



INSTALLATION, OPERATION, AND MAINTENANCE MANUAL
WELKER COMPOSITE GAS SAMPLER

MODEL
GSS-4PM

DRAWING NUMBERS
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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 Gas Sampler, GSS-4PM. 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 Gas 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 Gas 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 *GSS-4PM* Composite Gas Sampler is a self-purging positive displacement pump designed to extract samples from the center one-third ($\frac{1}{3}$) of a pressurized gas pipeline and collect them in a connected sample cylinder.

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 *GSS-4PM* 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 cylinder.

The *GSS-4PM* can be connected to a customer Programmable Logic Controller (PLC) or other signal control system to operate the solenoid. Alternatively, the *GSS-4PM* 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.

In locations where the process gas is not clean and dry, the *GSS-4PM* can be configured for operation by an auxiliary instrument air supply. For such locations, the Welker LE-2SSKO Probe Mounted Liquid Eliminator is recommended in place of the standard probe, as it removes free liquids, condensed hydrocarbons, glycol, and amines from gas samples, thus ensuring the collection of representative samples and protecting the sampler.



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 GSS-4PM 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: GSS-4PM Specifications

Products Sampled	Natural Gas and Other Gases Compatible With the Materials of Construction
Materials of Construction	316/316L Stainless Steel, PTFE, and Viton® Others Available
Maximum Allowable Operating Pressure	With LE-2SSKO: 1440 psig @ -20 °F to 120 °F (99 barg @ -28 °C to 48 °C) Standard: 2160 psig @ -20 °F to 120 °F (148 barg @ -28 °C to 48 °C)
Pipeline Connection	½" MNPT ¾" MNPT (Standard) 1" MNPT
Electrical Connection	AC 110 V DC 6 V DC 12 V (Standard) DC 24 V (Standard)
Sample Volume	0.065 cc Vanishing Chamber™ Collection Cup 0.22 cc Vanishing Chamber™ Collection Cup (Standard) 0.5 cc Vanishing Chamber™ Collection Cup 1.0 cc Vanishing Chamber™ Collection Cup 1.5 cc Vanishing Chamber™ Collection Cup
Operation	Diaphragm-Operated Motor
Features	Inline Relief Integrated Bypass Manifold With Valve Outlet Pressure Gauge Regulator With Relief and Pressure Gauge
Options	4-Way Solenoid Valve (Standard) Manifold for Welker SC Single Cavity Cylinder (Standard) Welker 4P Sample Frequency Controller Welker 6Tc Timer/Controller Welker LE-2SSKO Probe Mounted Liquid Eliminator (Standard)

