply Valve Configuration Option 1

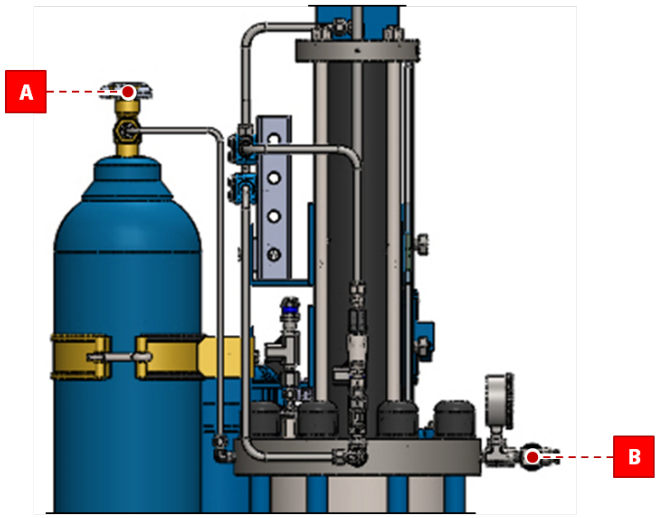


No.	Description
A	Inert Gas Supply Tank Valve
B	Inert Gas Supply Tank Fill Valve
C	Inert Gas Supply Tank Isolation Valve

17. Connect an appropriate customer-supplied nitrogen or other inert gas supply container to inert gas supply tank fill valve B located between the valve on the inert gas supply tank (valve A) and the isolation valve (valve C) (*Figure 11*).
18. Open valves A and C, and then slowly open valve B (*Figure 11*).
19. Allow the inert gas supply tank to fill.
20. While filling the inert gas supply tank, refer to the pre-charge side pressure gauge to monitor the pressure of the tank (*Figure 4*).
21. If the product side pressure gauge shows pressure, open purge/return valve D to lower the piston and relieve pressure within the LS-14 (*Figure 4*).
22. Fill the inert gas supply tank until the pre-charge side pressure gauge reads 50–100 psig above pipeline operating pressure, not to exceed the maximum allowable operating pressure of the LS-14.
23. Once full, close valve B and disconnect the customer-supplied inert gas supply container. Valves A and C must remain open (*Figure 11*).
24. Plug the port of valve B by wrapping the threads of a male hex plug with PTFE tape and screwing it into the port of valve B (*Figure 11*). Valve B must remain plugged at all times except when adding inert gas to the inert gas supply tank.
25. Check all connections between the inert gas supply tank and the receiver cylinder for leaks. Repair as necessary.
26. If the LS-14 will use pneumatics for mixer actuation, proceed to step 37. If the LS-14 will use hydraulics for mixer actuation, proceed to *Section 2.3, Preparing for Sampling*.

Inert Gas Supply Valve Configuration Option 2

Figure 12: Inert Gas Supply Valve Configuration Option 2



No.	Description
A	Inert Gas Supply Tank Valve
B	Inert Gas Supply Tank Fill Valve

27. Connect an appropriate customer-supplied nitrogen or other inert gas supply container to inert gas supply tank fill valve B located in front of the pre-charge pressure gauge (*Figure 12*).
28. Open valve A, and then slowly open valve B (*Figure 12*).
29. Allow the inert gas supply tank to fill.
30. While filling the inert gas supply tank, refer to the pre-charge side pressure gauge to monitor the pressure of the tank (*Figure 5* or *Figure 6*).
31. If the product side pressure gauge shows pressure, open purge/return valve D to lower the piston and relieve pressure within the LS-14 (*Figure 5* or *Figure 6*).
32. Fill the inert gas supply tank until the pre-charge side pressure gauge reads 50–100 psig above pipeline operating pressure, not to exceed the maximum allowable operating pressure of the LS-14.
33. Once full, close valve B and disconnect the customer-supplied inert gas supply container. Valve A must remain open (*Figure 12*).
34. Plug the port of valve B by wrapping the threads of a male hex plug with PTFE tape and screwing it into the port of valve B (*Figure 12*). Valve B must remain plugged at all times except when adding inert gas to the inert gas supply tank.
35. Check all connections between the inert gas supply tank and the receiver cylinder for leaks. Repair as necessary.
36. If the LS-14 will use pneumatics for mixer actuation, continue to step 37. If the LS-14 will use hydraulics for mixer actuation, proceed to *Section 2.3, Preparing for Sampling*.

