WELKER

INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

WELKER® CONSTANT PRESSURE CYLINDER–HIGH PRESSURE

MODEL
CP-2HP
CP-5HP

DRAWING NUMBER
AD618BA

MANUAL NUMBER
IOM-012

REVISION
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IMPORTANT SAFETY INFORMATION
READ ALL INSTRUCTIONS

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

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

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

This manual is intended to be used as a basic installation and operation guide for the Welker® Constant Pressure Cylinders With Tracker Tube, CP-2G, CP-5G, CP-35G, and CP-2G With Premium Purge. For comprehensive instructions, please refer to the IOM Manuals for each individual component. A list of relevant component IOM Manuals is provided in the Appendix to 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 Cylinder–High Pressure is of a mechanical nature.

Proper installation is the responsibility of the installer. Product failure due to improper installation is not covered under the warranty.

If you received a damaged Constant Pressure Cylinder–High Pressure, 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® *CP-2HP and CP-5HP Constant Pressure Cylinder* is designed for use where it is necessary to—safely and accurately—extract and isolate precise product samples by maintaining a steady pressure from the pipeline to the cylinder and from the cylinder to the analyzer (chromatograph). The cylinders are equipped with a magnetic indicator and a graduated scale set to specify the capacity of the device. During sampling of hydrocarbon liquids, when the magnetic indicator reaches the 80% mark, all sampling should be stopped. Some liquids might require a different ratio (e.g., 70/30 or 60/40). The pipeline itself or a pneumatic supply pre-charges the cylinder with pressure to correspond with pipeline pressure. Pre-charging allows the sample to be transferred to the cylinder without there being a pressure drop. An internal piston in the cylinder helps to purge out air and contaminants by displacement prior to taking a sample.

During the purge process, the piston is pushed to the end of the cylinder to minimize the volume to be purged. Burst discs and gauges are also included on both the device's end caps. Should the cylinder be overpressurized, the burst discs will rupture, relieving excess pressure from the cylinder. CP-2G Premium Purge model cylinders have valves built into the pre-charge and product end cap ports to further minimize the volume to be purged. They also include product purge and pre-charge purge valves. Welker® High Pressure D.O.T. approved CP-2HP cylinders have a working pressure of 3600 psig, and a temperature range of -20 °F to 180 °F. Welker® High Pressure D.O.T. approved CP-5HP cylinders have a working pressure of 2160 psig, and a temperature range of -20 °F to 180 °F.

Adjustable Relief Valve (Optional)
The adjustable relief valve [also known as a pressure-sensitive device (PSD)] functions as a safety device for the unit. During continuous sampling and during transportation of the cylinder, the relief valve provides assurance that the device maintains a constant pressure and does not exceed maximum allowable pressure. The valve will relieve any pressure that exceeds the set pressure.

1.3 Important Information

Please read the following information in its entirety once you have received the Welker® Constant Pressure Cylinder.

- Never fill a cylinder completely full of hydrocarbon liquid or refrigerated gas. Always allow for at least 20% expansion.
- Never transport a cylinder with pressure exceeding D.O.T. regulations (see U.S. Government CFR 49 for D.O.T. regulations). **In cases where the cylinders are exposed to varying temperatures, do not allow the cylinder to exceed the maximum allowable operating pressure indicated in Table 1.**
- Protect the cylinder at all times and handle with care. It is a precision instrument and may contain a flammable or caustic product as well as a valuable representation of your company's product.
- When analysis is complete, the cylinder should be emptied safely and in a safe area by opening the product inlet valve, allowing the pre-charge pressure to push the piston to the product end cap, emptying the cylinder.
- Welker® recommends cleaning and leak testing the cylinders after each use.
- Because of the design of the cylinder and the incorporated seals, the process of emptying the cylinder will simultaneously wipe the walls of the device clean.

Welker® might custom design the Constant Pressure Cylinder to suit the particular application and specifications of each customer.

