



INSTALLATION, OPERATION, AND MAINTENANCE MANUAL
WELKER COMPOSITE LIQUID SAMPLER

MODEL
LSSM-1PM

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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 Composite Liquid Sampler, LSSM-1PM. 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 Composite Liquid Sampler 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 Composite Liquid 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 *LSSM-1PM* Composite Liquid Sampler is a self-purging positive displacement pump designed to extract samples from the center one-third ($\frac{1}{3}$) of the pipeline and collect them in a connected sample container.

The compact design of this probe mounted sampler eliminates long tubing runs and sample lag time. By minimizing the distance between the product source and the collection head, the LSSM-1PM ensures quality sample grabs. With every actuation, pressure is applied to the Vanishing Chamber™ collection cup, collapsing the cup and fully displacing the trapped sample into the sample container.

The LSSM-1PM can be connected to a customer Programmable Logic Controller (PLC) or other signal control system to operate the solenoid. Alternatively, the LSSM-1PM can be supplied with a Welker 4P Sample Frequency Controller or a Welker 6Tc Timer/Controller, both of which are capable of operating the solenoid for timed or proportional to flow sampling.



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 LSSM-1PM 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: LSSM-1PM Specifications

Products Sampled	Liquids Compatible With the Materials of Construction
Materials of Construction	316/316L Stainless Steel, PTFE, and Viton® Others Available
Maximum Allowable Operating Pressure	3600 psig @ -20 °F to 120 °F (248 barg @ -28 °C to 48 °C)
Pipeline Connection	½" MNPT ¾" MNPT 1" MNPT
Electrical Connection	AC 110 V DC 6 V DC 12 V DC 24 V
Sample Volume	0.065 cc Vanishing Chamber™ Collection Cup 0.22 cc Vanishing Chamber™ Collection Cup 0.5 cc Vanishing Chamber™ Collection Cup 1.0 cc Vanishing Chamber™ Collection Cup 1.5 cc Vanishing Chamber™ Collection Cup
Operation	Piston-Operated Motor
Features	Inline Relief Pressure Gauge Welker IR-4 Instrument Regulator Welker PP-2 Pitot Probe Welker RV-1 Relief Valve
Options	4-Way Solenoid Valve Probe Mounting Bracket Welker 4P Sample Frequency Controller Welker 6Tc Timer Controller CRN Alberta Certification (Components Only)