Regulating the Pneumatic Supply (As Necessary)

37. Turn on the pneumatic supply.
38. Regulate the pneumatic supply to approximately 40–45 psig.

2.3 Preparing for Sampling

1. Open the pipeline connection.
2. As necessary, adjust the sample volume on the sampler. Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the sampler for instructions on adjusting the sample volume.
3. Turn ON power to the system.
4. As necessary, manually turn ON the motor starter for the EHUC (*Figure 7*).
5. Purge the LS-14 prior to beginning composite sampling.

Purging the LS-14

Welker recommends that the LS-14 be evacuated or purged prior to each sample batch to prevent cross-contamination between samples.

6. Open sample container isolation valve E (*Figure 4*, *Figure 5*, or *Figure 6*). Ensure that composite sample draw off valve F is closed.
7. Begin product flow through the system.
8. Open purge/return valve D (*Figure 4*, *Figure 5*, or *Figure 6*).
9. Manually or remotely actuate the sampler to purge the line of air or previous product.
10. Once all previous product has drained from the LS-14, close purge/return valve D (*Figure 4*, *Figure 5*, or *Figure 6*).

Verifying Sampler Operation

11. Close sample container isolation valve E (*Figure 4*, *Figure 5*, or *Figure 6*).
12. Manually actuate the sampler using the manual override on the solenoid.
13. Observe the product side pressure gauge on the LS-14 (*Figure 4*, *Figure 5*, or *Figure 6*). If the sampler is operating correctly, a spike in pressure is shown.
14. Once sampler operation has been verified, open sample container isolation valve E on the manifold block (*Figure 4*, *Figure 5*, or *Figure 6*).

Valve E on the manifold block must remain open for the duration of composite sampling.

2.4 Composite Sampling

1. If the LS-14 is equipped with inert gas supply valve configuration option 1, ensure that valves A and C on the inert gas supply tank are open (*Figure 11*). If the LS-14 is equipped with inert gas supply valve configuration option 2, ensure that valve A on the inert gas supply tank is open (*Figure 12*).

> Valves A and C on the inert gas supply tank must remain open for the duration of composite sampling.

2. Ensure that sample container isolation valve E is open (*Figure 4*, *Figure 5*, or *Figure 6*).

> If sample container isolation valve E is not open, product will vent through the relief valve instead of entering the LS-14.

3. As necessary, ensure that the EHUC is ON (*Figure 7*).
4. Ensure that the pipeline connection is open and sample is flowing to the sample receiver.
5. For sampling operation procedures, refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the sampler.
6. The magnetic volume indicator on the LS-14 should begin to rise as product fills the LS-14.
7. Allow the LS-14 to fill to the desired volume, not to exceed 80%.

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

Withdrawing Product for Transportation After Composite Sampling

> Welker recommends the following transportable containers for use with this unit:
> - Welker® Constant Pressure Cylinders for light liquid products;
> - Welker® Constant Pressure Cylinders or chilled containers for Reid vapor pressure (RVP) testing; and
> - capped metal or amber glass containers of the appropriate volume for retain samples.

8. As necessary, turn OFF and isolate the sampler from the LS-14.
9. To transfer sampled product to a constant pressure cylinder for laboratory analysis, connect the product side of the constant pressure cylinder to composite sample draw off valve F (*Figure 4*, *Figure 5*, or *Figure 6*). The cylinder should have a pre-charge pressure of approximately 100 psig above the product pressure in the LS-14. Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the constant pressure cylinder for pre-charging instructions.
10. Prior to withdrawing sampled product from the LS-14, the operator should manually cycle the mixer four to five times (4–5x). If the LS-14 is equipped with a pneumatic mixer, alternately press and release the mixer button on the side of the LS-14 (*Figure 4* or *Figure 5*). If the LS-14 is equipped with a hydraulic mixer, alternately hold up and release the mixer lever on the EHUC (*Figure 7*).
11. With sample container isolation valve E open, open composite sample draw off valve F on the LS-14, and then open the inlet valve on the constant pressure cylinder (*Figure 4*, *Figure 5*, or *Figure 6*).
12. Slowly open the product purge valve on the constant pressure cylinder to purge any air. Shut the valve completely once liquid beings to purge.
13. Actuate the mixer for another three to four (3–4) complete cycles.