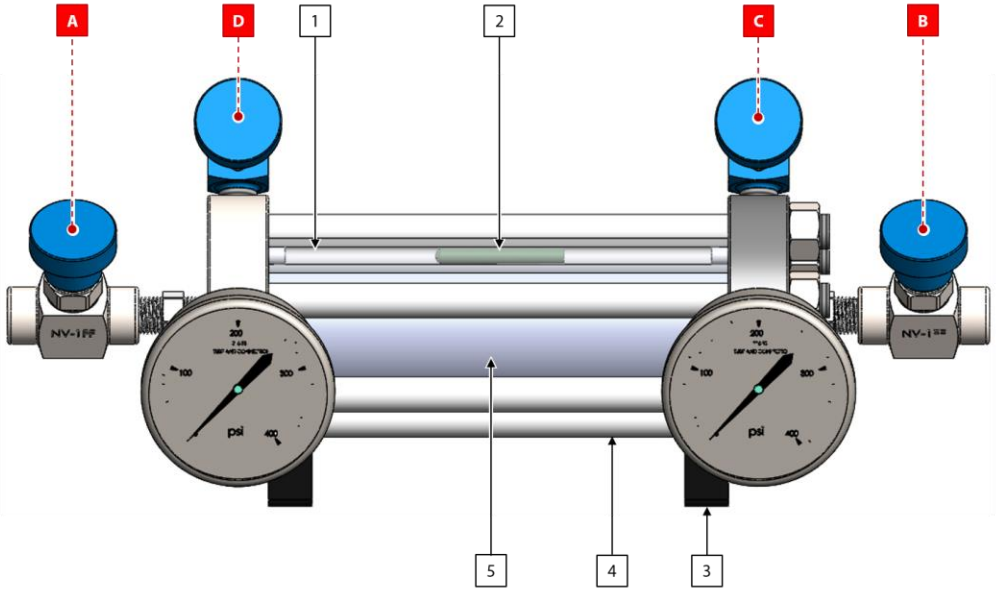
1.4 Specifications

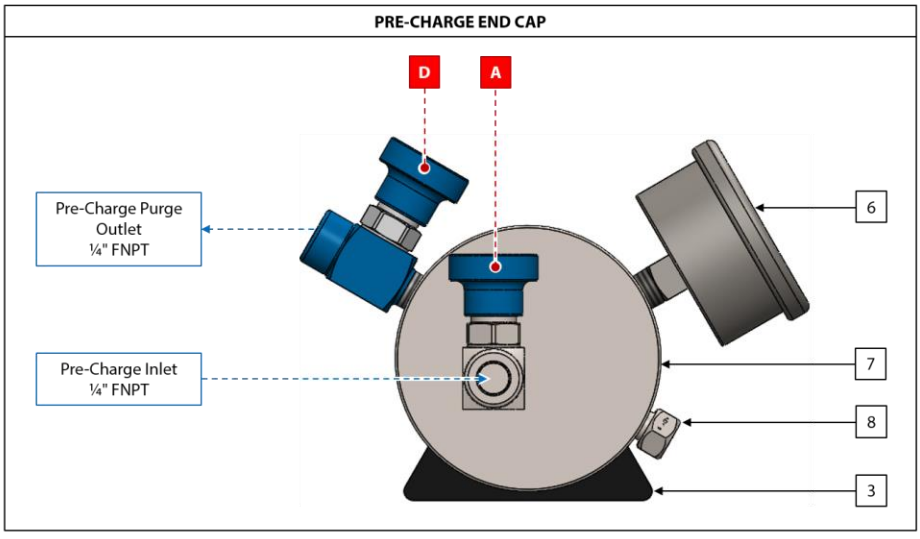
The specifications listed in this section are generalized for this equipment. Welker® can modify the equipment according to your company's needs. **Please note that the specifications may vary depending on the customization of your equipment.**