1.4 Equipment Diagrams

Figure 1: GSS-4PM Connections Diagram

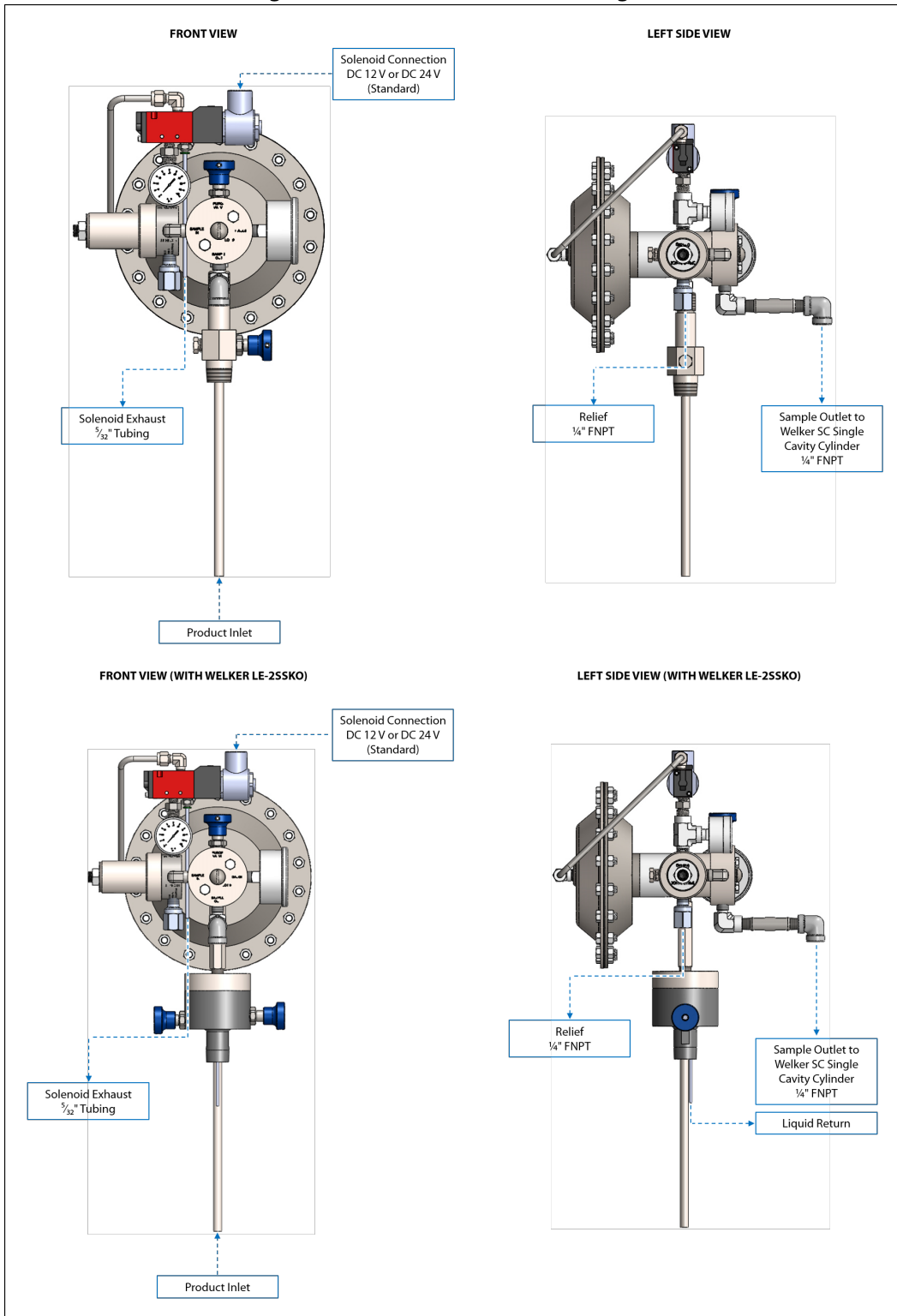


Figure 2: GSS-4PM With Standard Probe

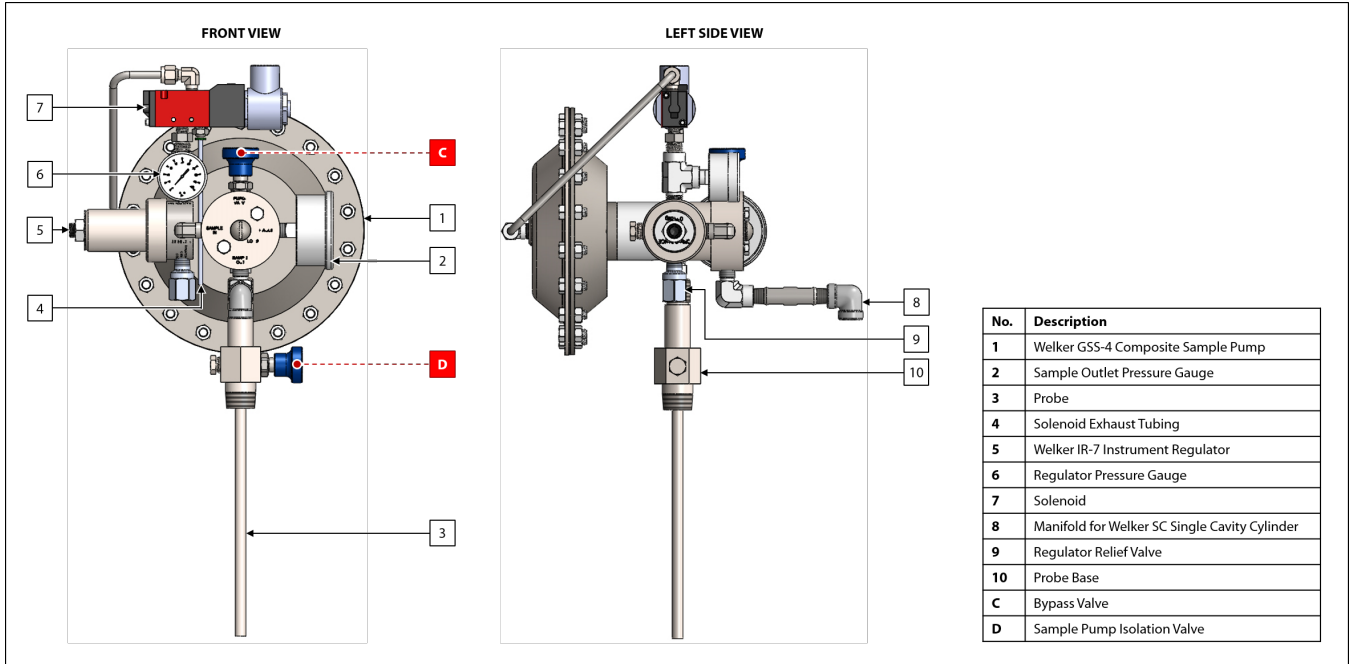


Figure 3: GSS-4PM With LE-2SSKO Probe Mounted Liquid Eliminator

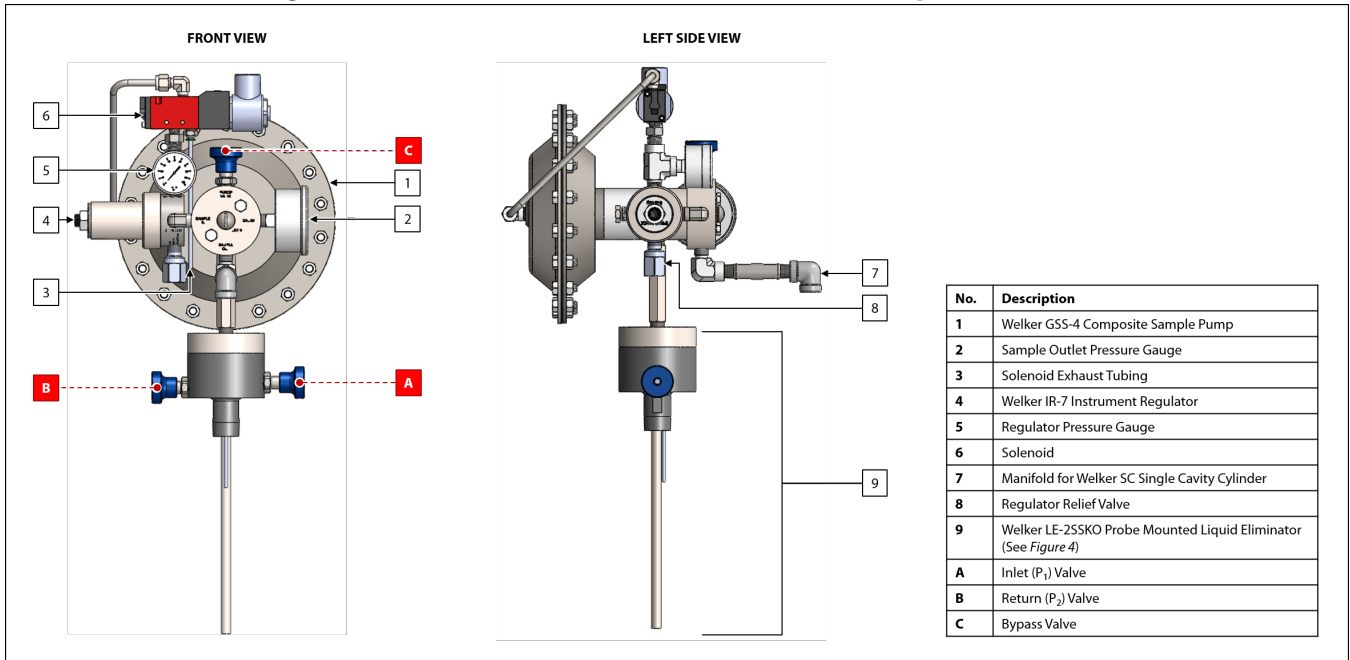
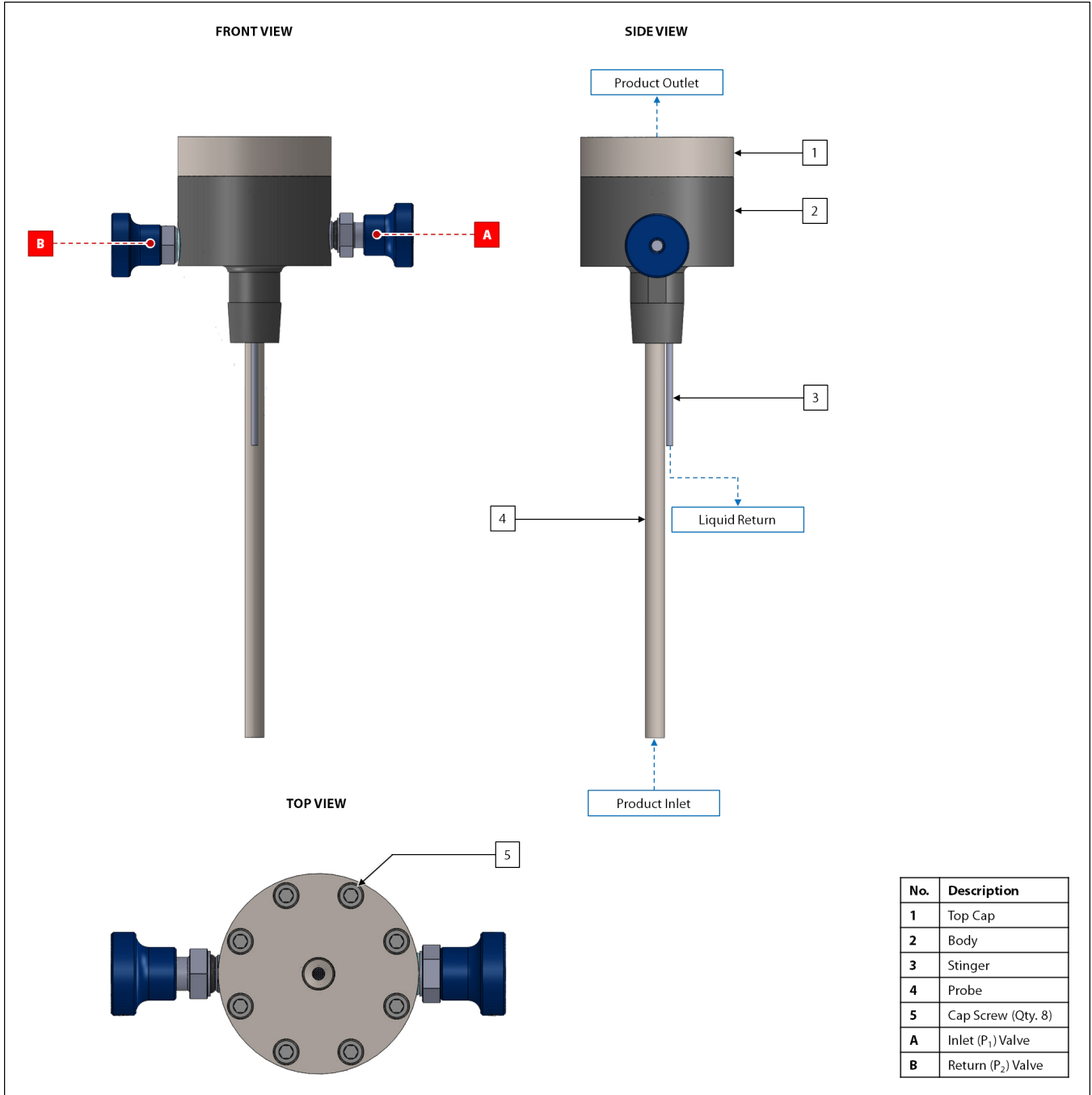


