



INSTALLATION, OPERATION, AND MAINTENANCE MANUAL
WELKER CONSTANT PRESSURE CYLINDER

MODEL
CP-82

DRAWING NUMBER
AD875C0

MANUAL NUMBER
IOM-194

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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 Cylinder, CP-82. For comprehensive instructions, please refer to the IOM Manuals for each individual component. A list of relevant component IOM Manuals is provided in Appendix A of this manual.

The information in this manual has been carefully checked for accuracy and is intended to be used as a guide for the installation, operation, and maintenance of the Welker equipment described in this manual. Correct installation and operation, however, are the responsibility of the end user. Welker reserves the right to make changes to this manual and all products in order to improve performance and reliability.

BEFORE YOU BEGIN

Read these instructions completely and carefully.

IMPORTANT - Save these instructions for local inspector's use.

IMPORTANT - Observe all governing codes and ordinances.

Note to Installer - Leave these instructions with the end user.

Note to End User - Keep these instructions for future reference.

Installation of this Constant Pressure Cylinder 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, please contact a Welker representative immediately.

Phone: 281.491.2331

Address: 13839 West Belfort 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 CP-82 Constant Pressure Cylinder is designed to contain and transfer accurate samples or calibration standards for laboratory analysis.

The CP-82 is designed for manual sample collection. If the customer pipeline is pressurized, the CP-82 must be pre-charged with an inert gas or pipeline gas so that cylinder contents are maintained under full pipeline pressure. Filling a pre-charged cylinder protects against phase change and maintains the sample's integrity by collecting sample at full line pressure. End caps with valves, gauges, and relieving devices enable the cylinder pressure to be controlled and monitored at all times.

The internal floating piston plays a key role in volume indication and contamination prevention. As the cylinder is filled and the piston moves inside the cylinder, the indicator rod with T-handle will be pushed out the pre-charge end cap, allowing the operator to monitor the product level within the cylinder. As the cylinder is emptied, the piston wipes the cylinder walls clean and forces any air and/or contaminants from the cylinder, preventing cross-contamination between samples.



The Welker CP-82 **does not** carry a DOT special permit. For a DOT-approved Welker Constant Pressure Cylinder, please contact a Welker representative.

Welker may custom design the CP-82 to suit the particular application and specifications of each customer.

1.3 Safety Warning and Important Information



Please read the following information in its entirety before using the Welker equipment described in this manual. Failure to adhere to these recommendations may result in equipment damage or personal injury.

General

1. Product expansion may occur if the sample cylinder is subjected to extreme temperature changes. Operators should be familiar with the physical properties of the sampled product and should be able to adequately estimate the expansion potential of the product. Certain products may require a greater proportion of inert gas to product (e.g., 40% inert gas to 60% product) to allow ample room for product expansion.
2. In cases where the sample cylinder is exposed to extreme or varying temperatures, do not allow the sample cylinder to exceed the maximum allowable operating pressure (MAOP) indicated in *Section 1.4, Specifications*.
3. Handle the sample cylinder with caution. The sample cylinder is a precision instrument and may contain flammable or hazardous product.
4. Welker recommends that the sample cylinder be purged and leak tested after each use and that the sample cylinder valves be capped or plugged during transit and when not in use.
5. Prior to plugging or capping valves, ensure that any residual liquids have been drained, purged, or absorbed from the accessible exterior dead volume of the valve body.
6. When analysis of the product is complete, the sample cylinder should be safely emptied.

Calibration Standards and Laboratory Use



For specific instructions on calibration, testing, and/or analysis, refer to the appropriate standard(s).

1. To preserve the integrity of the sample cylinder contents, pre-charge pressure equal to the starting pressure in the sample cylinder must be applied and maintained when sending calibration standards and/or the collected sample to the analyzer.



Applying and maintaining pre-charge pressure while emptying the sample cylinder prevents the original composition and phase state of the calibration standard and collected sample from changing.