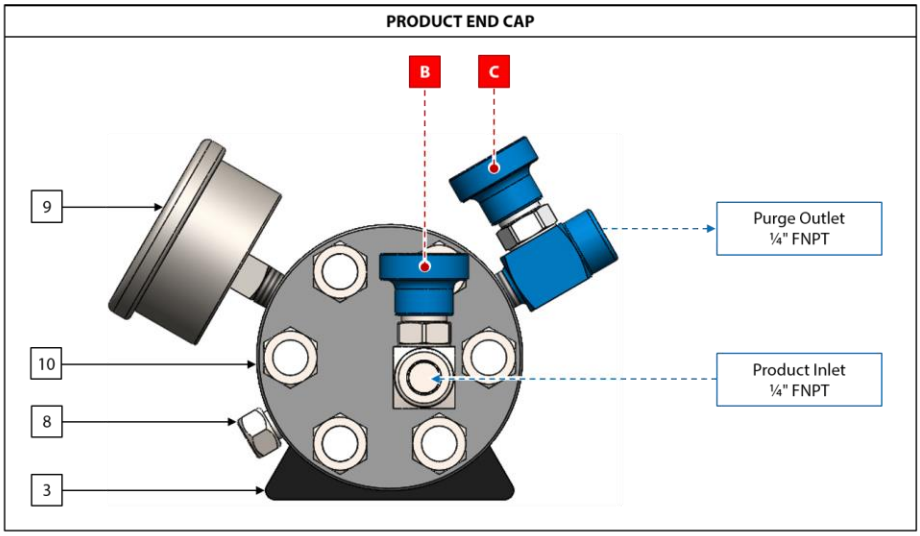
Table 1: Constant Pressure Cylinder CP-2HP, CP-5HP Specifications	
Applications	Spot or Continuous Sampling, Chromatograph Calibration
Products Sampled	Light Liquid Hydrocarbons, Refined Products, Liquid Petroleum Gas, Natural Gas Liquids, Light Crude, and Condensate
Materials of Construction	316/316L Stainless Steel, FKM, PTFE Others Available
Maximum Allowable Operating Pressure	CP-2HP: 3600 psig @ -20 °F to 120 °F (*248 barg @ -29 °C to 48 °C*) CP-5HP: 2160 psig @ -20 °F to 120 °F (*149 barg @ -29 °C to 48 °C*) *NOTE: Maximum allowable temperatures and pressures may be lower depending on the specifications of the pipeline connection device.*
Connections	**Sample Outlet Connection:** ¼" NPT (Others Available) **Sample Inlet Connection:** ¼" NPT (Others Available) **Relief Valve Connection (Optional):** ½" – 20 UNF (¼" NPT Available)
Cylinder Volume	150 cc, 300 cc, 500 cc, 800 cc, 1000 cc Others Available *****Volumes Over 1000 cc Are Not DOT Exempt
Operation	Piston-Operated
Mounting	Mounting Feet
Features	3700 ±100 psig @ 200 °F Rupture Disc and Bursting Relief Cap (Product and Pre-Charge) 0–3700 psig Gauges Indicator Rod DOT-SP 11054 Certified Transport Canada SU 4781 Certified
Industry Standards / Product Certifications	Material Conforming to DOT-SP 11054 Hydrostatic Test @ 6000 psig ASTM D1265, ASTM D3700, ASTM D4057 API 8.1, API 14.1 GPA 2166, GPA 2174 ISO 3170, ISO 4257, ISO 10715
Options	Relief Valve TC-SU 4781 ATEX, Non-Electrical CE Compliant NACE Compliant CRN 0H17082.213567 AD071CACRN.5 Rev. E

1.5 Equipment Diagram

Figure 1: Welker® CP-2HP and CP-5HP Constant Pressure Cylinder With Tracker Tube







No.	Description
1	Tracker Tube
2	Tracker Magnet
3	Cylinder Foot (Qty. 2)
4	Tie Bolt (Qty. 6)
5	Cylinder
6	Pre-Charge Pressure Gauge
7	Pre-Charge End Cap
8	Burst Relief Disc With Burst Relief Cap (Qty. 2)
9	Product Pressure Gauge
10	Product End Cap
A	Pre-Charge Inlet Valve
B	Product Inlet Valve
C	Purge Valve (Optional)
D	Pre-Charge Purge Valve (Optional)

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.

There are two ends to the Constant Pressure Cylinder–High Pressure. These are separated internally by a floating piston assembly. One end is marked PRODUCT INLET. The other end of the cylinder is marked PRE-CHARGE END, and it is marked on the tracker tube with a vertical line at both 80% full and 100% full.

The sample cylinder should be located as close as possible to the sample point.

Welker® recommends having the following tools available for use during installation of the Constant Pressure Cylinder–High Pressure. However, the tools used will vary according to the cylinder model.

a. Flexible Hose or Tubing
b. 6" Adjustable Wrench
c. Tubing Cutters
d. Small-Diameter Stainless Steel Tubing

Important Preliminary Decision

Before you begin, decide how you want to use the Constant Pressure Cylinder:

1. **For spot sampling,** in which case you would connect the Constant Pressure Cylinder–High Pressure directly to the pipeline (through a pipeline valve) and fill the cylinder from the pipeline product flow.
2. **For continuous sampling,** in which case you would connect the Constant Pressure Cylinder–High Pressure directly to a sampler. The sampler is inserted into the pipeline and the Constant Pressure Cylinder is connected to the sampler and receives sample grabs whenever an electrically timed solenoid actuates.
3. **For composite sampling,** in which case you would connect the Constant Pressure Cylinder–High Pressure to a large cylinder which in turn is connected to a sampler from which the large cylinder is taking grabs intermittently from the pipeline flow. The Constant Pressure Cylinder would be connected to a product sample draw-off valve and filled with the composite product that has accumulated in the large cylinder.
4. **For storing a standard mix in the Constant Pressure Cylinder–High Pressure,** with precise proportions of certain liquids or gases, filled and certified at a lab. This Constant Pressure Cylinder would from time to time be connected to the analyzer (chromatograph) in order to calibrate the analyzer.