14. Slowly open the pre-charge valve on the constant pressure cylinder and allow the constant pressure cylinder to fill to the desired volume, not to exceed 80%.

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

15. After the transfer is complete, close composite sample draw off valve F on the LS-14 and the inlet valve on the constant pressure cylinder (*Figure 4*, *Figure 5*, or *Figure 6*).
16. Disconnect the constant pressure cylinder from composite sample draw off valve F (*Figure 4*, *Figure 5*, or *Figure 6*).
17. Tag the constant pressure cylinder and prepare it for transportation to the testing laboratory in accordance with company policy.
18. If desired, repeat steps 9–17 to transfer any sampled product remaining in the LS-14 to additional constant pressure cylinders for laboratory analysis.

Draining the LS-14

> Any sample remaining in the LS-14 must be eliminated prior to the start of the next round of composite sampling.

19. Open purge/return valve D on the LS-14 to return any remaining product to the pipeline (*Figure 4*, *Figure 5*, or *Figure 6*).

> If pneumatics is used to actuate the mixer, air may be relieved from the mixer as the LS-14 is drained.

20. Purge the LS-14 prior to beginning a new round of composite sampling. See *Section 2.3, Preparing for Sampling,* for instructions on purging the LS-14.
21. Once the LS-14 has been purged, a new round of composite sampling may begin.

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.

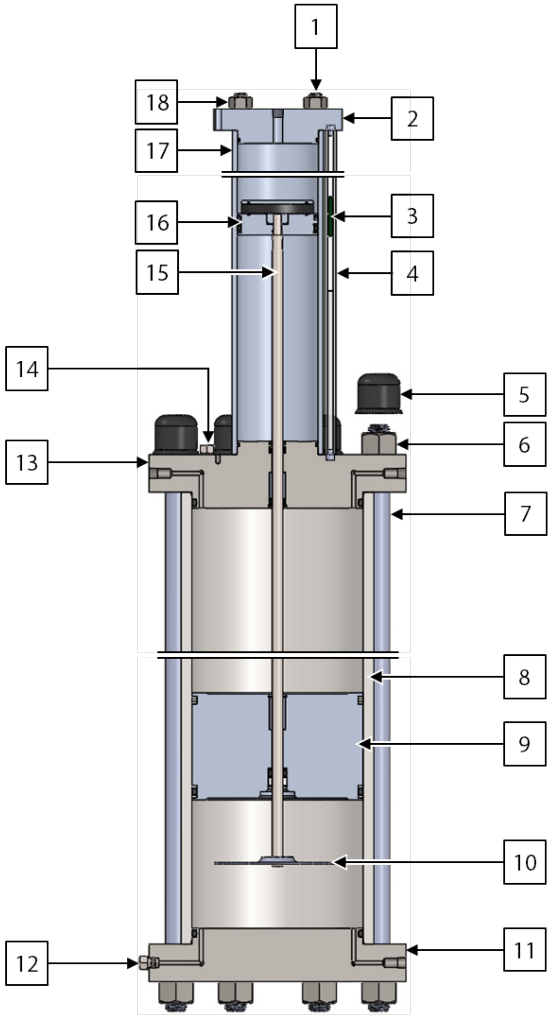
3. All maintenance and cleaning of the unit should be performed on a smooth, clean surface.
4. Welker recommends having the following tools available for maintenance. Please note that the exact tools required may vary by model.
    a. Channel Lock Pliers
    b. Large Crescent Wrench
    c. Seal Pick
    d. Small Crescent Wrench

3.2 Maintenance

1. Turn OFF all electrical power to the system and completely shut down the system.
2. Close inert gas supply tank valve A to preserve the inert gas in the tank (*Figure 10*).
3. Depressurize the LS-14 by removing the plug from inert gas supply tank fill valve B and then opening inert gas supply tank fill valve B (*Figure 10*). If applicable, open inert gas supply tank isolation valve C (*Figure 10*).
4. Open purge/return valve D to drain the LS-14 to the pipeline or to a safe recovery system or sump (*Figure 4*, *Figure 5*, or *Figure 6*).
5. As necessary, shut OFF or disconnect the pneumatic supply.