1.4 Equipment Diagrams

Figure 1: LSSM-1PM Connections Diagram

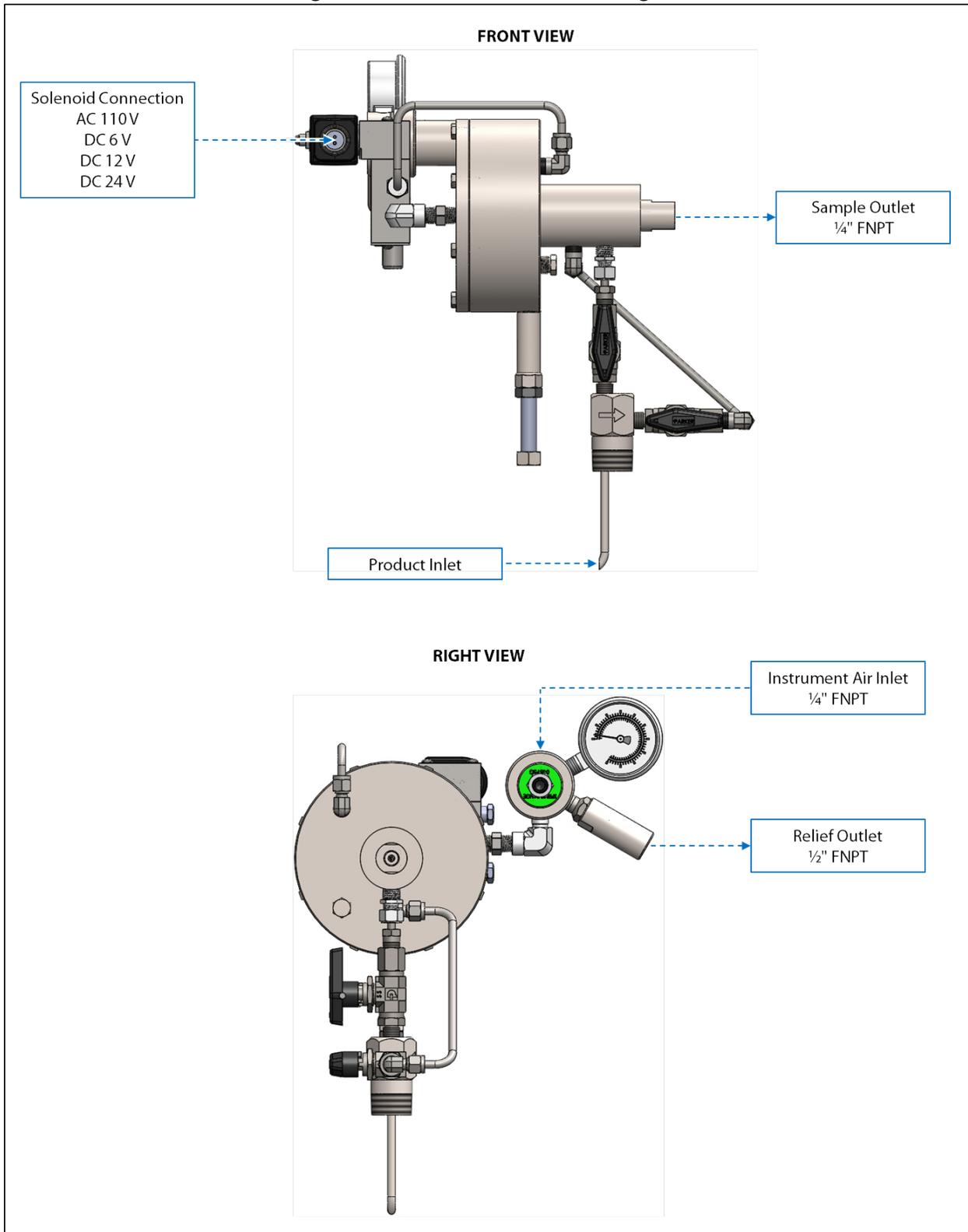
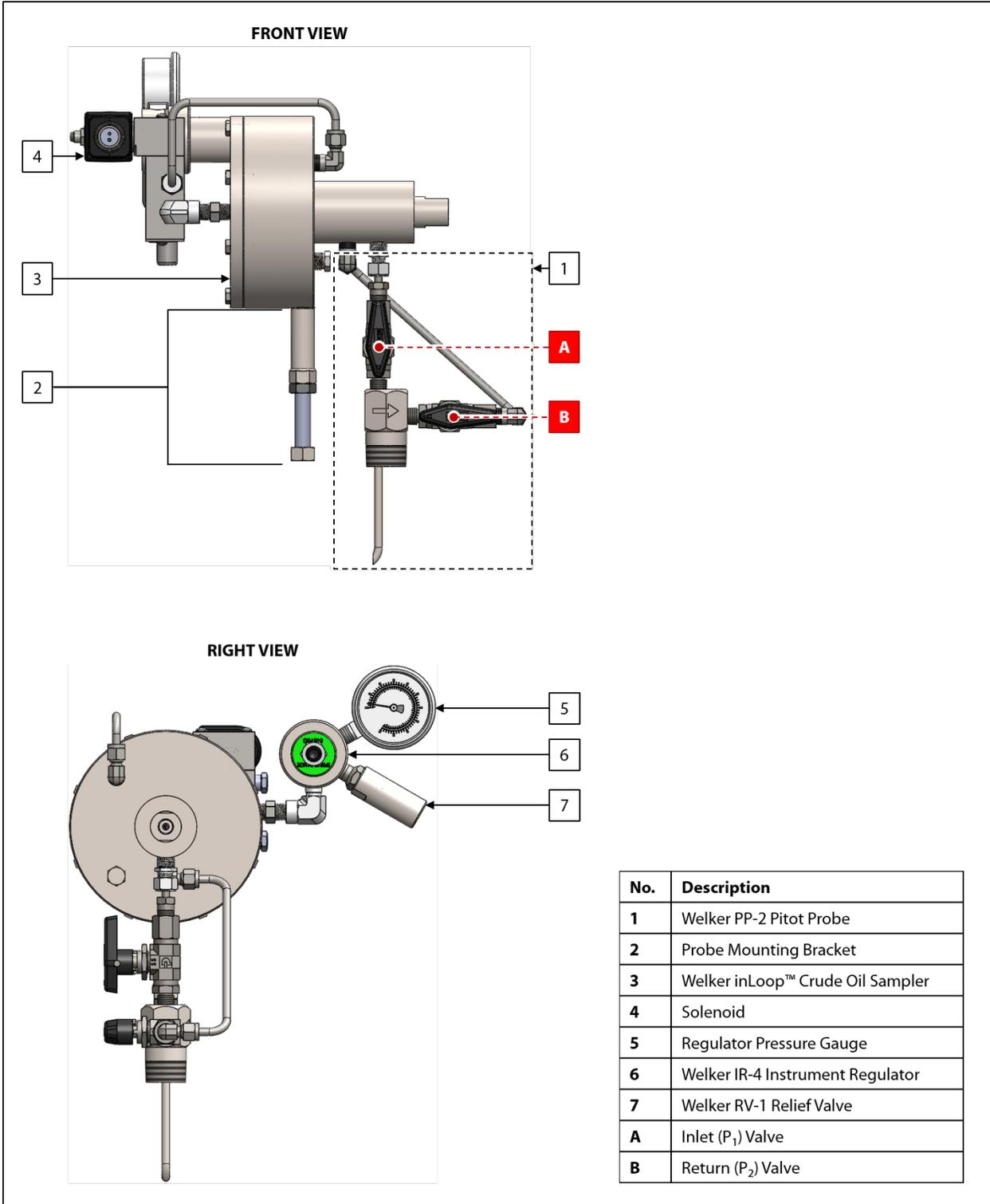