2.2 Pre-Charging the Cylinder

The pre-charge gas you use must be compatible with the seals used in the cylinder and the piston assembly. The relief valves and gauges must also be adequate for the pressures used when pre-charging.

Option 1: Preparing for Spot Sampling: Connecting the Constant Pressure Cylinder Pre-Charge Valve to the Pipeline

Always open valves slowly to avoid slamming the piston from one end to the other. The piston magnet might shatter with excessive impact.

1. Use small-diameter stainless steel tubing to connect from an available pipeline valve to the pre-charge inlet valve.
2. Make sure all valves are closed on the Constant Pressure Cylinder–High Pressure.
3. Open the pipeline isolation valve.
4. Slowly open the pre-charge inlet valve.
5. Slowly open the product inlet valve to relieve any pressure buildup. The piston assembly will begin to move.
6. The pre-charge gauge should begin to read pressure and will eventually reach pipeline pressure.
7. Once the piston assembly has reached the end of the cylinder, close all valves and check for leaks.
8. Disconnect the tubing from the cylinder and from the pipeline isolation valve.

Figure 2: Pre-Charge and Product End Caps

Option 2: Connecting the Pre-Charge Valve to the Return Port on a Sampler Probe (for Continuous Sampling)

1. Install a valve into the return port of the sampler probe.
2. Make sure all the valves are closed on the Constant Pressure Cylinder–High Pressure.
3. Use small-diameter stainless steel tubing to connect from the cylinder's pre-charge inlet valve to the valve on the return port of the probe (see *Figure 1* and *Figure 2*).
4. Open the valve on the return port of the sample probe.
5. Slowly open the pre-charge inlet valve.
6. Slowly open the product inlet valve (see *Figure 1*) to relieve any pressure buildup.
7. The pre-charge gauge should begin to read pressure and will eventually read the pipeline pressure.
8. Leave the pre-charge valve open during the sampling procedure.
9. Leave the return port valve on the probe open during the sampling procedure.
10. Check for leaks.

Option 3: Using an Auxiliary Pre-Charge Gas

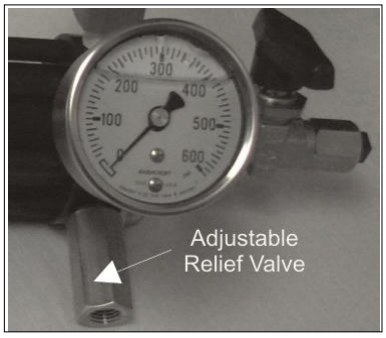
When using an auxiliary gas, the pre-charge side of the cylinder should be pressurized with a regulated gas supply (i.e., nitrogen or helium) and set 50 to 100 psig above pipeline operating pressure, not to exceed the maximum allowable pressure of the device.

1. Make sure all valves on the sample cylinder are closed.
2. Use small diameter stainless steel tubing to connect the pre-charge valve to the regulated auxiliary gas supply. If you have the premium purge model, connect from the gas supply to the pre-charge inlet port.
3. Open the valve on the gas supply.
4. Slowly open the pre-charge inlet valve.
5. Slowly open the product inlet valve to relieve any pressure buildup. The piston will begin to move.
6. The pre-charge gauge should begin to read pressure and will eventually read the designated pressure.
7. Once the piston assembly has reached the end of the cylinder, close all valves and check for leaks.
8. Disconnect the tubing from the cylinder and from the pipeline isolation valve.

2.3 Installation and Operation

If Option 1 or 3 is used to pre-charge, or if the cylinder is being used for continuous sampling and the pre-charge is NOT connected to the pipeline, it is necessary to install an adjustable, resetting relief valve in order to relieve the pre-charge pressure during continuous sampling.

Figure 3: Adjustable Relief Valve



1. If your Constant Pressure Cylinder–High Pressure is equipped with an adjustable relief valve, use an auxiliary gas supply to set the valve at least 50 to 100 psig above pipeline pressure, not to exceed the maximum allowable working pressure indicated in Table 1.
2. If your cylinder is not equipped with a product purge valve, create a purge valve by tubing a T-fitting and valve inline between the sample point and the cylinder in order to provide a way to purge the system.