Figure 4: LE-2SSKO Probe Mounted Liquid Eliminator Diagram



2.1 Before You Begin



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



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



All electrical connections must meet local and national electric codes, and excessive weight added to the conduit run must be supported.

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. 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).
3. Typically, the Welker GSS-4PM is installed with a single probe. The unique self-purging design of the GSS-4PM uses process gas to supply the solenoid, thus purging the sample line prior to each sample grab. If auxiliary instrument air is used to supply the solenoid, the customer must have a return port downstream of a moderate pressure drop (e.g., an orifice plate or control valve) 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

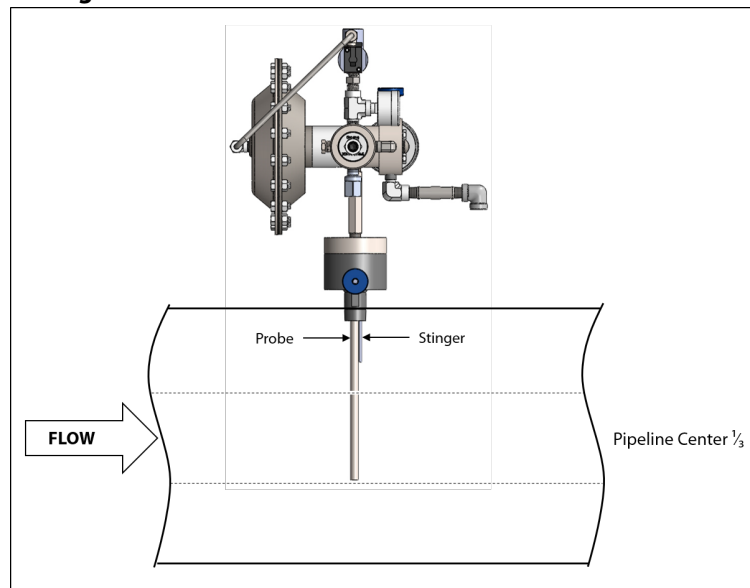
1. Depressurize the pipeline.



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

2. Ensure that all valves on the GSS-4PM are closed.
3. Wrap the threads of the threaded pipeline connection with PTFE tape.
4. Install the GSS-4PM to the pipeline. If the GSS-4PM is equipped with the optional Welker LE-2SSKO Probe Mounted Liquid Eliminator, ensure that it is installed so that the stinger is downstream of the direction of product flow (*Figure 5*).

Figure 5: Correct Installation of GSS-4PM With LE-2SSKO



5. As necessary, connect from the solenoid exhaust tubing to a flare (*Figure 1*).



If the process gas used to actuate the sampler cannot be safely vented to the atmosphere, Welker recommends connecting from the solenoid exhaust tubing to a flare.

6. If the GSS-4PM is equipped with a Welker 4P Sample Frequency Controller, refer to the *Installation, Operation, and Maintenance (IOM) Manual* for the 4P for wiring instructions.
7. If the GSS-4PM is equipped with a solenoid, connect from the PLC to the solenoid (*Figure 1*).
8. If process gas will be used to actuate the sampler, the sample cylinder may now be installed.



If a Welker SC Single Cavity Cylinder will be used for sample collection, proceed to step 15.
If a Welker Constant Pressure Cylinder will be used for sample collection, proceed to step 18.

9. If an auxiliary instrument air supply will be used to actuate the sampler, continue to step 10.



The GSS-4PM is designed to use process gas as the instrument supply and does not require an auxiliary instrument air supply. However, if process gas is not clean and dry and/or cannot be safely vented to the atmosphere, Welker recommends the use of an auxiliary instrument air supply.

Using an Auxiliary Instrument Air Supply (Optional)

10. Remove the elbow connecting the regulator to the base, and then tube from the instrument supply port in the base to the required downstream return. This creates a bypass for the sampler, which will allow for a "real-time" sample to be taken with each actuation of the sampler.
11. Connect the customer-supplied clean, dry auxiliary instrument air supply to the open port on the regulator.
12. Regulate the auxiliary instrument air supply to the pressure appropriate for the application. The auxiliary instrument air supply should be between 40 and 60 psig.



In applications where pipeline pressure is greater than 1500 psig, additional instrument air may be required to take a sample. Increase the instrument air supply and adjust the regulator relief valve as necessary. To protect the diaphragm motor, the instrument air supply should not exceed 100 psig.

13. Set the regulator relief valve to approximately 85 psig. Refer to the *Installation, Operation, and Maintenance (IOM) Manual* for the regulator relief valve for instructions on setting the relief.
14. The sample cylinder may now be installed.



If a Welker SC Single Cavity Cylinder will be used for sample collection, continue to step 15.
If a Welker Constant Pressure Cylinder will be used for sample collection, proceed to step 18.

Installing the Sample Cylinder

SC Single Cavity Cylinder

15. Ensure that the inlet and outlet valves on the SC are closed.
16. Install the inlet valve of the SC to the cylinder hanger on the manifold (*Figure 1*).
17. Installation is now complete.

Constant Pressure Cylinder

18. Ensure that the pre-charge and product inlet valves on the constant pressure cylinder are closed.
19. Tube from the pre-charge pressure supply to the pre-charge inlet valve on the constant pressure cylinder.