Figure 2: LSSM-1PM Diagram



SECTION 2: INSTALLATION & OPERATION

2.1 Before You Begin



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



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

1. The installation instructions are written with the assumption that the sampler has been purchased as part of a complete sampling system. If the sampler has been purchased individually, a sampling system should be constructed in a fashion compatible with the instructions in this *Installation, Operation, and Maintenance (IOM) Manual*.
2. Welker recommends that the probe be installed to the side of the pipe and inserted into the center one-third ($\frac{1}{3}$) of the pipeline in a location where the product is well-mixed and will yield an accurate and representative sample.
3. The sample probe should be located in the least turbulent area of the flowing stream available (i.e., not in a header or blow-down stack and away from obstructions, elbows, and partially closed valves).
4. The Welker LSSM-1PM is equipped with a pitot probe to create a bypass for the sampler, which will allow for a "real-time" sample to be taken with each actuation of the sampler.

2.2 Installation

1. Depressurize the pipeline.



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

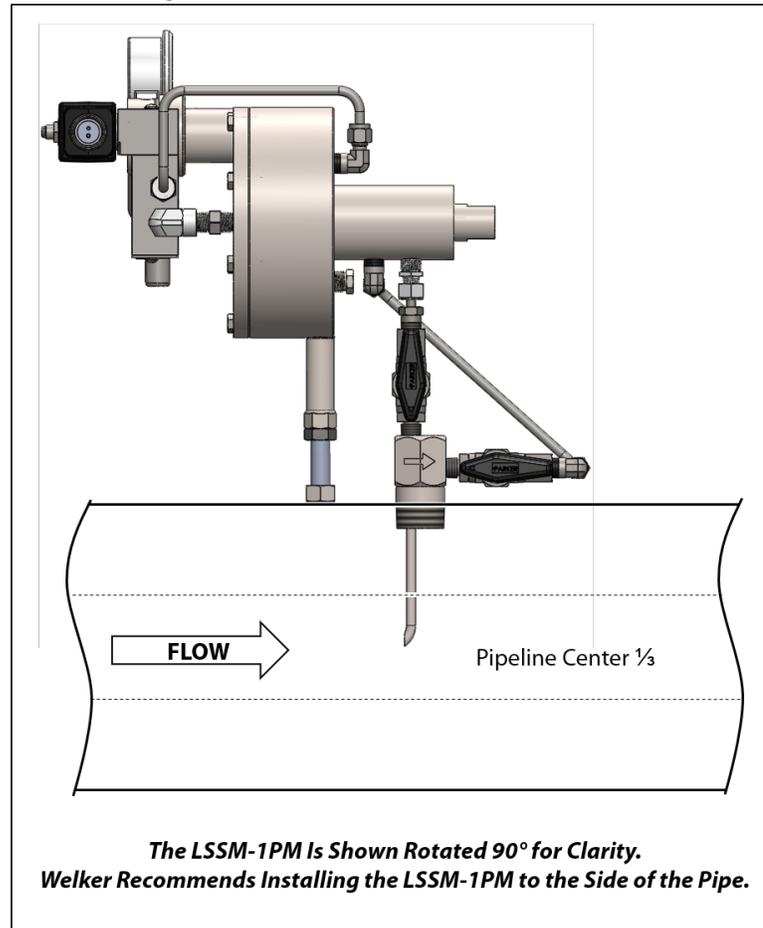
2. Ensure that all valves on the LSSM-1PM are closed.
3. Wrap the threads of the threaded pipeline connection with PTFE tape.

- Determine the direction of product flow in the pipeline. For the LSSM-1PM to function correctly, it must be installed so that the scooped probe tip is open against the direction of product flow (*Figure 3*).



As necessary, refer to the flow direction stamped below inlet (P₁) valve A to determine correct orientation before installing the LSSM-1PM to the pipeline.