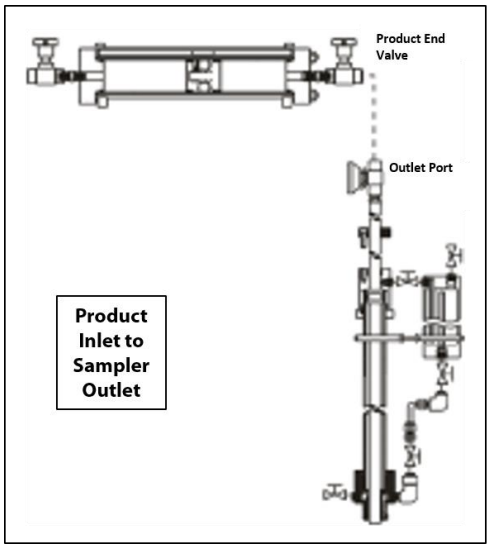
Purging the system of excess air is important to ensure the system is not contaminated by the previous sample.

3. Close the product inlet valve.
4. Connect the product inlet valve to the sample point (i.e., probe or sampler). If you have the premium purge model, connect the sample point to the product inlet port.

Refer to GPA-2166 (Gas Processors Association) and API 14.1 (American Petroleum Institute) sampling standards for guidance.

Spot Sampling

Figure 4: Product Inlet to Sampler Outlet



1. Open the product purge valve to purge the system of any contaminants. Close the purge valve.
2. After pre-charging the cylinder above pipeline pressure (see *Section 2.2*), connect the product inlet valve of the cylinder to the sampler outlet port.
3. Slowly open the sampler outlet valve.
4. Slowly open the product inlet valve on the product end cap. The piston will not yet move because pre-charge pressure is above pipeline pressure.
5. With the sampler valve and product valve fully open, slowly open the pre-charge valve to relieve pre-charge pressure. This will allow the sampled product to enter the cylinder and push against the piston. This ensures that no pressure loss is encountered.

Relieving the pre-charge too quickly can produce a pressure drop and, as a result, an inaccurate sample. A bleed plug can be installed on the pre-charge valve to regulate the relieving rate. The bleed plug will allow only a small amount of pressure to exit, ensuring pre-charge pressure is relieved steadily.

6. When the desired amount of sample is extracted, close all valves on the cylinder.
7. Close the probe outlet valve.
8. Carefully disconnect the cylinder from the probe, allowing the trapped product between the probe and cylinder to vent.
9. Plug or cap all valves on the cylinder.
10. Make a note of pressure, locations, and so forth, on the information tag, according to the customer's company's policy.
11. Check all fittings for leaks.
12. Place the cylinder into a carrying case to provide maximum protection during transportation. Ensure that you follow your company's transportation procedures and requirements.

Continuous Sampling

For continuous sampling to take place, the pre-charge valve must remain open. However, if there is an (optional) adjustable relief valve, the adjustable relief valve can be kept open and the pre-charge valve could be shut.

1. Pre-charge the sample cylinder (see *Section 2.2*) and connect the product inlet end of the cylinder to the sampler outlet port. If you have the premium purge model, connect the sampler from the outlet port to the product inlet port.
2. Open the product purge valve to purge the system of any contaminants. Close the purge valve. Welker® recommends plugging the purge valve when not in use.
3. Open the sample outlet valve.
4. Slowly open the product valve on the product end cap. The piston will not yet move because pre-charge pressure is above pipeline pressure.

The automatic sampler will push product against the piston, causing the pre-charge pressure to relieve from the adjustable relief and/or to be pushed into the pipeline.

5. Turn the sampler off when the cylinder is at 80% capacity. This allows a 20% margin for possible expansion due to temperature changes.
6. When the desired amount of sample is extracted, close all valves on the cylinder.
7. Close the sampler outlet valve.

8. Carefully disconnect the cylinder from the sampler, allowing the trapped product between the sampler outlet valve and the product inlet valve to vent.
9. Plug or cap all valves on the cylinder.
10. Record pressure, locations, and so forth, on the information tag according to the customer's company's policy.
11. Check all fittings for leaks.
12. Place the cylinder into a carrying case to provide maximum protection during transportation. Ensure that you follow your company's transportation procedures and requirements.

SECTION 3: MAINTENANCE

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.