If the GSS-4PM is equipped with the standard probe and process gas will be used to pre-charge the constant pressure cylinder, remove the plug from the probe base, and then tube from this port to the pre-charge valve on the constant pressure cylinder. Welker recommends first installing a valve to the port on the probe base.



If the GSS-4PM is equipped with the optional LE-2SSKO and process gas will be used to pre-charge the constant pressure cylinder, remove the plug from the back of the regulator, and then tube from this port to the pre-charge valve on the constant pressure cylinder.



If the optional auxiliary instrument air supply will be used to pre-charge the constant pressure cylinder, remove the plug from the back of the regulator, and then tube from this port to the pre-charge valve on the constant pressure cylinder.

20. Tube from the sample outlet on the base of the GSS-4 to the product inlet valve on the constant pressure cylinder.
21. 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.

2.3 Start-Up Procedures

1. Ensure that all valves on the GSS-4PM are closed.
2. Pressurize the pipeline.
3. As necessary, adjust the inline relief. If the inline relief does not need to be adjusted, proceed to step 22.



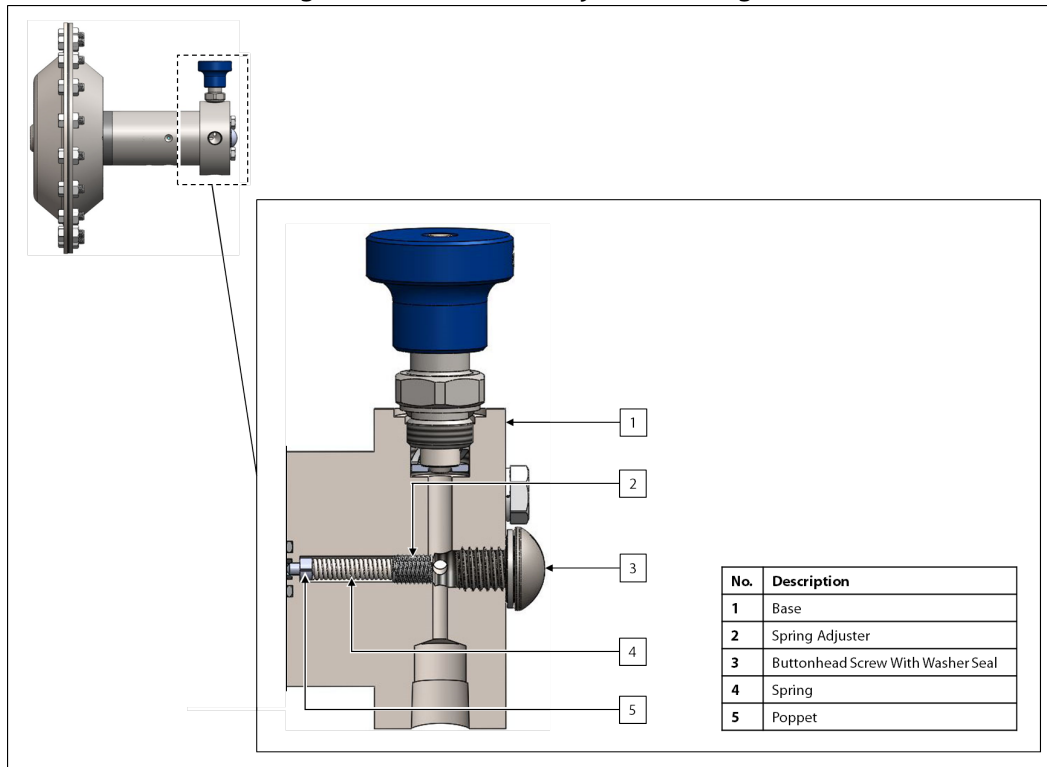
If a Welker SC Single Cavity Cylinder will be used for sample collection, continue to step 4.
If a Welker Constant Pressure Cylinder will be used for sample collection, proceed to step 11.

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.

Figure 6: Inline Relief Adjustment Diagram



SC Cylinder

4. Remove the buttonhead screw and washer seal from the end of the base.
5. Insert a hex key through the base to the spring adjuster.
6. Allow full pipeline pressure to reach the GSS-4PM. Check for leaks and repair as necessary.



If the GSS-4PM is equipped with a standard probe, slowly open sample pump isolation valve D (*Figure 2*).
If the GSS-4PM is equipped with the optional LE-2SSKO, slowly open inlet (P₁) valve A and return (P₂) valve B (*Figure 3*).

7. Turn the spring adjuster to adjust the spring tension until no gas bleeds through, and then turn the spring adjuster clockwise another full turn.



When sampling into a Welker SC Single Cavity Cylinder, 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.



Each full clockwise turn of the spring adjuster increases spring tension approximately 100 psig.

8. Replace the washer seal, and then return the buttonhead screw to the base.
9. Verify that the sample outlet pressure gauge reads the pressure appropriate for the sample cylinder (*Figure 2* or *Figure 3*). This reading indicates that the inline relief is holding and that sample cannot flow back to the pipeline.



When sampling into a Welker SC Single Cavity Cylinder, the pressure gauge should read 0 psig at start-up.

10. Proceed to step 22.

Constant Pressure Cylinder

11. Allow full pipeline pressure to reach the GSS-4PM. Check for leaks and repair as necessary.



If the GSS-4PM is equipped with a standard probe, slowly open sample pump isolation valve D (*Figure 2*).
If the GSS-4PM is equipped with the optional LE-2SSKO, slowly open inlet (P₁) valve A and return (P₂) valve B (*Figure 3*).

12. Read the pressure on the sample outlet pressure gauge (*Figure 2* or *Figure 3*). 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.

13. If the current inline relief setting is approximately 200 psig, the inline relief does not need to be adjusted; proceed to step 22. If the current inline relief setting is anything other than approximately 200 psig, the inline relief must be adjusted; continue to step 14.
14. Isolate the GSS-4PM from pipeline pressure.



If the GSS-4PM is equipped with a standard probe, close sample pump isolation valve D (*Figure 2*).
If the GSS-4PM is equipped with the optional LE-2SSKO, close inlet (P₁) valve A and return (P₂) valve B (*Figure 3*).

15. Remove the buttonhead screw and washer seal from the end of the base.
16. Insert a hex key through the base 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.



Each full clockwise turn of the spring adjuster increases spring tension approximately 100 psig.

18. Replace the washer seal, and then return the buttonhead screw to the base.
19. Allow full pipeline pressure to reach the GSS-4PM.



If the GSS-4PM is equipped with a standard probe, slowly open sample pump isolation valve D (*Figure 2*).
If the GSS-4PM is equipped with the optional LE-2SSKO, slowly open inlet (P₁) valve A and return (P₂) valve B (*Figure 3*).

20. Read the pressure on the sample outlet pressure gauge (*Figure 2* or *Figure 3*). 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.

21. If the current inline relief setting is approximately 200 psig, the inline relief does not need to be adjusted; continue to step 22. If the current inline relief setting is anything other than approximately 200 psig, the inline relief must be adjusted; repeat steps 14–21 until the inline relief is set to approximately 200 psig.

Purging the Sample Cylinder



Refer to Gas Processors Association (GPA) Standard 2166-86, *Obtaining Natural Gas Samples for Analysis by Gas Chromatography*, for further instructions on GPA-recommended purge methods.