Figure 3: Correct Installation of LSSM-1PM



- Install the LSSM-1PM to the pipeline.
- As necessary, adjust the probe mounting bracket so that the LSSM-1PM is supported by the pipeline (*Figure 2*).
- If the LSSM-1PM is equipped with a Welker 4P Sample Frequency Controller, refer to the *Installation, Operation, and Maintenance (IOM) Manual* for the 4P for wiring instructions.
- If the LSSM-1PM is equipped with a Welker 6Tc Timer/Controller, refer to the *Installation, Operation, and Maintenance (IOM) Manual* for the 6Tc for wiring instructions.
- If the LSSM-1PM is equipped with a solenoid, connect from the PLC to the solenoid (*Figure 1*).
- Using 1/4" tubing, connect from a customer-supplied pneumatic supply to the regulator (*Figure 1*).
- Regulate the customer-supplied pneumatic supply to the pressure appropriate for the application. The supply should be between 40 and 65 psig.
- As necessary, use 1/2" tubing to connect from the relief outlet to a sump or the pipeline (*Figure 1*).
- As necessary, set the regulator relief valve to approximately 90–95 psig. Refer to the *Installation, Operation, and Maintenance (IOM) Manual* for the relief valve for instructions on setting the relief.

2.3 Start-Up Procedures

1. Ensure that all valves are closed.
2. Pressurize the pipeline.
3. As necessary, adjust the inline relief.



If an atmospheric container will be used for sample collection, continue to step 4.
If a Welker Constant Pressure Cylinder will be used for sample collection, proceed to step 9.

Setting the Inline Relief

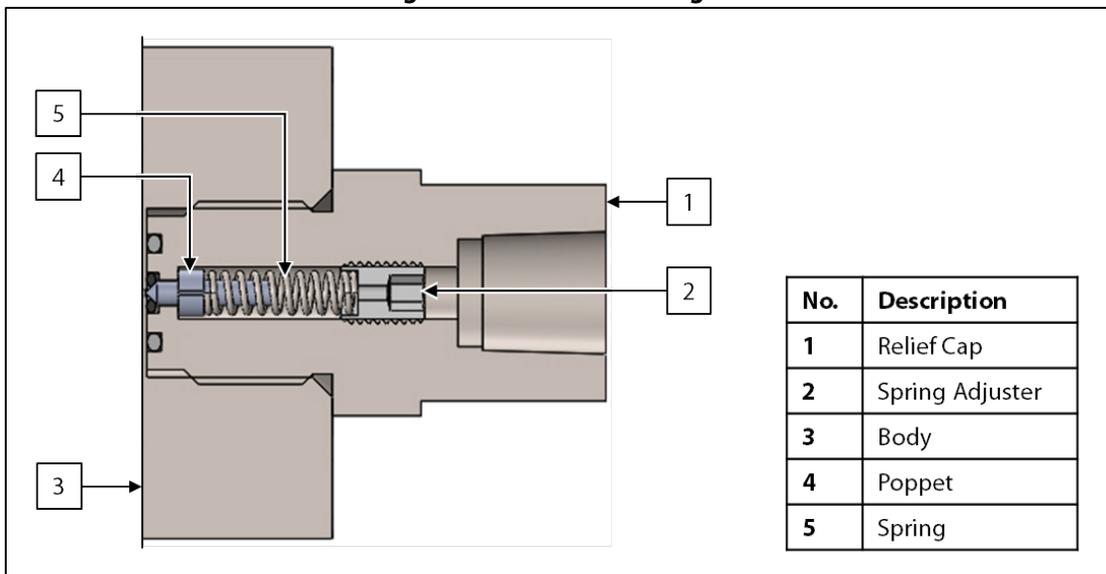


The inline relief is designed to allow product to flow in one direction only. Acting as a check valve, the inline relief will ensure that sample pumped into the sample cylinder cannot flow back to the pipeline even if pipeline pressure drops.



For the factory inline relief setting, refer to the tag on the LSSM-1PM.

Figure 4: Inline Relief Diagram



Atmospheric Container

4. Remove the fitting from the relief cap.
5. Insert a hex key through the relief cap to the spring adjuster.
6. Open inlet (P₁) valve A and return (P₂) valve B to allow full pipeline pressure to reach the LSSM-1PM. Check for leaks and repair as necessary.
7. Turn the spring adjuster to adjust the spring tension until no product bleeds through, and then turn the spring adjuster clockwise another full turn.



When sampling into an atmospheric container, the inline relief must be set to approximately 100 psig above pipeline pressure.



To increase spring tension and raise the relief set point, turn the spring adjuster clockwise.
To decrease spring tension and lower the relief set point, turn the spring adjuster counterclockwise.

8. Return the fitting to the relief cap.

Welker Constant Pressure Cylinder

9. Install a pre-charged constant pressure cylinder to the LSSM-1PM. See *Section 2.4, Connecting a Sample Cylinder*, for instructions.
10. Open inlet (P₁) valve A and return (P₂) valve B to allow full pipeline pressure to reach the LSSM-1PM. Check for leaks and repair as necessary.
11. Read the pressure on the constant pressure cylinder gauge. To determine the current inline relief setting, subtract this pressure reading from the pipeline pressure.