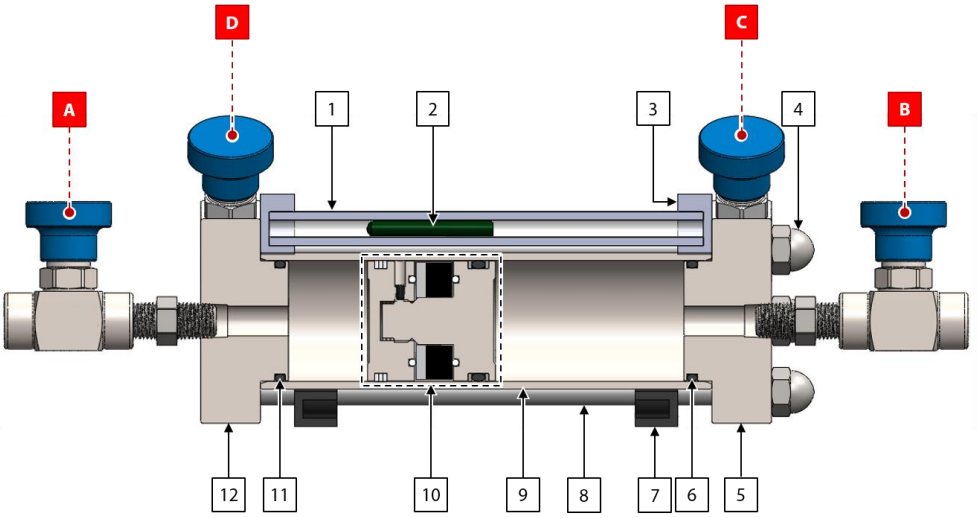
For sample-exposed seals, Welker® recommends non-hydrocarbon-based lubricants, such as Krytox®.
For non-sample-exposed seals, Welker® recommends either non-hydrocarbon-based lubricants or silicone-based lubricants, such as Molykote® 111.

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

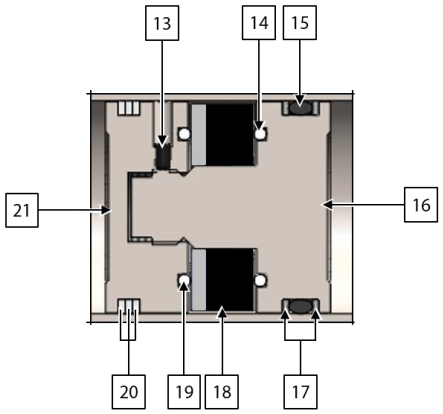
3. All maintenance and cleaning of the unit should be performed on a smooth, clean surface.
4. Welker® recommends having the following tools available for maintenance. Please note that the exact tools required may vary by model.
    a. Small Hex Key Set
    b. 6″ Adjustable Wrench
    c. 10″ Adjustable Wrench
    d. 10″ Channel Lock Pliers
    e. Fine Grit Sandpaper
    f. Flat Blade Screwdriver
    g. Torque Wrench

3.2 Maintenance Diagram

Figure 6: Welker® CP-2HP and CP-5HP Constant Pressure Cylinder Maintenance Diagram



PISTON ASSEMBLY DETAIL



No.	Description
1	Tracker Tube
2	Tracker Magnet
3	Tracker Tube Clip (Qty = 2)
4	Crown Nut (Qty = 6)
5	Product End Cap
6	O-Ring
7	Cylinder Foot (Qty = 2)
8	Tie Bolt (Qty = 6)
9	Cylinder
10	Piston Assembly (*See Detail*)
11	O-Ring
12	Pre-Charge End Cap
13	Setscrew
14	O-Ring
15	O-Ring
16	Product Side Piston
17	Back Up (Qty = 2)
18	Magnet Ring
19	O-Ring
20	Back Up (Qty = 3)
21	Pre-Charge Side Piston
A	Pre-Charge Inlet Valve
B	Product Inlet Valve
C	Purge Valve (Optional)
D	Pre-Charge Purge Valve (Optional)

3.3 Disassembly Instructions

1. Make sure the unit is depressurized prior to maintenance.

Check valves for leaks and repair as necessary during reinstallation.

2. Remove the cylinder feet.
3. Remove the six crown nuts and the six tie bolts.
4. Remove the tracker tube O-rings.
5. Remove both the product end cap and the pre-charge end cap.
6. Remove the tracker tube.

Burst discs should be replaced after 6 to 10 cylinder fillings or at least once a year. While the discs do help maintain the product, they are designed as a safety device to prevent overpressurization of the cylinder.

7. When necessary, replace the burst discs:
   - Insert the clear seal.
   - Insert the rupture disc after the clear seal. The dome should face out.
   - Torque the bursting relief caps to the proper specification (see *Table 2*).

Table 2: Torque Specifications for Cylinder Rupture Disc Caps

Pressure Range (psig)	Torque Requirements	Torque Requirements
0–300	50 in-lbs	5.6 Nm
301–5000	20 ft-lbs	27 Nm
5001–6000	24 ft-lbs	32 Nm
6001–7000	29 ft-lbs	39 Nm

8. If there is an adjustable relief valve on either end cap, remove it and replace all seals within the part (refer to the *Installation, Operation, and Maintenance* (IOM) *Manual* for the adjustable relief valve).