Disassembling the LS-14

Figure 13: LS-14 Maintenance Diagram



No.	Description
1	Actuator Cylinder Tie Bolt (Qty. 4)
2	Top Cap
3	Tracker Magnet
4	Tracker Tube
5	Hex Nut Cover (Qty. 8)
6	Receiver Cylinder Hex Nut (Qty. 16)
7	Receiver Cylinder Tie Bolt (Qty. 8)
8	Receiver Cylinder
9	Receiver Piston
10	Mixing Plate
11	Product End Cap
12	Burst Relief Disc With Burst Relief Cap
13	Pre-Charge End Cap
14	Burst Relief Disc With Burst Relief Cap
15	Mixing Shaft
16	Actuator Piston
17	Actuator Cylinder
18	Actuator Cylinder Hex Nut (Qty. 4)

6. Disconnect the tubing from the top cap.
7. Disconnect the tubing between the inert gas supply tank and the pre-charge end cap.
8. Remove the actuator cylinder hex nuts from the actuator cylinder tie bolts, and then remove the top cap.
9. Remove the tracker tube and tracker magnet, and then set them aside. Take care not to misplace the tracker tube pins inside the tracker tube.
10. Slowly slide the actuator cylinder up and off the actuator piston.
11. Remove the magnet retainer, magnet, and actuator piston from the mixer shaft (*Figure 18*).
12. Loosen the receiver cylinder hex nuts on the pre-charge end cap, and then loosen the receiver cylinder hex nuts on the product end cap.
13. Fully unscrew six (6) of the receiver cylinder hex nuts on the pre-charge end cap and their respective receiver cylinder hex nuts on the product end cap.
14. Remove the six (6) receiver cylinder tie bolts by pulling them up and out of the pre-charge end cap.
15. Fully unscrew and remove the remaining receiver cylinder hex nuts on the pre-charge end cap.
16. Remove the pre-charge end cap from the LS-14.
17. Carefully lift the pre-charge end cap straight up and off the mixer shaft.

18. With the receiver piston still inside, carefully lift the receiver cylinder off the product end cap.

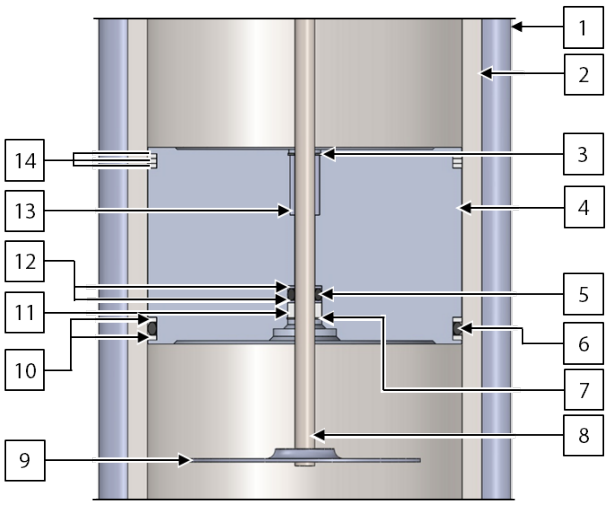
The receiver cylinder is extremely heavy. It may be necessary to have a partner assist in removing the cylinder. Use appropriate personal protective equipment (PPE) and follow appropriate company policies for heavy lifting.

19. Gripping the mixing shaft above the mixing plate, gently pull the mixing shaft out through the bottom of the receiver piston, taking care not to scratch the mixing shaft, as scratches may cause seals to leak. If scratches are present, the unit may need to be repaired or replaced. Contact Welker for service options.
20. From the pre-charge side, slowly push the receiver piston out of the receiver cylinder. Note the position of the top and bottom of the piston and cylinder for ease of reassembly.

As necessary, use a clean wooden dowel or PVC pipe to gently push the piston out of the cylinder. DO NOT use metal objects, as they may scratch and damage the unit.

Receiver Cylinder

Figure 14: Receiver Cylinder Maintenance Diagram



No.	Description
1	Receiver Cylinder Tie Bolt (Qty. 8)
2	Receiver Cylinder
3	Snap Ring
4	Receiver Piston
5	O-ring
6	O-ring
7	Retaining Ring
8	Mixing Shaft
9	Mixing Plate
10	Back Up (Qty. 2)
11	Bearing
12	Back Up (Qty. 2)
13	Bearing
14	Back Up (Qty. 3)

21. Closely examine the polished and honed surfaces of the receiver cylinder, as 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.
22. Lightly lubricate the inside of the receiver cylinder.