When sampling into a Welker Constant Pressure Cylinder, the pressure gauge should read approximately 200 psig below pipeline pressure at start-up.

12. If the current inline relief setting is approximately 200 psig below pipeline pressure, the inline relief does not need to be adjusted; proceed to step 21. If the current inline relief setting is anything other than approximately 200 psig below pipeline pressure, the inline relief must be adjusted; continue to step 13.
13. Close inlet (P₁) valve A and return (P₂) valve B to isolate the LSSM-1PM from pipeline pressure.
14. Disconnect the constant pressure cylinder from the LSSM-1PM.
15. Remove the fitting from the relief cap.
16. Insert a hex key through the relief cap to the spring adjuster.
17. Turn the spring adjuster to adjust the spring tension.



When sampling into a Welker Constant Pressure Cylinder, the pressure gauge should read approximately 200 psig below pipeline pressure at start-up.



To increase spring tension and raise the relief set point, turn the spring adjuster clockwise.
To decrease spring tension and lower the relief set point, turn the spring adjuster counterclockwise.

18. Return the fitting to the relief cap.
19. Allow full pipeline pressure to reach the LSSM-1PM.
20. Repeat steps 9–12 until the inline relief is set.

Preparing for Sampling

- 21. As necessary, ensure that the constant pressure cylinder has been pre-charged.
- 22. Open the inlet valve on the sample container. Check for leaks and repair as necessary.
- 23. Set the signal control system to the desired sampling frequency based on the sampling actuation equations provided (Figure 5). Refer to the *Installation, Operation, and Maintenance (IOM) Manual* for the controller used for instructions on setting the sampling frequency.

Figure 5: Sampling Frequency Equations

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



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



Note the 0.8 in Equation 1 represents the 80% volume limit for liquid sampling.



Note that the sample volume of the Vanishing Chamber™ collection cup could be 0.065 cc, 0.22 cc, 0.5 cc, 1.0 cc, or 1.5 cc.

- 24. The LSSM-1PM is now operational.

2.4 Connecting a Sample Cylinder



Install the sample cylinder as close to the LSSM-1PM as possible.

1. If an atmospheric container will be used for sample collection, continue to step 2. If a Welker Constant Pressure Cylinder will be used for sample collection, proceed to step 5.

Atmospheric Container

2. Ensure that the inlet and outlet valves on the atmospheric container are closed.
3. Using $\frac{1}{8}$ " or $\frac{1}{4}$ " tubing or flexline, connect from the sample outlet to the inlet of the atmospheric container (*Figure 1*).
4. The atmospheric container is now connected to the LSSM-1PM.

Constant Pressure Cylinder

5. Pre-charge the constant pressure cylinder. Refer to the *Installation, Operation, and Maintenance (IOM) Manual* for the constant pressure cylinder for instructions on pre-charging the constant pressure cylinder.
6. Using $\frac{1}{8}$ " or $\frac{1}{4}$ " tubing or flexline, connect from the sample outlet to the inlet of the constant pressure cylinder (*Figure 1*).
7. The sample cylinder is now connected to the LSSM-1PM.

3.1 Before You Begin

1. **Welker recommends that the unit have standard yearly maintenance under normal operating conditions.** In cases of severe service, dirty conditions, excessive usage, or other unique applications that may lead to excess wear on the unit, a more frequent maintenance schedule may be appropriate.
2. Prior to maintenance or disassembly of the unit, it is advisable to have a repair kit available for repairs of the system in case of unexpected wear or faulty seals.



New seals supplied in spare parts kits should be lightly lubricated before being installed to ease the installation of the seals and reduce the risk of damage when positioning them on parts. Wipe excess lubricant from the seals, as it may adversely affect analytical instrument results.



For sample-exposed seals, Welker recommends non-hydrocarbon-based lubricants, such as Krytox®. For non-sample-exposed seals, Welker recommends either non-hydrocarbon-based lubricants or silicone-based lubricants, such as Molykote® 111.



After the seals are installed, the outer diameter of shafts and inner diameter of cylinders may be lubricated to allow smooth transition of parts.

3. All maintenance and cleaning of the unit should be performed on a smooth, clean surface.
4. Welker recommends having the following tools available for maintenance. Please note that the exact tools required may vary by model.
 - a. Adjustable Wrench (Qty. 2)
 - b. Anti-galling Compound
 - c. Hex Key Set
 - d. Seal Pick
 - e. Snap Ring Pliers

3.2 Maintenance



If maintenance on the valves or probe is required, the LSSM-1PM must be isolated from pipeline pressure and removed from the pipeline before maintenance can be safely performed.