This method is only advisable if the sample cylinder will be used in the same location to sample the same type of product.

22. Purge the sample cylinder.



To purge the Welker SC Single Cavity Cylinder, continue to step 23.
To purge the Welker Constant Pressure Cylinder, proceed to step 30.

SC

23. Slowly open bypass valve C (*Figure 2* or *Figure 3*). Check for leaks and repair as necessary.
24. Close bypass valve C.
25. Open the outlet valve on the SC.
26. Open bypass valve C.
27. Open the inlet valve on the SC.
28. Close bypass valve C.
29. Proceed to step 35.

Constant Pressure Cylinder

30. Open the pre-charge supply to the constant pressure cylinder. Check for leaks and repair as necessary.



If process gas will be used to pre-charge the constant pressure cylinder, slowly open sample pump isolation valve D (*Figure 2*).
If the optional auxiliary instrument air supply will be used to pre-charge the constant pressure cylinder, slowly open the supply to the constant pressure cylinder.

31. Slowly open the pre-charge valve on the constant pressure cylinder. This supplies pre-charge pressure to the constant pressure cylinder and forces the constant pressure cylinder piston to the product side of the cylinder.
32. Open the product inlet valve on the constant pressure cylinder.
33. Open the process connection to the constant pressure cylinder. Check for leaks between the pipeline and the constant pressure cylinder and repair as necessary.



If the GSS-4PM is equipped with a standard probe, slowly open sample pump isolation valve D (*Figure 2*).
If the GSS-4PM is equipped with the optional LE-2SSKO, slowly open inlet (P₁) valve A and return (P₂) valve B (*Figure 3*).

34. Purge the tubing between the GSS-4PM and the constant pressure cylinder.



If the constant pressure cylinder is equipped with a purge valve, open the purge valve for approximately three to five (3–5) seconds to purge the tubing, and then close the purge valve. Welker recommends plugging the purge valve when not in use.
If the constant pressure cylinder is not equipped with a purge valve, the tube fitting at the product inlet of the constant pressure cylinder may be cracked. However, Welker recommends installing a tee with a valve between the sample outlet on the GSS-4PM and the product inlet on the constant pressure cylinder to enable the tubing to be purged.

Testing the GSS-4PM

35. Ensure that bypass valve C is closed (*Figure 2* or *Figure 3*).
36. Close the product inlet valve on the sample cylinder.
37. Actuate the GSS-4PM.
38. Observe the sample outlet pressure gauge (*Figure 2* or *Figure 3*). Allow pressure to build above line pressure, and then let the GSS-4PM sit for several minutes.
39. After several minutes, read the pressure on the sample outlet pressure gauge. If the pressure has dropped, check the GSS-4PM for leaks and repair as necessary. If the pressure has not dropped, the unit is ready to be placed into operation.
40. Bleed off the test pressure from the sample cylinder.
41. Open the product inlet valve on the sample cylinder.

Preparing for Sampling

42. Set the signal control system to the desired sampling frequency based on the sampling actuation equations provided (*Figure 7*). If the GSS-4PM is equipped with a 4P, refer to the *Installation, Operation, and Maintenance (IOM) Manual* for the 4P for instructions on setting the sampling frequency. If the GSS-4PM is equipped with a 6Tc, refer to the *Installation, Operation, and Maintenance (IOM) Manual* for the 6Tc for instructions on setting the sampling frequency.

Figure 7: Gas Sampling Equations

Gas Sampling, Proportional to Flow Collection	
<p>Equation 1: Number of Samples Needed</p> $\text{Number of Samples Needed to Fill to 100\%} = \frac{\text{Cylinder Size (cc)}}{\text{Bite Size (cc)}}$	
<p>Equation 2: Proportional-to-Flow</p> $\text{Volume of Flow Between Sample Grabs} = \frac{\text{Batch Size (Total Volume to be Sampled)}}{\text{Number of Samples Needed (Eq. 1)}}$	
<p>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.</p>	
Gas Sampling, Timed Collection	
<p>Equation 1: Number of Samples Needed</p> $\text{Number of Samples Needed to Fill to 100\%} = \frac{\text{Cylinder Size (cc)}}{\text{Bite Size (cc)}}$	
<p>Equation 2: Timed Sampling</p> $\text{Time Between Sample Grabs} = \frac{\text{Total Time in Sample Period}}{\text{Number of Samples Needed (Eq. 1)}}$	
<p>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.</p>	



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.

43. The GSS-4PM is now operational.

3.1 Before You Begin

1. **Welker recommends that the unit have standard maintenance every six (6) months 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. ½" Wrench
 - b. 6" Adjustable Wrench
 - c. Adjustable Pliers
 - d. Anti-galling Compound
 - e. Hex Key Set
 - f. Seal Pick
 - g. Snap Ring Pliers
 - h. Threadlocker

3.2 Maintenance



If maintenance on the valves or probe is required, the GSS-4PM must be isolated from pipeline pressure and removed from the pipeline before maintenance can be safely performed.



Prior to performing maintenance, the GSS-4PM must be isolated from pipeline pressure. However, the GSS-4PM does NOT need to be removed from the pipeline to perform **standard** maintenance.

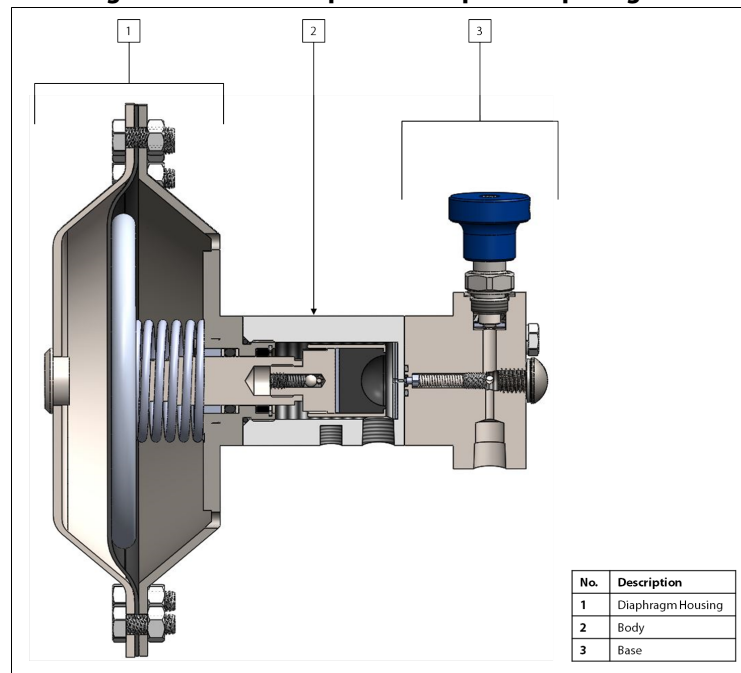
1. Isolate the GSS-4PM from pipeline pressure.



If the GSS-4PM is equipped with a standard probe, close sample pump isolation valve D (Figure 2).
If the GSS-4PM is equipped with the optional LE-2SSKO, close inlet (P₁) valve A and return (P₂) valve B (Figure 3).