> ⚠ DO NOT use a hydrocarbon-based lubricant, as it can leave a residue that can skew laboratory analysis results.

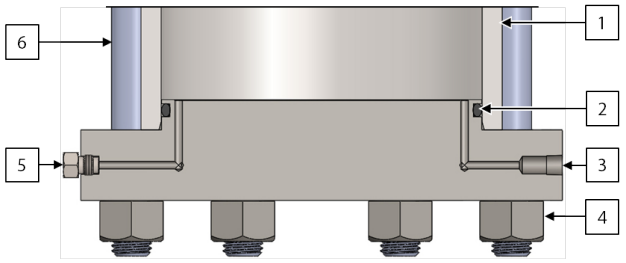
23. Ensure that the bearing in the receiver piston is clean and smooth. Replace as necessary.
24. Replace the back ups, O-rings, retaining ring, and snap ring on the receiver piston.
25. Closely examine the polished and honed surfaces on the mixing shaft, as scratches or pits may cause the seals to leak. If scratches or pits are present, the unit may need to be repaired or replaced. Contact Welker for service options.
26. Lightly lubricate the mixing shaft.

> ⚠ DO NOT use a hydrocarbon-based lubricant, as it can leave a residue that can skew laboratory analysis results.

27. Insert the mixing shaft into the receiver piston, taking care not to damage the seals. Gently rotate the threads through the seals.
28. Insert the receiver piston into the receiver cylinder.

Product End Cap

Figure 15: Product End Cap Maintenance Diagram

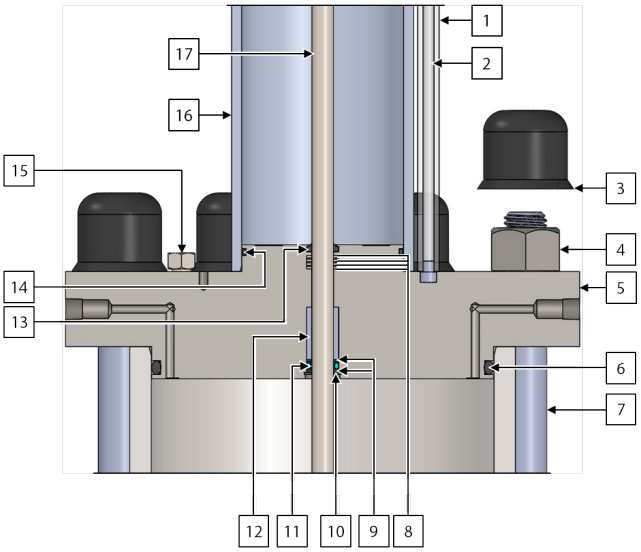


No.	Description
1	Receiver Cylinder
2	O-ring
3	Product End Cap
4	Receiver Cylinder Hex Nut (Qty. 8)
5	Burst Relief Disc With Burst Relief Cap
6	Receiver Cylinder Tie Bolt (Qty. 8)

29. Replace the O-ring on the product end cap.
30. If the LS-14 is equipped with a burst relief disc, replace the burst relief disc. Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the burst relief disc for instructions on installing replacement discs.
31. If applicable, tighten the burst relief cap to 25 ft•lb once the replacement burst relief disc has been installed.
32. If the LS-14 is equipped with an external relief, maintain the relief. Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the external relief for maintenance instructions.