2. Sample cylinders used for calibration standards may require mixing to thoroughly blend the calibration standard and ensure even distribution of components or heating to prevent the calibration standard from falling below its dew point.
3. After being emptied, sample cylinders used for calibration standards should be cleaned and maintained and then properly conditioned and prepared prior to reuse.

1.4 Specifications

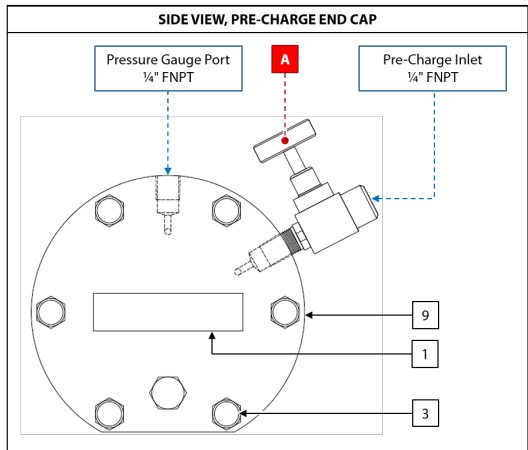
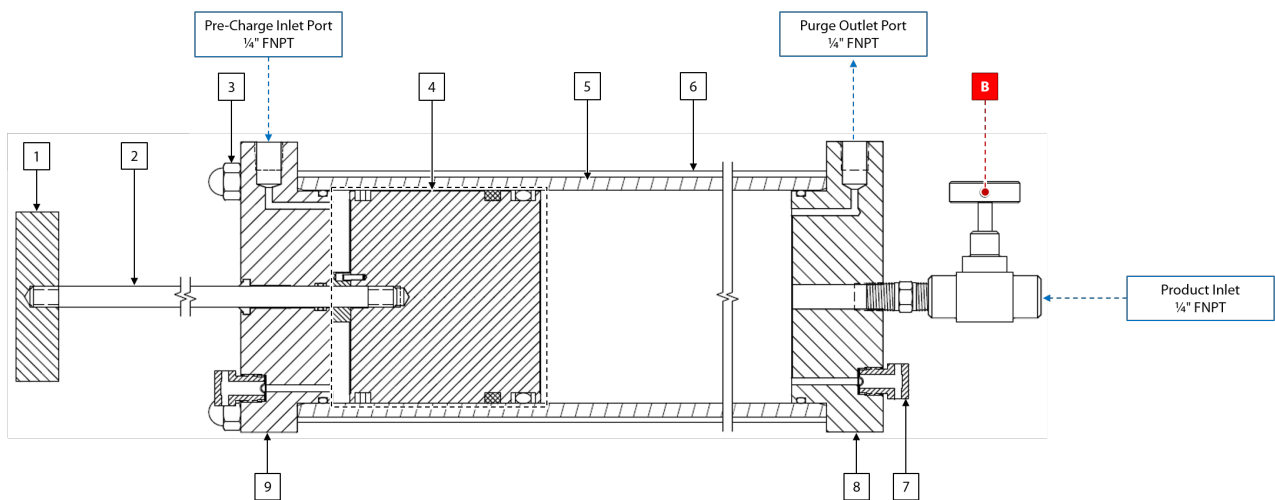


The specifications listed in this section are generalized for this equipment. Welker can modify the equipment according to your company's needs. **Please note that the specifications may vary depending on the customization of your equipment.**