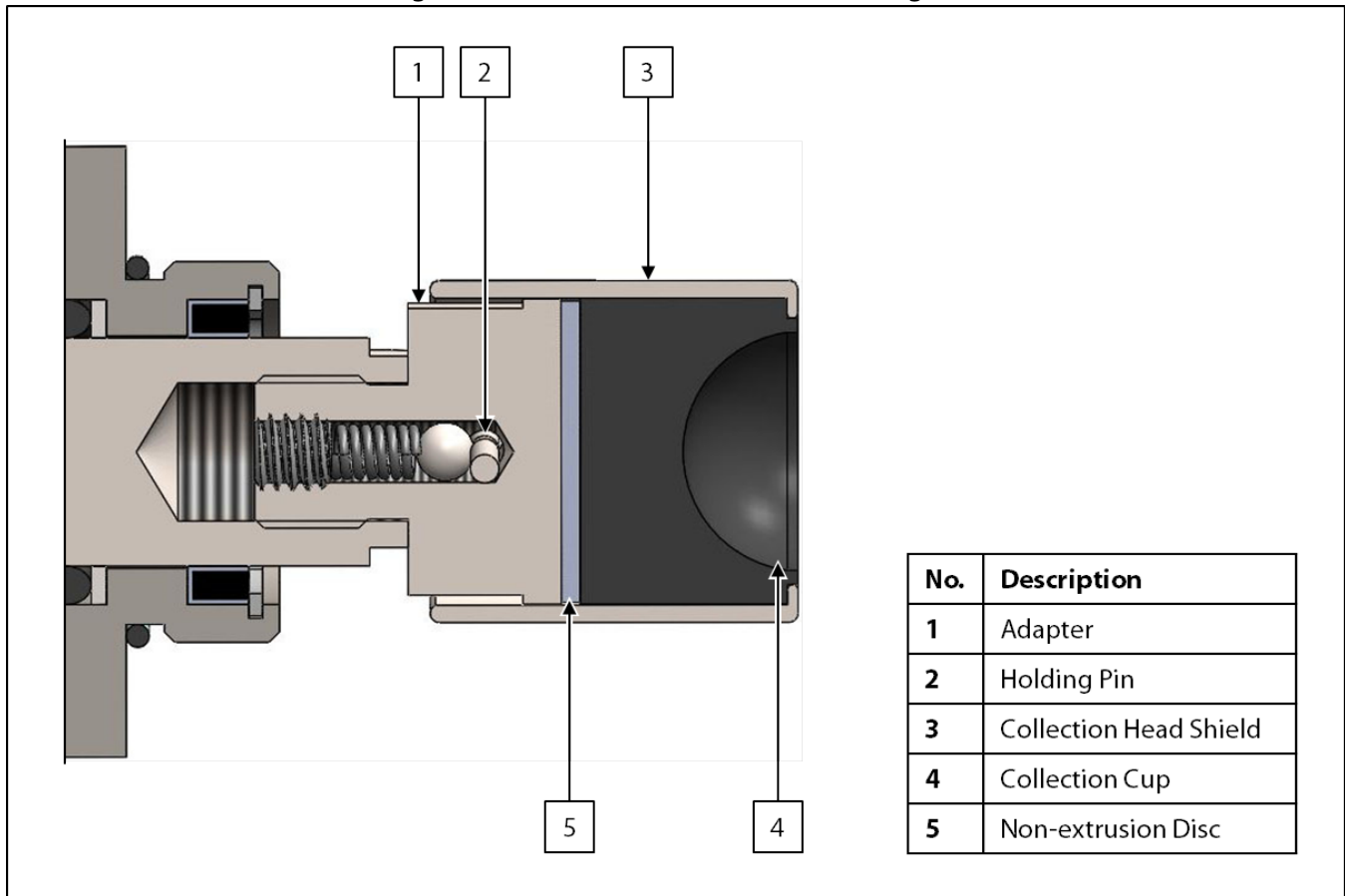
2. Turn OFF electrical power to the system and carefully remove all electrical connections.
3. As necessary, disconnect the tubing between the solenoid exhaust and flare.
4. As necessary, disconnect the auxiliary instrument air supply.
5. As necessary, relieve pressure from the tubing connecting the GSS-4PM to the sample cylinder.
6. Remove the GSS-4PM body from the standard probe or from the optional LE-2SSKO.
7. As necessary, maintain the optional LE-2SSKO. Refer to the *Installation, Operation, and Maintenance (IOM) Manual* for the LE-2SSKO for maintenance instructions.
8. Unscrew the diaphragm 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 diaphragm housing (Figure 8 or Figure 11). The collection head assembly should now be exposed.

Figure 8: GSS-4 Composite Sample Pump Diagram



Collection Head Maintenance

Figure 9: Collection Head Maintenance Diagram



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

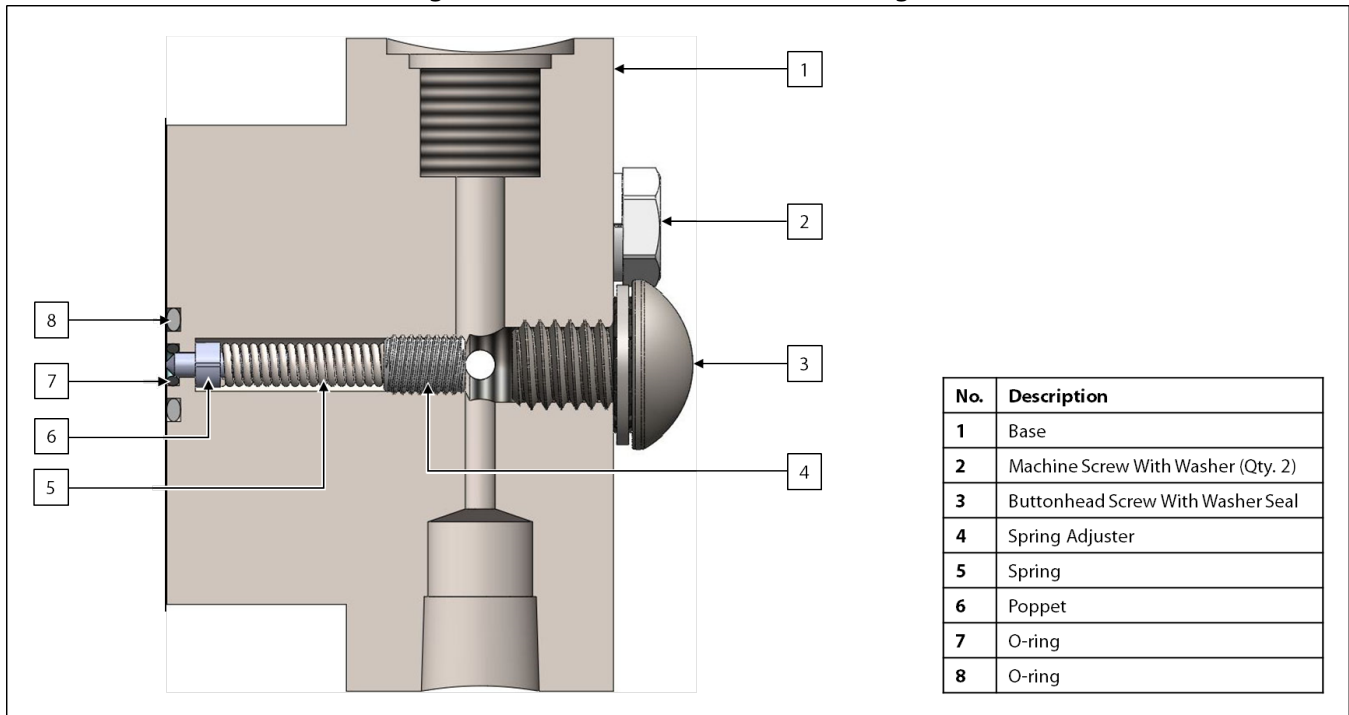


Welker recommends a non-hydrocarbon-based lubricant, such as Krytox®, for use with this unit.