Pre-Charge End Cap

Figure 16: Pre-Charge End Cap Maintenance Diagram



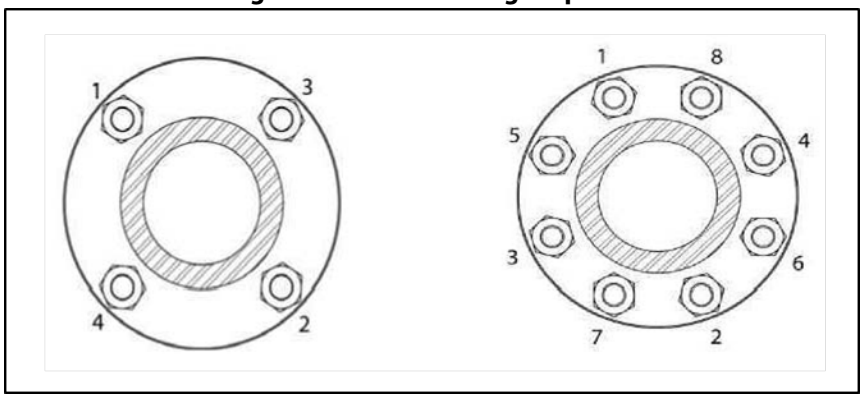
No.	Description
1	Tracker Tube
2	Tracker Tube Pin
3	Hex Nut Cover (Qty. 8)
4	Receiver Cylinder Hex Nut (Qty. 8)
5	Pre-Charge End Cap
6	O-ring
7	Receiver Cylinder Tie Bolt (Qty. 8)
8	Back Up (Qty. 4)
9	Back Up (Qty. 2)
10	Snap Ring
11	Crown Seal
12	Bearing
13	Wiper Ring
14	O-ring
15	Burst Relief Disc With Burst Relief Cap
16	Actuator Cylinder
17	Mixing Shaft

33. Ensure that the bearing in the pre-charge end cap is clean and smooth. Replace as necessary.
34. Replace the wiper ring, O-rings, back ups, snap ring, and crown seal on the pre-charge end cap.
35. If the LS-14 is equipped with a burst relief disc, replace the burst relief disc. Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the burst relief disc for instructions on installing replacement discs.
36. If applicable, tighten the burst relief cap to 25 ft•lb once the replacement burst relief disc has been installed.
37. If the LS-14 is equipped with an external relief, maintain the relief. Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the external relief for maintenance instructions.

Reassembling the Receiver Cylinder

38. Place the receiver cylinder onto the product end cap.
39. Carefully place the pre-charge end cap onto the receiver cylinder. The gauge port on the pre-charge end cap should align with the gauge port on the product end cap.
40. Insert the receiver cylinder tie bolts into the product end cap.
41. Following a cross-bolting sequence, first screw the receiver cylinder hex nuts down two (2) threads on the top of each bolt, and then screw the hex nuts up two (2) threads on the bottom of each bolt (*Figure 17*).

Figure 17: Cross-Bolting Sequence



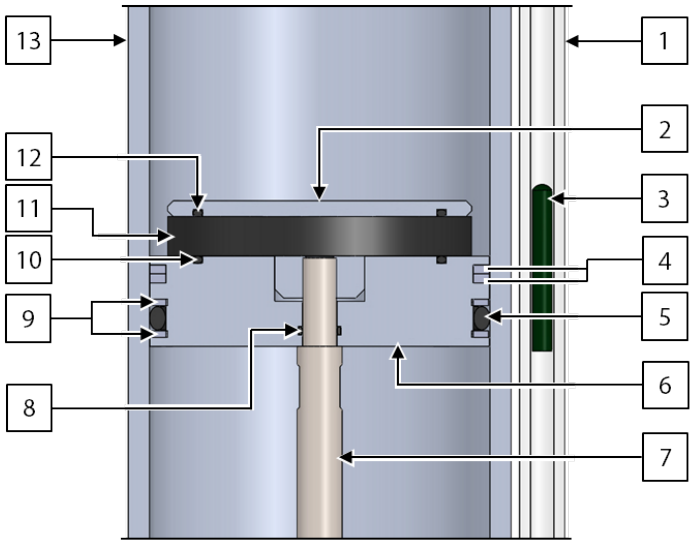
42. Push each tie bolt up from the bottom, and then hand-tighten the hex nuts on each top bolt.
43. As necessary, tighten all tie bolts to the correct torque (*Table 2*).