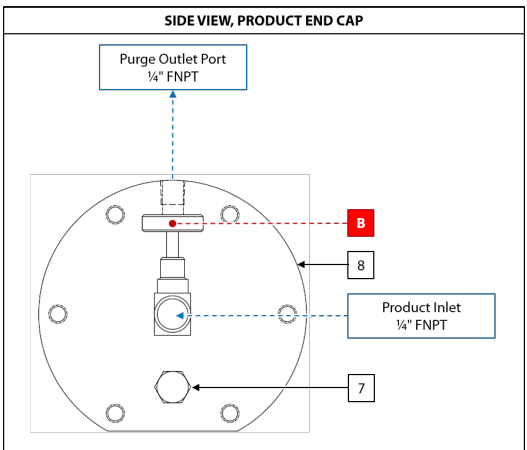
Table 1: CP-82 Specifications	
Products Sampled	Gases and Liquids Compatible With the Materials of Construction
Materials of Construction	316/316L Stainless Steel, PTFE, Teflon®, and Viton®
Maximum Allowable Operating Pressure	600 psig @ -20 °F to 120 °F (41 barg @ -28 °C to 48 °C)
Connections	Pre-Charge Inlet: ¼" FNPT Product Inlet: ¼" FNPT Purge Outlet (Optional): ¼" FNPT
Volume	1000 cc
Features	Burst Discs Valves
Options	Pressure Gauges Purge Valve Sulfinert®-Treated Sample Exposed Parts

1.5 Equipment Diagram

Figure 1: CP-82 Diagram



No.	Description
1	T-handle
2	Indicator Rod
3	Crown Nut (Qty. 6)
4	Piston Assembly
5	Cylinder
6	Tie Bolt (Qty. 6)



No.	Description
7	Burst Disc With Burst Relief Cap (Qty. 2)
8	Product End Cap
9	Pre-Charge End Cap
A	Pre-Charge Inlet Valve
B	Product Outlet Valve
C	Purge Valve (Optional; Not Shown)

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.

2.2 Pre-Charging the CP-82



The relief valves and gauges must be adequate for the pressure used to pre-charge the CP-82.



The gas used to pre-charge the CP-82 must be compatible with the cylinder seals.



It is not necessary to pre-charge a syringe-style CP-82 if it will be used to spot sample from a vacuum or non-pressurized source.



If the CP-82 will be pre-charged using pipeline product, continue to step 1.
If the CP-82 will be pre-charged using an auxiliary gas, proceed to step 11.

Using Pipeline Product



This method should only be used if connecting to a pressurized gas pipeline.

1. Ensure that all valves on the CP-82 are closed (*Figure 1*).
2. Using small diameter tubing, connect from an available pipeline isolation valve to pre-charge inlet valve A (*Figure 1*).
3. Open the pipeline isolation valve.
4. Slowly open pre-charge inlet valve A (*Figure 1*). The piston inside the CP-82 should begin to move toward the product end cap, as indicated by the indicator rod.



Once the pre-charge pressure gauge begins to read pressure, do not open the valve any further. The cylinder should be pre-charged slowly and smoothly. Opening the valve too quickly or too much may cause the piston to slam from one end of the cylinder to the other and may result in damage to the unit.

5. Slowly open product inlet valve B to relieve any pressure from the product side of the CP-82 (*Figure 1*).
6. Once pressure has been relieved from the product side of the CP-82, close product inlet valve B (*Figure 1*).
7. Fill the pre-charge side of the CP-82 until the indicator rod indicates 0% and the pre-charge pressure gauge indicates pipeline pressure.
8. Once the CP-82 has been pre-charged, close all valves and check for leaks.
9. Disconnect the tubing between the pipeline isolation valve and pre-charge inlet valve A.
10. Proceed to *Section 2.3, Installation*.

Using an Auxiliary Gas



The auxiliary gas used to pre-charge the CP-82 must be regulated to 50–100 psig above pipeline pressure, not to exceed the maximum allowable operating pressure (MAOP) of the cylinder.



Welker recommends using nitrogen or helium as the inert gas supply.

11. Ensure that all valves on the CP-82 are closed (*Figure 1*).
12. Using small diameter tubing, connect from the auxiliary gas supply to pre-charge inlet valve A (*Figure 1*).
13. Open the valve on the auxiliary gas supply.
14. Slowly open pre-charge inlet valve A (*Figure 1*). The piston inside the CP-82 should begin to move toward the product end cap, as indicated by the indicator rod.