Be careful when removing O-rings from the O-ring grooves. Scratching the sealing surface can result in a leak. If necessary, carefully extract the O-ring and replace it during reassembly. Should the sealing surface become damaged, use a 600-grit wet sandpaper strip to carefully smooth the surface, after which the surface should be cleaned. Check the ball bearing for any signs of wear or damage. Replace if necessary.

9. Push the piston assembly out of the cylinder.
10. Loosen the set screw in the piston assembly. Disconnect the male piston from the ring magnet and female piston.

3.4 Maintenance Instructions

1. Remove and replace the backups on the male and female piston.
2. Replace the O-rings in the male and female piston.
3. Remove and replace the seals in each end cap.
4. Wipe down the inside of cylinder and dry carefully (also see *Section 3.5*).
5. Closely examine the honed surface of the cylinder. Scratches and pits will cause the seals to leak.

3.5 Reassembly Instructions

1. Reassemble the piston assembly as below. Carefully reinsert the piston assembly back into the cylinder. Be careful not to scratch the cylinder or damage the seals. Make sure that the direction of piston assembly insertion is correct. The female end of the piston goes toward the pre-charge end cap.
2. Reattach the pre-charge and product end caps onto the cylinder.
3. Reattach the tie bolts and tighten the nuts to the correct torque (see *Table 3*) using a cross bolting sequence.

Table 3: Torque Specifications for Tie Bolts

Diameter of Tie Bolt	Torque Requirements	Torque Requirements
⅜" (CP-2, etc.)	5–6 in-lbs	.69–.82 KG/M
⅝" (CP-5, etc.)	23–30 ft-lbs	3.45–4.14 KG/M

4. Reattach the tracker tube, clips, and the O-rings that have been replaced. Ensure that the tracker magnet is facing the correct direction (i.e., it should align with the piston assembly).
5. Pressure up the cylinder at one end with an inert gas supply and test for leaks. Repeat the process from the opposite end. Pressurize slowly to avoid slamming the piston from one end to the other.
6. Welker® recommends using helium to test for leaks.

3.6 Cleaning the Constant Pressure Cylinder–High Pressure

Regular cleaning of the cylinder is essential for the device's proper functioning. Solvent cleaning is normally done during scheduled maintenance. However, some companies require such cleaning before each cylinder is put into service. Any debris or residue that is not removed from the cylinder will contaminate the results of the next sample extracted from the cylinder. Welker® recommends cleaning and leak testing of the cylinder after each use.

Welker® recommends cleaning and leak testing of the cylinder after each use.

<u>Cleaning a Constant Pressure Cylinder–High Pressure can be accomplished one of the following four ways:</u>

1. Purging (i.e., flushing) with new product:
- Purge (i.e., flush) the cylinder using the product to be sampled. This can be accomplished each time the cylinder is put into service.
- Repeat step 5 of *Section 3.5*.

2. Cleaning with solvent:
- Fill and empty the cylinder repeatedly with solvent.
- Use an inert gas to dry and purge the cylinder.
- Use method 3.6.1 to verify the system is free of contaminants.
- Repeat step 5 of *Section 3.5*.

3. Using a very clean rag:
- Remove the six (6) crown nuts.
- Remove the product end cap.
- Using a very clean rag, wipe the product end cap and what can be seen of the piston assembly.
- Replace the product end cap, the six (6) crown nuts, and the cylinder feet.
- Repeat step 5 of *Section 3.5*.

4. Using a steam cleaner:
Ensure that the temperature rating of the steam cleaner will not exceed that of the seals and the tracker tube. When the steam cleaning is complete, ensure that no moisture from the steam remains within the Constant Pressure Cylinder. Also, keep the valves open sufficient time for the steam heat to dissipate and the temperature of the Constant Pressure Cylinder to normalize. When the steam cleaning is finished, repeat step 5 of *Section 3.5*.

3.7 Leak Testing the Constant Pressure Cylinder–High Pressure

Welker® recommends leak testing the cylinder after each time it is put into service.

- Slowly pressure up the product end with helium and leak check all the external fittings and reliefs on the product end.
- Slowly open the pre-charge end valves and ensure there are no leaks across the piston.
- Slowly pressure up the pre-charge end with helium, which will push the piston back to the product end.
- Leak check all the external fittings and reliefs on the pre-charge end.
- Slowly open the product end valves and ensure there are no leaks across the piston in that direction.
- Relieve all pressure and shut off all valves.
- The cylinder is now ready to go back into service, starting with the pre-charging procedure.