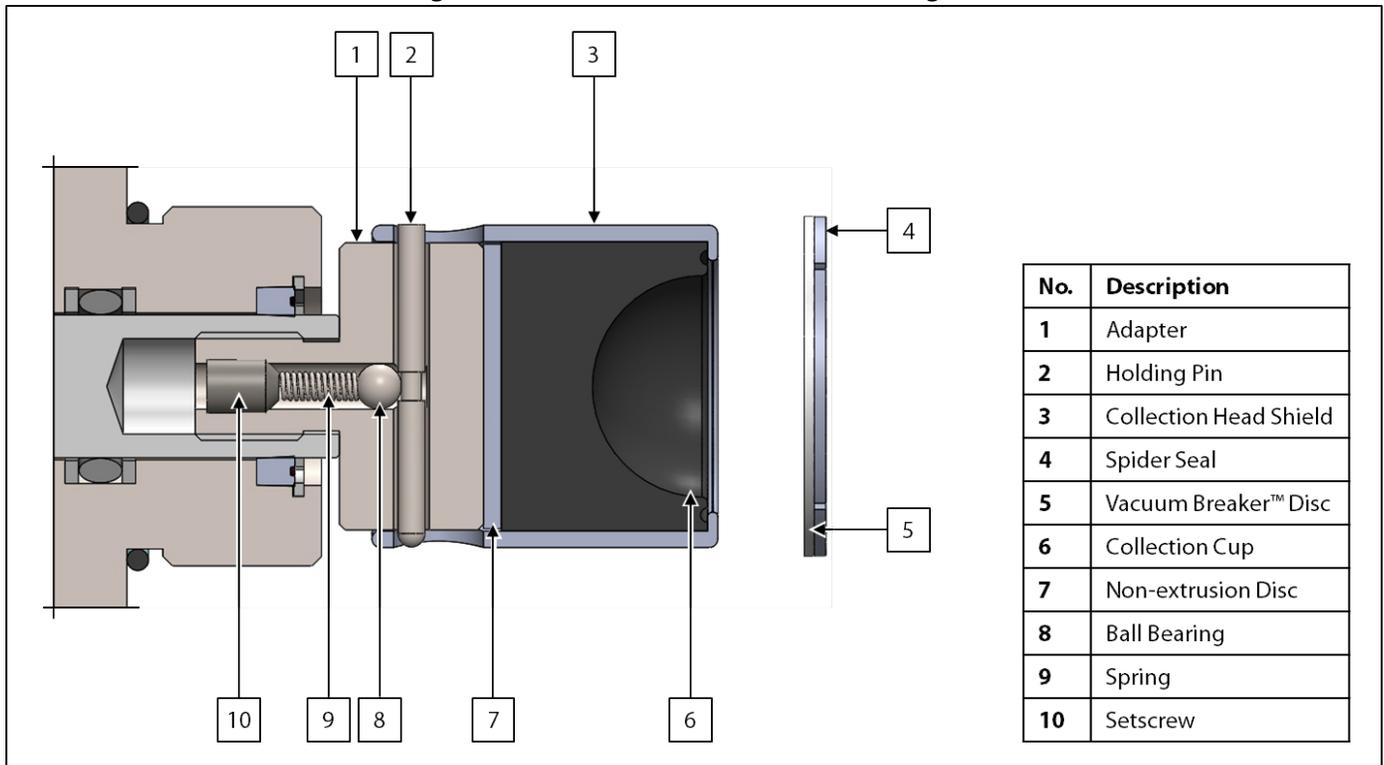


Prior to performing maintenance, the LSSM-1PM must be isolated from pipeline pressure. However, the LSSM-1PM does NOT need to be removed from the pipeline to perform **standard** maintenance.

1. Close inlet (P₁) valve A and return (P₂) valve B to isolate the LSSM-1PM from pipeline pressure (*Figure 2*).
2. Turn OFF electrical power to the system and carefully remove all electrical connections.
3. Depressurize and disconnect the customer-supplied pneumatic supply.
4. Close the inlet valve on the sample cylinder.
5. Relieve pressure from the tubing connecting the LSSM-1PM to the sample cylinder.
6. Unscrew the Welker inLoop™ Crude Oil Sampler from the Welker PP-2 Pitot Probe (*Figure 2*).
7. Unscrew the motor housing from the body, taking care not to misplace the stainless steel Vacuum Breaker™ disc or clear spider seal, which separate from the body with the removal of the motor housing (*Figure 6*). The collection head assembly should now be exposed.

Collection Head Maintenance

Figure 6: Collection Head Maintenance Diagram



8. Remove the holding pin from the collection head shield, and then separate the collection head shield from the adapter.
9. Push the collection cup and non-extrusion disc out of the collection head shield.
10. Lubricate the inside of the collection head shield, and then install the replacement collection cup and non-extrusion disc.