Once the pre-charge pressure gauge begins to read pressure, do not open the valve any further. The cylinder should be pre-charged slowly and smoothly. Opening the valve too quickly or too much may cause the piston to slam from one end of the cylinder to the other and may result in damage to the unit.

15. Slowly open product inlet valve B to relieve any pressure from the product side of the CP-82 (*Figure 1*).
16. Once pressure has been relieved from the product side of the CP-82, close product inlet valve B (*Figure 1*).
17. Fill the pre-charge side of the CP-82 until the indicator rod indicates 0% and the pre-charge pressure gauge indicates the pressure of the regulated auxiliary gas (i.e., 50–100 psig above pipeline pressure but not exceeding the maximum allowable operating pressure (MAOP) of the CP-82).
18. Once the CP-82 has been pre-charged, close all valves and check for leaks.
19. Disconnect the tubing between the auxiliary gas supply and pre-charge inlet valve A.
20. Continue to *Section 2.3, Installation*.

2.3 Installation



If the CP-82 will be used to spot sample from a vacuum or non-pressurized source, proceed to *Section 2.5, Spot Sampling From a Vacuum or Non-Pressurized Source*.

1. If the CP-82 is not equipped with a purge valve, tube a T-fitting and valve inline between the sample point and the CP-82 to provide a means by which the system can be purged.
2. Ensure that all valves on the CP-82 are closed (*Figure 1*).
3. Install the CP-82 as close to the sample point as possible.
4. Using small diameter tubing, connect from the sample point (i.e., the probe or sampler outlet) to product inlet valve B (*Figure 1*).

Purging the CP-82



Welker recommends that the sample cylinder be cleaned or purged prior to each sample batch to remove any air and/or old product from the system and prevent cross-contamination between samples.

5. Connect from purge valve C to a drain, flare, or safe ventilation area (*Figure 1*).
6. Open product inlet valve B, and then open purge valve C (*Figure 1*).
7. Pressure from the sample point will cause air and/or old product to purge from the sample line.



During the purge cycle, the product pressure gauge will indicate a pressure drop.

8. Allow approximately 5–10 seconds for air and/or old product to purge.
9. Once purging is complete, close product inlet valve B, and then close purge valve C (*Figure 1*).
10. Disconnect purge valve C from the drain, flare, or safe ventilation area.



Welker recommends plugging the purge valve when not in use.

11. Sampling may now begin. Continue to *Section 2.4, Spot Sampling From a Pressurized Source*.

2.4 Spot Sampling From a Pressurized Source

1. Ensure that the CP-82 has been adequately pre-charged.
2. Ensure that the CP-82 has been purged.
3. Ensure that product inlet valve B is connected to the sample point (i.e., the probe or sampler outlet).
4. Slowly open the outlet valve on the probe or sampler.
5. Slowly open product inlet valve B (*Figure 1*). The piston will not yet move because pre-charge pressure is at or above pipeline pressure.
6. With the outlet valve and product inlet valve B fully open, slowly open pre-charge inlet valve A to relieve pre-charge pressure (*Figure 1*).



Relieving pre-charge pressure too quickly can result in a pressure drop and an inaccurate sample. A bleed plug can be installed to pre-charge inlet valve A to regulate the relieving rate. By allowing only a small amount of pressure to exit, the bleed plug ensures that pre-charge pressure is relieved steadily.

7. Continue sampling until the desired volume of sample has been obtained.



For liquid products, never fill the cylinder above 80% of its capacity. Allow at least 20% room for product expansion should the cylinder be exposed to increased temperatures. Note that certain products may require a greater proportion of inert gas to product.