3.8 Troubleshooting Guidelines

Table 4: Constant Pressure Cylinder–Troubleshooting Guidelines		
Issues	**Possible Causes**	**Solutions**
Migration of gas from one side of the cylinder to another.	Cylinder scratches or pitting.	Return the device to the manufacturer.
Cylinder wall thickness is compromised.	Damage to the outside of the cylinder.	Return the device to the manufacturer.
Gauge indicates a loss of pressure.	There is a leak from one of the fittings.	Use a leak detector to check all fittings for leaks. Replace thread sealant.
	There is a leak from the burst discs.	Ensure that the burst discs are properly torqued (see *Table 2*). If the problem persists, the discs may need to be replaced.
	The cylinder experienced a temperature drop.	Restore the temperature to pipeline temperature.
	There is a defective valve.	Repair or restore the defective valve.
Pressure is leaking across the piston.	Seals in the piston are leaking.	Disassemble and clean the unit. Inspect the cylinder for scratches. Replace seals in the piston and reassemble. (See *Sections 3.3* to *3.5*.)
Pressure is leaking from the indicator rod.	Seals in the pre-charge end cap are leaking.	Disassemble the unit. Replace pre-charge end cap seals. Inspect the rod for scratches, then reassemble. (See *Section 3.3*.)
The pre-charge or product end cap is leaking.	The burst disc is leaking.	Replace the burst disc. (See *Section 3.3* to *3.5*.)
	There is a loose fitting.	Tighten the fittings.
	The seat on the purge valve is leaking.	Replace the seat.

3.9 Special Safety Warning for Liquid Sample Cylinders

After drawing the sample into the cylinder, the inlet and pre-charge valves should be closed. The sample line is then disconnected from the cylinder and the cylinder is completely isolated from the process. Paperwork is processed and the cylinder is prepared for transport. Prior to transporting the cylinder, Welker® recommends plugging or capping the valves on the cylinder. These valves may terminate with a female NPT or a male NPT. The female valves are typically plugged, while the male valves are typically capped.

When liquid sampling, due to the potential extremes of thermal expansion of many LPG products, caution should be taken to ensure that any residual liquid is drained, blown, or absorbed from the accessible exterior dead volume of the valve body (downstream of the seat) prior to plugging or capping the valve.

It is common to see temperature differentials of as much as 100 °F (*38 ℃*) or more. Liquid samples that are drawn at -40 °F (*-40 ℃* to *-46 ℃*) can be transported in shipping cases that may see ambient temperatures as high as 100 °F to 160 °F (*38 ℃* to *71 ℃*) and at times may exceed 160 °F (*71 ℃*).

Operators should be familiar with the basic and general physical properties of the product they are sampling so they can adequately estimate the expansion potential of the sampled product within the cylinder and therefore ample outage for expansion to occur. In the majority of cases, 80% fill and 20% pre-charge is acceptable. But certain products might require a large inert gas pre-charge ratio—for example, 70% and 30% or 60% and 40%.

Burst discs are installed on the Constant Pressure Cylinder–High Pressure to protect it from structural failure. The operator must be aware that flammable product will be released in the event of overpressurization of the working pressure of the cylinder. Therefore, it is important to all for ample expansion within the cylinder prior to attainment of the rupture disc activation. Burst disc ranges and cylinder working pressures are determined by the U.S. Department of Transportation. These guidelines and rules are found in CFR-49.

Should you have any questions, please call Welker®.

APPENDIX: REFERENCED DOCUMENTS

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

- IOM-011: Welker® Constant Pressure Cylinders With Tracker Tube (Non-Mixer)—Models CP-2G, CP-5G, CP-2G With Premium Purge
- IOM-013: Welker® Constant Pressure Cylinders With Tracker Tube and Gravity Mixer—Models CP2GM and CP5GM
- IOM-014: Welker® Constant Pressure Cylinder With Welker® Magnetic Indicator (With Gravity Mixer)—Model CP2GM-HP
- IOM-033: Welker® Relief Valve—Models RV-1, RV-2, RV-2CP, RV-3
- IOM-063: Welker® Constant Pressure Cylinders With Welker® Solid Indicator, Syringe T-Handle, or Vortex Mixer—Models CP2SI, CP5SI, CP52SY, CP5SY, CP35SY, CP2M, CP5M, CP35M
- IOM-115: Welker® Constant Pressure Cylinders–High Pressure With Welker® Solid Indicator, T-Handle, and Vortex Mixer—Model CP2M-HP

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

- None

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

- Assembly Drawing: AD618BA (Welker® Constant Pressure Sample Cylinder CP-2GMHP)

NOTES

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