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

Inline Relief Maintenance

Figure 10: Inline Relief Maintenance Diagram



14. Unscrew the machine screws and washers from the base, and then remove the base from the body.
15. Remove the buttonhead screw and washer seal from the end of the base.
16. Insert a hex key through the base to the spring adjuster. Turn the hex key counterclockwise to unscrew and remove the spring adjuster from the base.
17. Remove the spring and poppet from the base.
18. Inspect the seating face of the poppet for scratches or other damage. Replace as necessary.

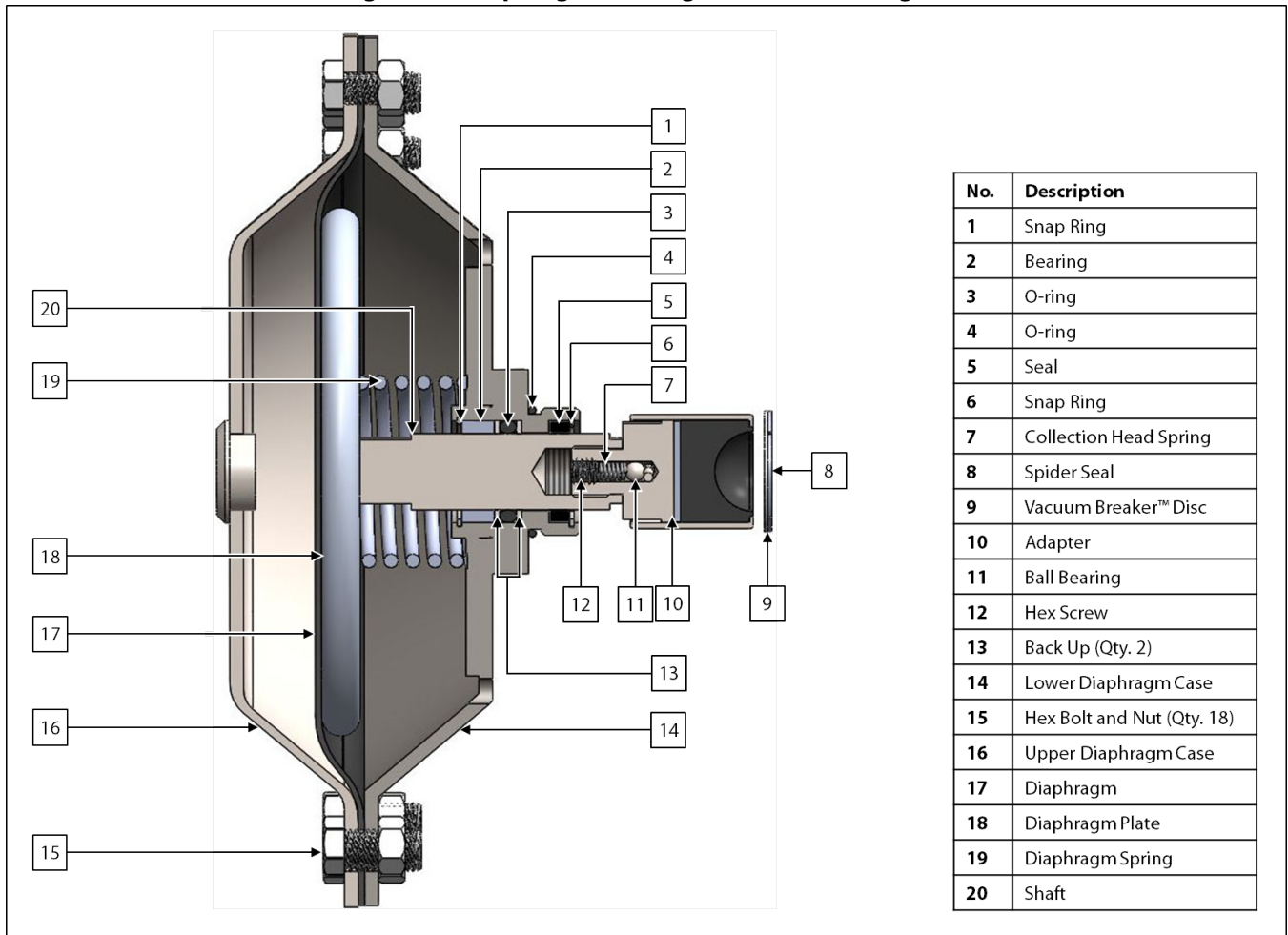


Debris or scratches on the poppet will prevent positive shutoff of the relief.

19. Return the poppet and spring to the base.
20. Using a hex key, screw the spring adjuster into the base.
21. Return the buttonhead screw and washer seal to the end of the base.
22. Replace the O-rings on the sealing face of the base.
23. Set the base aside.

Diaphragm Housing Maintenance

Figure 11: Diaphragm Housing Maintenance Diagram



24. Unscrew and remove the hex nuts and bolts holding the upper and lower diaphragm cases together.
25. Remove the upper diaphragm case to expose the diaphragm.
26. Remove the diaphragm and inspect it for cracks or other damage. Replace as necessary.
27. Carefully push the shaft until the diaphragm plate clears the lower diaphragm case, and then carefully pull the diaphragm plate, diaphragm spring, and shaft out from the lower diaphragm case.
28. Remove the diaphragm spring from the shaft.
29. Closely 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.
30. Remove the snap ring and seal from the body side of the lower diaphragm case.
31. Replace the seal, and then return the snap ring to the body side of the lower diaphragm case.
32. Remove the snap ring, bearing, back ups, and O-ring from the diaphragm plate side of the lower diaphragm case.
33. Replace the back ups, O-ring, and bearing, and then return the snap ring to the lower diaphragm case.
34. Lightly lubricate the shaft, and then carefully slide the diaphragm spring back onto the shaft.

Reassembly

35. Carefully push the diaphragm plate assembly through the seals of the lower diaphragm case.
36. Apply an appropriate threadlocker to the adapter threads, and then screw the adapter into the shaft.
37. Attach the diaphragm to the diaphragm plate.
38. Set the upper diaphragm case in place against the lower diaphragm case.
39. Following a cross-bolting sequence, bolt the upper and lower diaphragm cases together and tighten by hand.
40. Return the spider seal to the body.
41. Return the Vacuum Breaker™ disc to the body. It should rest on top of the spider seal in the body.
42. Using the machine screws and washers, install the base to the body (*Figure 10*). Tighten the machine screws by hand.
43. Apply anti-galling compound to the threads on the lower diaphragm case.