8. Once the desired volume of sample has been obtained, close pre-charge inlet valve A, product inlet valve B, and the outlet valve on the probe or sampler (*Figure 1*).
9. Carefully disconnect the CP-82 from the probe or sampler, allowing product trapped between the CP-82 and the probe or sampler to vent.



It is the responsibility of the end user to determine how best to vent product trapped between the CP-82 and the sample source prior to disconnection. Failure to vent trapped product could prevent disconnection or cause injury to the operator.

10. Plug or cap all valves on the CP-82.



Female valves are typically plugged.
Male valves are typically capped.

11. Label the filled CP-82 and prepare it for transfer to the testing laboratory in accordance with company policy.

2.5 Spot Sampling From a Vacuum or Non-Pressurized Source



Pre-charging the CP-82 is not necessary if the CP-82 will be used to spot sample from a vacuum or non-pressurized source.

1. Connect from the outlet of the sample source to the product inlet on the CP-82 (*Figure 1*).
2. Open pre-charge inlet valve A (*Figure 1*).



Pre-charge inlet valve A must remain open during spot sampling procedures.

Purging the CP-82



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.

3. Open product inlet valve B (*Figure 1*).
4. Push down on the T-handle to push the piston to the product side of the cylinder (*Figure 1*).
5. Open the outlet valve on the sample source.
6. Slowly pull up on the T-handle.
7. Close product inlet valve B.
8. Open purge valve C, and then push down on the T-handle to push the piston to the product side of the cylinder and purge the cylinder of air and product.
9. Repeat steps 3–8 as necessary.
10. Once the CP-82 has been purged, spot sampling may begin. Continue to step 11 for spot sampling procedures.

Spot Sampling Procedures

11. Open product inlet valve B.
12. Slowly pull up on the T-handle until the desired volume of sample has been obtained.



For liquid products, never fill the cylinder above 80% of its capacity. Allow at least 20% room for product expansion should the cylinder be exposed to increased temperatures. Note that certain products may require a greater proportion of inert gas to product.

13. Once the desired volume of sample has been obtained, close product inlet valve B and pre-charge inlet valve A, and then close the outlet valve on the sample source (*Figure 1*).
14. Carefully disconnect the CP-82 from the sample source, allowing product trapped between the CP-82 and the sample source to vent.



It is the responsibility of the end user to determine how best to vent product trapped between the CP-82 and the sample source prior to disconnection. Failure to vent trapped product could prevent disconnection or cause injury to the operator.

15. Plug or cap all valves on the CP-82.



Female valves are typically plugged.
Male valves are typically capped.

16. Label the filled CP-82 and prepare it for transfer to the testing laboratory in accordance with company policy.

3.1 Before You Begin

1. **Welker recommends that the unit have standard maintenance any time the CP-82 will be used to contain a different product.**
2. **Welker recommends that the unit have standard maintenance under normal operating conditions:** for *gas sampling* every six (6) months; and for *liquid sampling* every twelve (12) months. 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.
3. Prior to maintenance or disassembly of the unit, it is advisable to have a repair kit available for repairs of the system in case of unexpected wear or faulty seals.



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.

4. All maintenance and cleaning of the unit should be performed on a smooth, clean surface.
5. Welker recommends having the following tools available for maintenance. Please note that the exact tools required may vary by model.
 - a. Channel Lock Pliers
 - b. Flat Head Screwdriver
 - c. Hex Key Set
 - d. Seal Pick
 - e. Strap Wrench
 - f. Torque Wrench

3.2 Leak Testing the CP-82



Welker recommends leak testing the CP-82 after each use.

1. Slowly apply inert gas to the product end of the CP-82 until the piston is at the pre-charge end cap. Check for leaks in the product-side fittings and repair as necessary.
2. Open pre-charge inlet valve A to check for leaks across the piston. Repair as necessary.
3. Relieve pressure from the product side of the CP-82.
4. Slowly apply inert gas to the pre-charge end of the CP-82 until the piston is at the product end cap. Check for leaks in the pre-charge side fittings and repair as necessary. Note that this will pre-charge the CP-82.
5. Open product inlet valve B to check for leaks across the piston. Repair as necessary.