Table 2: Torque Specifications for Tie Bolts

Tie Bolt Diameter	Foot-Pounds (ft•lb)	Kilograms per Meter (kg/m)
3/8"	5–6	0.69–0.82
1/2"	15–20	2.07–2.76
5/8"	25–30	3.45–4.14
7/8" or 1"	55–65	7.60–8.98

Actuator Piston

Figure 18: Actuator Piston Maintenance Diagram



No.	Description
1	Tracker Tube
2	Magnet Retainer
3	Tracker Magnet
4	Back Up (Qty. 2)
5	O-ring
6	Piston
7	Mixing Shaft
8	O-ring
9	Back Up (Qty. 2)
10	O-ring
11	Piston Magnet
12	O-ring
13	Actuator Cylinder

44. Replace the O-rings and back ups on the actuator piston.
45. Replace the O-ring on the magnet retainer.

Reassembling the Actuator

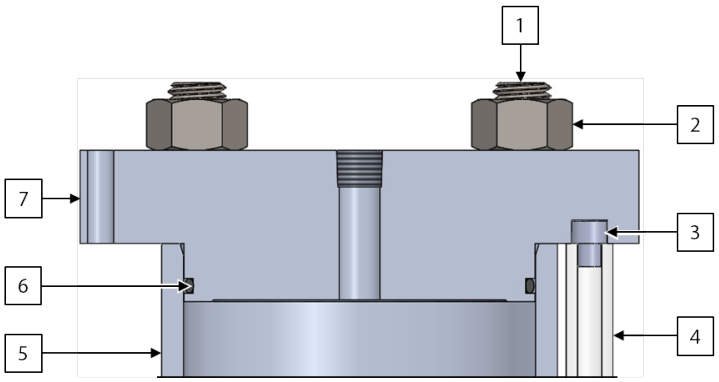
46. Assemble the actuator piston, magnet, and magnet retainer.
47. Ensure that the tracker magnet and tracker tube pins are inside the tracker tube, and then carefully attach the volume indicator to the actuator cylinder.

If the tracker tube pins are not inside the tracker tube, the tracker magnet will fall below 0%, yielding an inaccurate reading.

48. Slide the actuator cylinder down into place over the mixing shaft.

Top Cap

Figure 19: Top Cap Maintenance Diagram



No.	Description
1	Actuator Tie Bolt (Qty. 4)
2	Actuator Hex Nut (Qty. 4)
3	Tracker Tube Pin
4	Tracker Tube
5	Actuator Cylinder
6	O-ring
7	Top Cap

49. Replace the O-ring on the top cap.

Reassembling the LS-14

50. Place the top cap onto the actuator cylinder.
51. Insert the actuator tie bolts into the top cap.
52. Following a cross-bolting sequence, tighten the actuator hex nuts (*Figure 17*).
53. As necessary, tighten all tie bolts to the correct torque (*Table 2*).
54. Connect the tubing to the top cap.
55. Connect the tubing between the inert gas supply tank and the pre-charge end cap.
56. Check the system for loose fittings. Tighten any loose fittings and replace ferrules where necessary.
57. Install the system according to the instructions in *Section 2.2, Installation*, and *Section 2.3, Preparing for Sampling*.

Check valves for leaks and repair as necessary during reinstallation.

3.3 Troubleshooting

Table 3: LS-14 Troubleshooting		
Issues	**Possible Causes**	**Solutions**
The LS-14 will not fill to 80%.	Pre-charge pressure may not be relieving back to the inert gas supply tank.	Ensure that valve A (and valve C, if applicable) on the inert gas supply tank are open during composite sampling to allow pressure to be relieved back to the inert gas supply tank from the pre-charge side as product enters the LS-14 (*Figure 10*).
The LS-14 is filling too quickly.	Pre-charge pressure may not be supplied to the LS-14 at the appropriate pressure.	Apply additional pre-charge pressure to the LS-14 until the pre-charge pressure reaches 50–100 psig above pipeline operating pressure, not to exceed the maximum allowable operating pressure of the equipment.
	The sampler may be set at a faster sampling frequency than desired.	Adjust the PLC to sample at the desired rate. Ensure that the calculations used to determine the sample frequency are correct (*Figure 9*).
The tracker magnet is not moving.	The hydraulic or pneumatic supply may not be directed below the actuator piston.	Ensure that the mixer lever/button is tubed to the bottom of the actuator cylinder.
	Sample is leaking from the receiver cylinder.	Ensure that purge/return valve D is closed. Check for leaks between the sampler and the receiver cylinder and repair as necessary.
The burst disc on the product side of the LS-14 is leaking.	The lifespan of the burst disc may have been exceeded.	Replace the burst disc. A more frequent preventative maintenance schedule may be required for the burst disc. Do not exceed 80% volume in the LS-14 to avoid overpressurizing the receiver cylinder.
The burst disc on the pre-charge side of the LS-14 is leaking.	The valve on the pre-charge side of the LS-14 may be closed.	Ensure that valve A (and valve C, if applicable) on the inert gas supply tank is open during composite sampling to allow pressure to be relieved back to the inert gas supply tank from the pre-charge side as product enters the LS-14 (*Figure 10*).
	The lifespan of the burst disc may have been exceeded.	Replace the burst disc. A more frequent preventative maintenance schedule may be required for the burst disc.