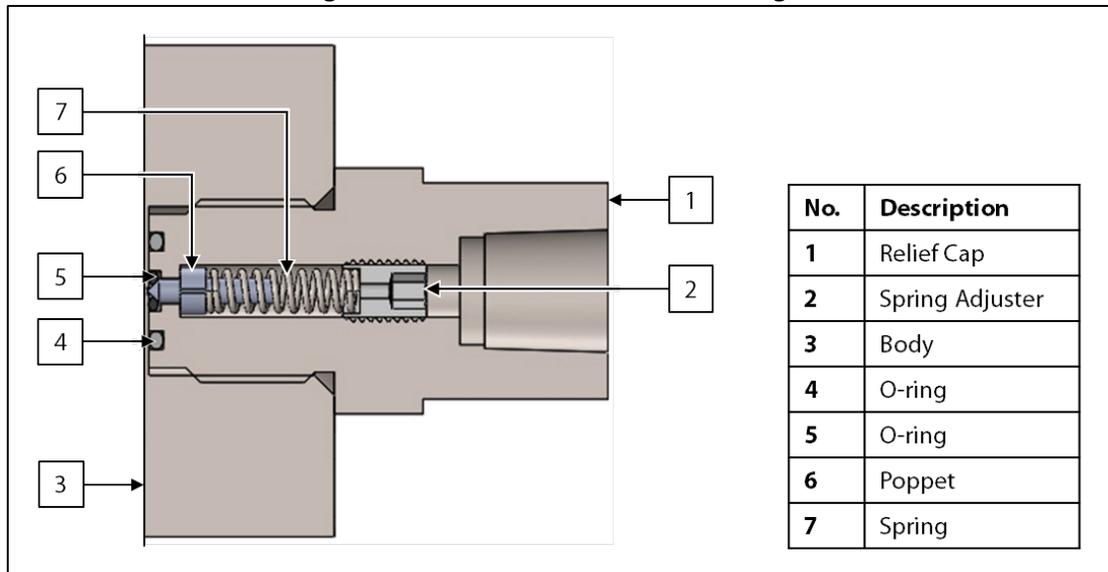


Welker recommends a non-hydrocarbon-based lubricant, such as Krytox®, for use with this unit.

11. Return the collection head shield to the adapter, and then install the holding pin to secure the collection head shield to the adapter.
12. Unscrew the adapter from the shaft.

Inline Relief Maintenance

Figure 7: Inline Relief Maintenance Diagram



13. Remove the fitting from the relief cap.
14. Unscrew the relief cap from the body.
15. Using a hex key, unscrew the spring adjuster from the relief cap, and then remove the spring and poppet from the relief cap.
16. Inspect the spring for damage or wear. Replace as necessary.
17. Inspect the poppet for damage or wear. Replace as necessary.

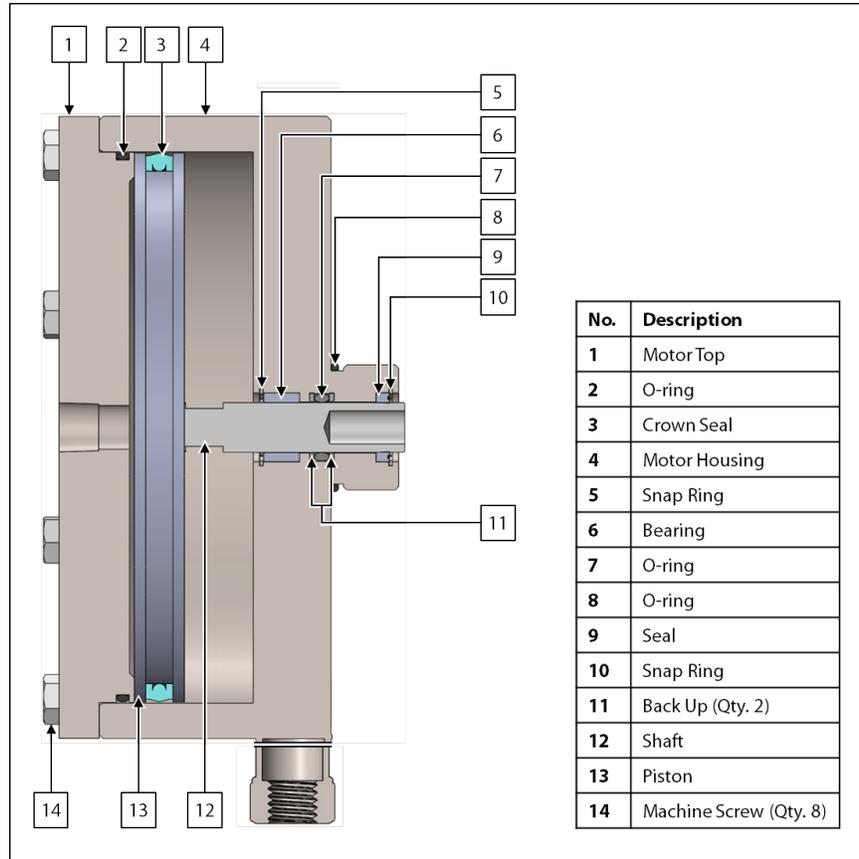


Debris or scratches on the poppet will prevent positive shutoff of the relief.