3.3 Purging and Decontaminating the CP-82



Take the necessary precautions and wear appropriate personal protective equipment (PPE) to protect from potential harm caused by the sampled product.



Regular cleaning of the sample cylinder 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.

Purging

Purging With Nitrogen

1. Fill the CP-82 with clean, dry nitrogen, and then empty the cylinder. Repeat several times.
2. Fill the CP-82 with helium, and then 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 CP-82 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, it may be necessary to decontaminate the CP-82 with solvent.
4. Purging is complete when no hydrocarbons and/or contaminants are present in the analysis.

Purging With New Product

Purge the CP-82 with the product to be sampled. This can be accomplished each time the CP-82 is put into service. See *Section 2.3, Installation*, for instructions on purging the CP-82 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.

Decontaminating With Solvent

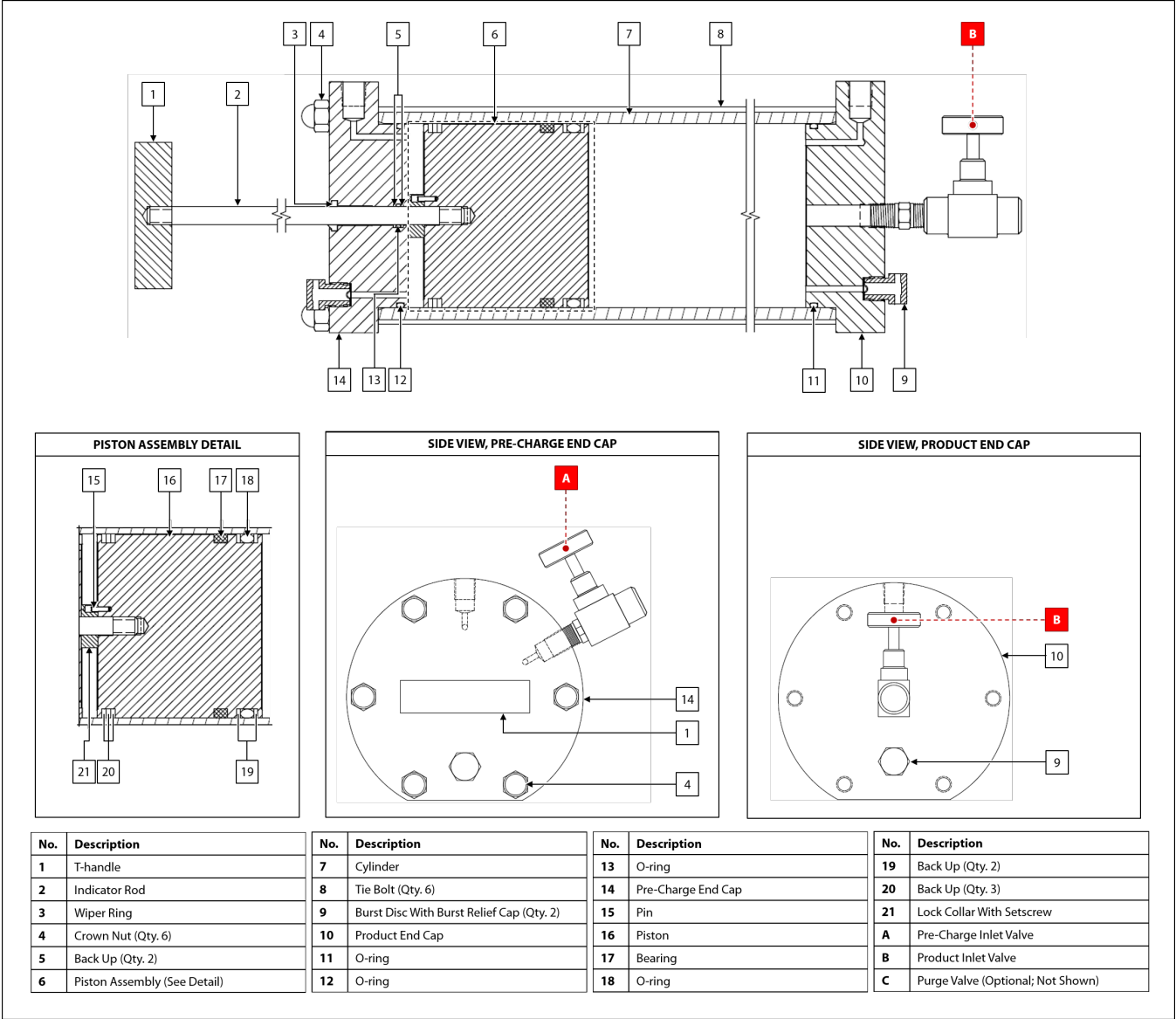
1. Repeatedly flush the CP-82 with solvent.
2. Use clean, dry nitrogen to dry the CP-82.
3. Purge the CP-82 with nitrogen to remove any remaining solvent.
4. Fill the CP-82 with helium, and then take a sample of the helium and test it for trace amounts of solvent and hydrocarbons.
5. If solvent and/or hydrocarbons are present in the analysis, the CP-82 has not been adequately cleaned and further decontamination with solvent and/or purging of the CP-82 is necessary. Steps 1 and 2 may need to be repeated. Repeat steps 3 and 4.
6. Decontamination is complete when no solvent or hydrocarbons are present in the analysis.