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

44. Install the body to the diaphragm assembly.
45. Screw the sampler onto the standard probe or optional LE-2SSKO.
46. Maintenance is now complete. See *Section 2.2, Installation*, and *Section 2.3, Start-Up Procedures*, for instructions on returning the GSS-4PM to operation.



Check valves for leaks and repair as necessary during reinstallation.

3.3 Troubleshooting

Table 2: GSS-4PM Troubleshooting

Issues	Possible Causes	Solutions
<p>The GSS-4 is not actuating properly.</p>	<p>The pneumatic supply may be too low or not operating.</p>	<p>Inspect the pneumatic supply and regulator to ensure that air is supplied at the appropriate pressure (i.e., approximately 40–60 psig).</p>
	<p>The solenoid may not be operating properly.</p>	<p>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.</p>
	<p>The stroke and exhaust times are too short.</p>	<p>Ensure that the pump cycle is no faster than every four (4) seconds.</p>
<p>The sample cylinder or constant pressure cylinder is not filling.</p>	<p>The inlet valve on the sample cylinder is closed.</p>	<p>Ensure that the inlet valve on the sample cylinder is open.</p>
	<p>There is a leak between the sample outlet and the sample cylinder.</p>	<p>Check all fittings from the sample outlet to the inlet valve on the sample cylinder for leaks. Repair as necessary.</p>
	<p>The inline relief setting is too high.</p>	<p>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.</p>
	<p>The GSS-4PM is unable to build pressure.</p>	<p>See <i>Section 2.3, Start-Up Procedures</i>, for instructions on testing the GSS-4PM and ensuring that the sampler will build pressure.</p>
	<p>The Vacuum Breaker™ disc is installed incorrectly.</p>	<p>See <i>Section 3.2, Maintenance</i>, for instructions on correct installation of the Vacuum Breaker™ disc.</p>

Table 2: GSS-4PM Troubleshooting (Continued)

Issues	Possible Causes	Solutions
<p>The single cavity cylinder is filling too quickly.</p>	<p>The inline relief setting is not adequate.</p>	<p>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.</p>
	<p>The sampler may be set at a faster sampling frequency than desired.</p>	<p>Adjust the 4P, 6Tc, or PLC to sample at the desired rate. Ensure that the calculations used to determine the sample frequency are correct (<i>Figure 7</i>).</p>
<p>The constant pressure cylinder is filling too quickly.</p>	<p>The inline relief setting is not adequate.</p>	<p>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.</p>
	<p>The constant pressure cylinder is not pre-charged.</p>	<p>Pre-charge the constant pressure cylinder. Refer to the <i>Installation, Operation, and Maintenance (IOM) Manual</i> for the constant pressure cylinder for instructions.</p>
	<p>The GSS-4 may be set at a faster sampling frequency than desired.</p>	<p>Adjust the 4P, 6Tc, or PLC to sample at the desired rate. Ensure that the calculations used to determine the sample frequency are correct (<i>Figure 7</i>).</p>
	<p>The purge valve on the constant pressure cylinder is open.</p>	<p>Ensure that the purge valve on the constant pressure cylinder is closed.</p>
	<p>Pressure is leaking past the cylinder piston.</p>	<p>Check the piston seals to ensure they are not leaking. As necessary, replace the piston seals. Refer to the <i>Installation, Operation, and Maintenance (IOM) Manual</i> for the constant pressure cylinder for instructions.</p>

3.4 Purging and Cleaning the Sample Cylinder



Regular cleaning of the sample cylinders is essential for proper functioning of the unit. For cylinders used for sample containment, any debris or residue left in the sample cylinders may contaminate the results of later samples collected in the sample cylinders.



Welker recommends routinely inspecting the sample cylinders for any dents, damage, and/or signs of misuse, as these may affect proper functioning of the unit. If any dents, damage, and/or signs of misuse are present, please contact Welker for service options.

Purging

Purging With Helium

1. Fill the sample cylinder with helium, and then empty the cylinder. Repeat several times.
2. Take a sample of the helium and test it for trace amounts of hydrocarbons.
3. If hydrocarbons and/or contaminants are present in the analysis, the sample cylinder has not been adequately cleaned and further purging of the sample cylinder is necessary; repeat steps 1 and 2. If hydrocarbons and/or contaminants remain present after repeating steps 1 and 2, a solvent cleaning may be necessary.
4. Purging is complete when no hydrocarbons and/or contaminants are present in the analysis.

Purging With New Product

Purge the sample cylinder with the product to be sampled. This can be accomplished each time the sample cylinder is put into service. See *Section 2.3, Start-Up Procedures*, for instructions on purging the sample cylinder with new product.



This method is only advisable if the sample cylinder will be used in the same location to sample the same type of product.

Cleaning

Cleaning With Solvent

1. Repeatedly flush the sample cylinder with solvent.
2. Use helium to dry the sample cylinder.
3. Purge the sample cylinder with helium to remove any remaining solvent.
4. Take a sample of the helium and test it for trace amounts of solvent and hydrocarbons.
5. If solvent and/or hydrocarbons are present in the analysis, the sample cylinder has not been adequately cleaned and further solvent cleaning and/or purging of the sample cylinder is necessary. Steps 1 and 2 may need to be repeated. Repeat steps 3 and 4.
6. If solvent and/or hydrocarbons remain present after repeating steps 3 and 4, a steam and vacuum cleaning may be necessary.
7. Solvent cleaning and purging are complete when no solvent or hydrocarbons are present in the analysis.

Other Cleaning Options

Welker recommends the Welker CSVC Cylinder Steam & Vacuum Cleaner for sample cylinder steam cleaning.

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-044: Welker IR-7 Instrument Regulator
- IOM-048: Welker FIR-1 Filter / Instrument Regulator
- IOM-069: Welker LE-2SSKO Probe Mounted Liquid Eliminator
- IOM-105: Welker NV-1 and NV-2 Instrument Valves
- IOM-128: Welker CSVC Cylinder Steam & Vacuum Cleaner
- IOM-146: Welker SC Single Cavity Cylinder

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

- Circle Seal Controls 500 Series Adjustable Popoff & Inline Relief Valves (Welker IOM-V178)
- McDaniel Controls, Inc. All Stainless Gauges 1½", 2", 2½", 4" and 6" (Welker IOM-V197)
- Norgren R83 Cylinder Gas Pressure Regulator For Industrial Gas Systems (Welker IOM-V014)
- Versa Products Company, Inc. C-Series Valves (Welker IOM-V041)
- Versa Products Company, Inc. C-316 Series Stainless Steel 3-Way and 4-Way Manual, Latching and Key Valves (Welker IOM-V070)
- Versa Products Company, Inc. CSG-4222-LA-XX-D012 4-Way Solenoid Valve (Welker IOM-V071)
- WIKA Instrument Corporation Bourdon Tube Pressure Gauges Type 232.53 and Type 233.53 (Welker IOM-V171)

Welker drawings and schematics suggested for use with this unit:

- Assembly Drawing: AD617BS (GSS-4PM With Standard Probe)
- Assembly Drawing: AD617CL (GSS-4PM With Welker LE-2SSKO Probe Mounted Liquid Eliminator)