Table 3: LS-14 Troubleshooting (Continued)		
Issues	**Possible Causes**	**Solutions**
The regulator is leaking.	The poppet assembly may need to be replaced.	Check the poppet assembly and the seat on the regulator. Replace as necessary. Refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the regulator for instructions on maintaining the regulator.
The mixer is not working properly.	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 hydraulic supply may be too low or not operating.	Inspect the electro-hydraulic unit (EHUC). Add hydraulic oil as necessary. Ensure that hydraulics is supplied at the appropriate pressure. If the EHUC is not operating, refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the EHUC.
	The relief and check valve in the hydraulic line have failed.	Maintain the relief and check valve. Refer to the *Installation, Operation, and Maintenance* (IOM) *Manuals* for the relief and check valve for instructions.

APPENDIX A: REFERENCED OR ATTACHED DOCUMENTS

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

- IOM-001: Welker® 4P Sample Frequency Controller
- IOM-002: Welker® 6Tc Timer/Controller
- IOM-011: Welker® CP-2G, CP-5G, CP-35G, and CP-2G With Premium Purge Constant Pressure Sample Cylinders With Tracker Tube
- IOM-025: Welker® IR-1, IR-2, IR-4, and IR-6 Instrument Regulators
- IOM-029: Welker® inLoop™ Crude Oil Sampler
- IOM-033: Welker® RV-1, RV-2, RV-2CP, and RV-3 Relief Valves
- IOM-041: Welker® AVA-1 and AVA-2 Volume Analyzers
- IOM-046: Welker® F-4, F-5, F-19, F-23, and F-31 Filters/Dryers
- IOM-056: Welker® MPS-2 Gas Sampler
- IOM-105: Welker® NV-1 and NV-2 Instrument Valves
- IOM-175: Welker® SSO-9MED Injection Pump
- IOM-182: Welker® CV-K Check Valve

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

- Automatic Timing & Controls 354B Series Shawnee II High Speed Counter (Welker® IOM-V034)
- Circle Seal Controls 500 Series Adjustable Popoff & Inline Relief Valves (Welker® IOM-V178)
- Continental Disc Corporation Preparation and Installation of the ½" Standard Type Rupture Disc/Screw Type Holder Assembly (Welker® IOM-V301)
- Gems Sensors Inc. Series Piston-Type Flow Switches FS-925/926 & FS-927/930 (Welker® IOM-V029)
- Magnetrol® Thermatel® Model TD1/TD2 Thermal Dispersion Flow/Level/Interface Switch (Welker® IOM-V129)
- MTS Sensors Corporation Level Plus® Liquid-Level Sensors With Temposonics® Technology M-Series Model MR Analog Transmitter (Welker® IOM-V036)
- Norgren® L73M and L73C Micro-Fog® and Oil-Fog Tool Lubricators (Welker® IOM-V013)
- Norgren® R83 Cylinder Gas Pressure Regulator For Industrial Gas Systems (Welker® IOM-V014)
- Swagelok® Proportional Relief Valves R Series (Welker® IOM-V086)
- TopWorx® 10 & 20 Series GO™ Switch (Welker® IOM-V131)
- Versa Products Company, Inc. C-316 Series Stainless Steel 3-Way and 4-Way Manual, Latching and Key Valves (Welker® IOM-V070)
- WIKA Bourdon Tube Pressure Gauges Type 232.53 and Type 233.53 (Welker® IOM-V171)
- Wilson Company Standard Hydraulic Power Units (Welker® IOM-V009)

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

- Assembly Drawing: AD245.HCRN (LS-14 With CRN Certification With Optional Hydraulic Mixer Actuation)
- Assembly Drawing: AD245CRN (Standard LS-14 With CRN Certification)
- Assembly Drawing: AD245CV (Standard LS-14)

NOTES

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