3.4 Maintenance

- 1. Ensure that the CP-82 has been purged and/or decontaminated prior to performing maintenance. See *Section 3.3, Purging and Decontaminating the CP-82*, for instructions.
- 2. Ensure that the CP-82 has been disconnected from all pressure sources and depressurized prior to performing maintenance.

Disassembly

Figure 2: CP-82 Maintenance Diagram



- 3. If applicable, remove the valves and pressure gauges from the end caps.
- 4. Unscrew the crown nuts from the tie bolts.
- 5. Remove the T-handle from the indicator rod, and then carefully remove the pre-charge end cap by sliding it off the indicator rod.
- 6. Holding the indicator rod, remove the piston assembly from the cylinder.

7. Loosen the setscrew in the piston lock collar, and then unscrew the indicator rod from the piston assembly, taking care not to misplace the pin that aligns the lock collar with the piston.
8. Unscrew the tie bolts from the product end cap, and then remove the product end cap from the cylinder.

End Caps

9. Remove the O-ring from the product end cap.
10. Remove the wiper ring, O-rings, and back ups from the pre-charge end cap.
11. Carefully clean and dry the end caps.
12. Install a replacement O-ring to the product end cap.
13. Install a replacement wiper ring and replacement O-rings and back ups to the pre-charge end cap.
14. As necessary, maintain the valves. To perform maintenance on the valves, refer to the *Installation, Operation, and Maintenance (IOM) Manual* for the valves for instructions.
15. If the CP-82 is equipped with burst relief discs, replace the burst relief discs. Refer to the *Installation, Operation, and Maintenance (IOM) Manual* for the burst relief discs for instructions.

Piston Assembly

16. Remove the back ups, O-ring, and bearing from the piston.
17. Carefully clean and dry the piston.
18. Install replacement back ups and a replacement O-ring and bearing to the piston.
19. With the lock collar installed, screw the indicator rod into the piston.
20. Assemble the piston to the lock collar by aligning the pin in the lock collar with the pin hole in the piston.
21. Tighten the setscrew in the lock collar to secure the lock collar to the piston.