18. Carefully screw the relief cap into the body.
19. Install the spring to the poppet, and then install the spring adjuster to the spring.
20. Using a hex key, screw the spring adjuster into the relief cap.
21. Replace the O-rings on the sealing face of the relief cap.

Motor Housing Maintenance

Figure 8: Motor Housing Maintenance Diagram



22. Unscrew the machine screws, and then remove the motor top from the motor housing.
23. Replace the O-ring on the motor top.
24. Carefully push the shaft up through the motor housing. Once the piston clears the motor housing, pull the shaft out by the piston.
25. Replace the crown seal on the piston.
26. Carefully inspect the polished outer diameter of the shaft. Scratches or pits may cause the seals to leak. If scratches or pits are present, the unit may need to be repaired or replaced. Contact Welker for service options.
27. Remove the snap ring and seal from the base of the motor housing.
28. Replace the seal in the motor housing base, and then reinstall the snap ring.
29. Remove the snap ring, bearing, back ups and O-ring from the motor housing.
30. Replace the back ups and O-ring.
31. Examine the bearing for damage or wear. Replace as necessary.
32. Install the snap ring to the motor housing.
33. Replace the O-ring on the motor housing.

Reassembly

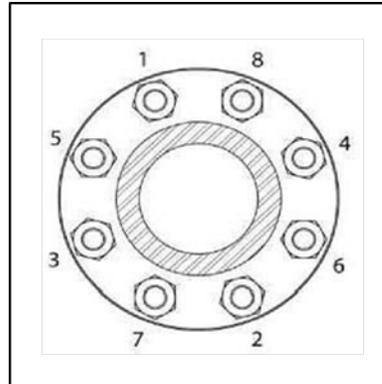
34. Lubricate the shaft, and then carefully install the shaft to the motor housing.
35. Apply an appropriate threadlocker to the adapter threads, and then screw the adapter into the shaft. Tighten securely.
36. Apply anti-galling compound to the threads on the motor housing.



Welker recommends Never-Seez® or an equivalent anti-galling compound for use with this unit.

37. Return the Vacuum Breaker™ disc and spider seal to the body. The Vacuum Breaker™ disc should rest on top of the spider seal in the body.
38. Carefully install the motor housing to the body.
39. Install the motor top to the motor housing.
40. Following a cross-bolting sequence, secure the motor top to the motor housing using the machine screws (*Figure 9*).

Figure 9: Cross-Bolting Sequence



41. Screw the inLoop™ onto the PP-2.
42. Maintenance is now complete. See *Section 2.3, Start-Up Procedures*, for instructions on returning the LSSM-1PM to operation.

3.3 Troubleshooting

Table 2: LSSM-1PM Troubleshooting		
Issues	Possible Causes	Solutions
Supply pressure is leaking from the motor housing.	The piston seal has failed.	Halt sampling and maintain the LSSM-1PM. See <i>Section 3.2, Maintenance</i> , for instructions on replacing the piston seal.
The LSSM-1PM is not actuating properly.	The pneumatic supply may be too low or not operating.	Inspect the pneumatic supply and regulator to ensure that air is supplied at the appropriate pressure (i.e., approximately 40–65 psig).
	The solenoid may not be operating properly.	Use the manual override button to check the solenoid and ensure proper operation. If the solenoid is operating improperly, refer to the <i>Installation, Operation, and Maintenance (IOM) Manual</i> for the solenoid.
	The stroke and exhaust times are too short.	Ensure that the pump cycle is no faster than every four (4) seconds.
The sample container is filling too quickly.	The inline relief setting is not adequate.	See <i>Section 2.3, Start-Up Procedures</i> , for instructions on setting the inline relief. As necessary, see <i>Section 3.2, Maintenance</i> , for instructions on maintaining the inline relief.
	The sampler may be set at a faster sampling frequency than desired.	Adjust the signal control system to sample at the desired rate. Ensure that the calculations used to determine the sample frequency are correct (<i>Figure 5</i>).

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 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-101: Welker PP-1, PP-1W, PP-2, and PP-3 Pitot Probes

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

- Parker Hannifin Corporation General Purpose Solenoid Valves Skinner™ and Gold Ring™ Valves (Welker IOM-V272)

Welker drawings and schematics suggested for use with this unit:

- Assembly Drawing: AD149CT.3