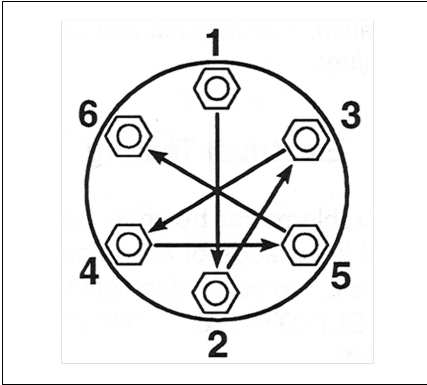
Cylinder

22. Carefully wipe down and dry the inside of the cylinder.
23. Closely examine the polished and honed surfaces of the cylinder, as scratches or pits may cause the seals to leak. If scratches or pits are present, the unit may need to be repaired or replaced. Contact Welker for service options.

Reassembly

- 24. Install the cylinder to the product end cap.
- 25. Following a cross-bolting sequence, install the tie bolts to the product end cap (Figure 3).

Figure 3: Cross-Bolting Sequence



- 26. Holding the indicator rod, insert the piston assembly into the cylinder.
- 27. Install the pre-charge end cap to the indicator rod, and then carefully push the pre-charge end cap down to the cylinder. Ensure that the end cap fits onto the tie bolts.
- 28. Following a cross-bolting sequence, install the crown nuts to the tie bolts, and then tighten the crown nuts to the appropriate torque (Figure 3 and Table 2).

Table 2: Torque Specifications for Tie Bolts		
Tie Bolt Diameter	Foot-Pounds (ft·lb)	Kilograms per Meter (kg/m)
$\frac{3}{8}$ "	5–6	0.69–0.82

- 29. Return the valves and pressure gauges to the end caps.
- 30. Return the T-handle to the indicator rod.
- 31. Leak test the CP-82. See Section 3.2, Leak Testing the CP-82, for instructions.
- 32. Maintenance is now complete.

3.5 Troubleshooting

Table 3: CP-82 Troubleshooting		
Issues	Possible Causes	Solutions
A gauge indicates loss of pressure.	There is a leak from one of the fittings.	Use leak detector to check all fittings for leaks. Replace the thread sealant on the fittings.
	There is a leak from the burst discs.	Ensure that the burst discs are tightened to the proper torque. Refer to the <i>Installation, Operation, and Maintenance (IOM) Manual</i> for the burst discs for torque recommendations. If the problem persists, the burst discs may need to be replaced. If the lifespan of the burst discs has been exceeded, a more frequent preventative maintenance schedule may be required for the burst discs.
	The cylinder experienced a temperature drop.	Restore the temperature to pipeline temperature.
	There is a defective valve.	Refer to the <i>Installation, Operation, and Maintenance (IOM) Manual</i> for the valve for maintenance instructions.
Pressure is leaking across the piston.	The piston seals are leaking.	Disassemble and clean the CP-82. Inspect the cylinder for scratches. Replace seals on the piston, and then reassemble the CP-82. <i>Section 3.4, Maintenance</i> , for maintenance instructions.
The pre-charge or product end cap is leaking.	There is a leak from the burst disc.	Ensure that the burst disc is tightened to the proper torque. Refer to the <i>Installation, Operation, and Maintenance (IOM) Manual</i> for the burst discs for torque recommendations. If the problem persists, the burst disc may need to be replaced. If the lifespan of the burst discs has been exceeded, a more frequent preventative maintenance schedule may be required for the burst discs.
	A fitting is loose.	Tighten the fitting.
	The seat on the purge valve is leaking.	Replace the seat on the purge valve.

APPENDIX A: REFERENCED OR ATTACHED DOCUMENTS

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

- IOM-105: Welker NV-1 and NV-2 Instrument Valves

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

- Continental Disc Corporation Preparation and Installation of the ½" Standard Type Rupture Disc/Screw Type Holder Assembly (Welker IOM-V301)

Welker drawings and schematics suggested for use with this unit:

- Assembly Drawing: AD875CO

NOTES

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