



INSTALLATION, OPERATION, AND MAINTENANCE MANUAL
WELKER® CYLINDER STEAM & VACUUM CLEANER

MODEL

CSVC

DRAWING NUMBERS

AD881CA

AD881CB

MANUAL NUMBER

IOM-128

REVISION

Rev. B, 3/16/2016

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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® Cylinder Steam & Vacuum Cleaner, CSVC. 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 Cylinder Steam & Vacuum Cleaner 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 Cylinder Steam & Vacuum Cleaner, 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® CSVC Cylinder Steam & Vacuum Cleaner is an effective cleaning system that utilizes heat from saturated and super-heated steam to clean sample cylinders. Unlike hot water, steam evenly distributes heat to all surfaces. Moisture content of steam can be quickly and easily controlled by regulating the inlet pressure. The use of a steam separator will reduce moisture in saturated steam to less than one percent (1%). This system does not require any chemicals, saves on water usage, and facilitates the simultaneous cleaning of multiple cylinders. In short, the CSVC is an efficient, environmentally-friendly system for removing contaminants inside sample cylinders.

Welker may custom design the CSVC to suit the particular application and specifications of each customer.

1.3 Safety Warning

1. Steam may be dangerous if the proper precautions are not taken. Hot surfaces and release of live steam may cause serious bodily injury. Follow safety and correct operating procedures when working with steam. When operating the system, wear appropriate personal protective equipment (PPE), which could include gloves that cover the forearms.
2. Exposure to steam is hazardous. If not properly controlled, steam may cause serious bodily injury and/or property damage.

1.4 Important Information

1. Cylinders must be completely emptied and drained before being connected to the CSVC.
2. A damaged steam hose may result in serious personal injury and/or property damage.
3. Never transport a cylinder with pressure exceeding DOT regulations as established in 49 C.F.R. In cases where the cylinder may be exposed to varying temperatures, do not allow the cylinder to exceed its maximum allowable operating pressure (MAOP).
4. Handle the cylinder with care. Protect the cylinder and valves during transport.
5. Once analysis is complete, the cylinder should be emptied safely and placed in a safe area.
6. Welker recommends cleaning and leak testing the cylinder after each use. Refer to the *Installation, Operation, and Maintenance (IOM) Manual* for the Welker® SC Single Cavity Sample Cylinder for instructions.

1.5 Specifications



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

Table 1: CSVC Specifications

| | |
|---|---|
| Application | Cleaning of Sample Cylinders |
| Maximum Allowable Operating Pressure | 90 psig (6.2 barg) |
| Steam Temperature Range | 212 °F to 331 °F (100 °C to 166 °C) |
| Connections | ½" FNPT (Standard) ¾" FNPT |
| Utility Requirement | Water Supply: Up to 100 psig (6.8 barg) |
| Electrical Connection | AC 120 V AC 480 V, 3 Phase |
| Cylinder Volume | 300 cc (Standard) 500 cc 1000 cc |
| System Cylinder Capacity | Up to 6 Cylinders (Standard) Up to 12 Cylinders Up to 24 Cylinders |
| Features | Blowdown Separator Insulated Tubing Steam Generator Steam Traps Swagelok® Quick-Connects Thermostatically Controlled Heater Vacuum Pump |
| Options | FasMate® Quick-Connects Water Pump Welker® SG-3 Sight Glasses |

1.6 Equipment Diagrams

Figure 1: CSVC Schematic

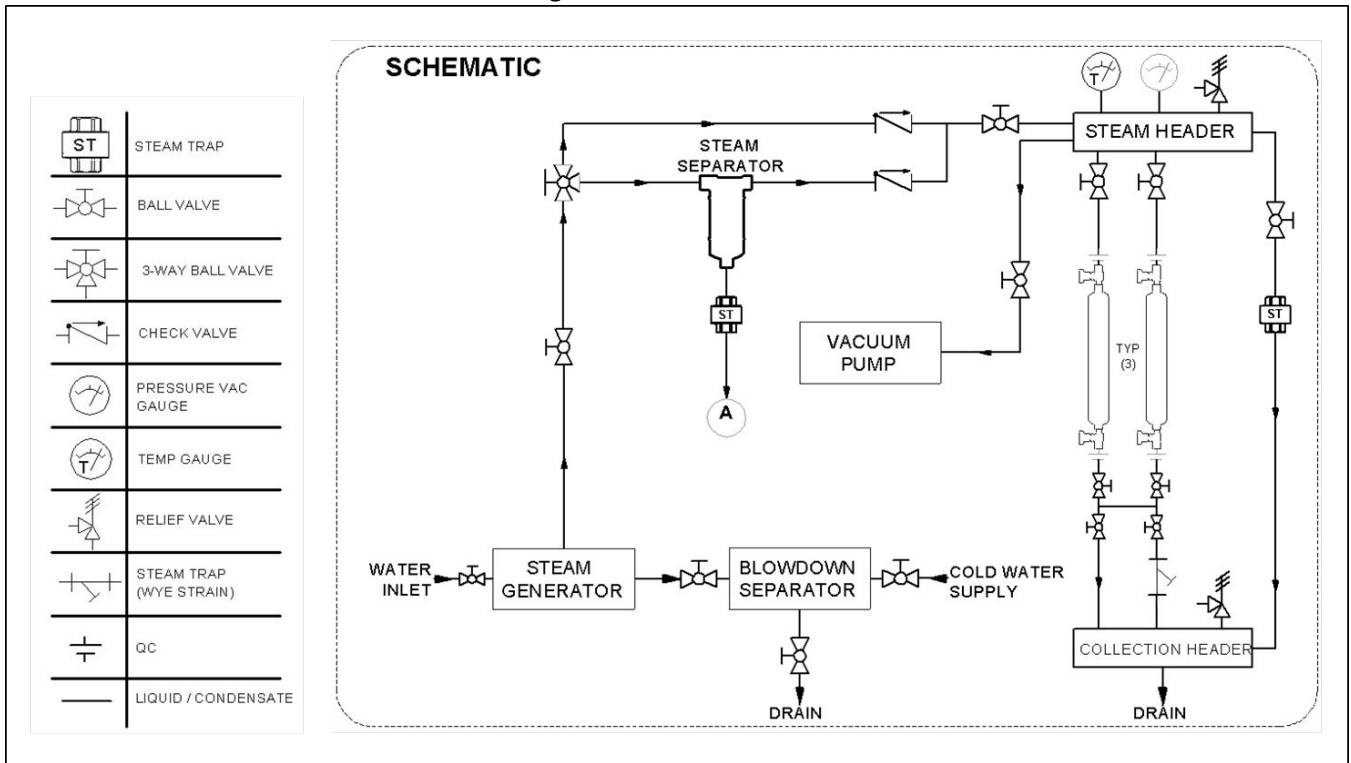


Figure 2: CSVC Connections Diagram (Shown With Optional FasMate® Quick-Connects)

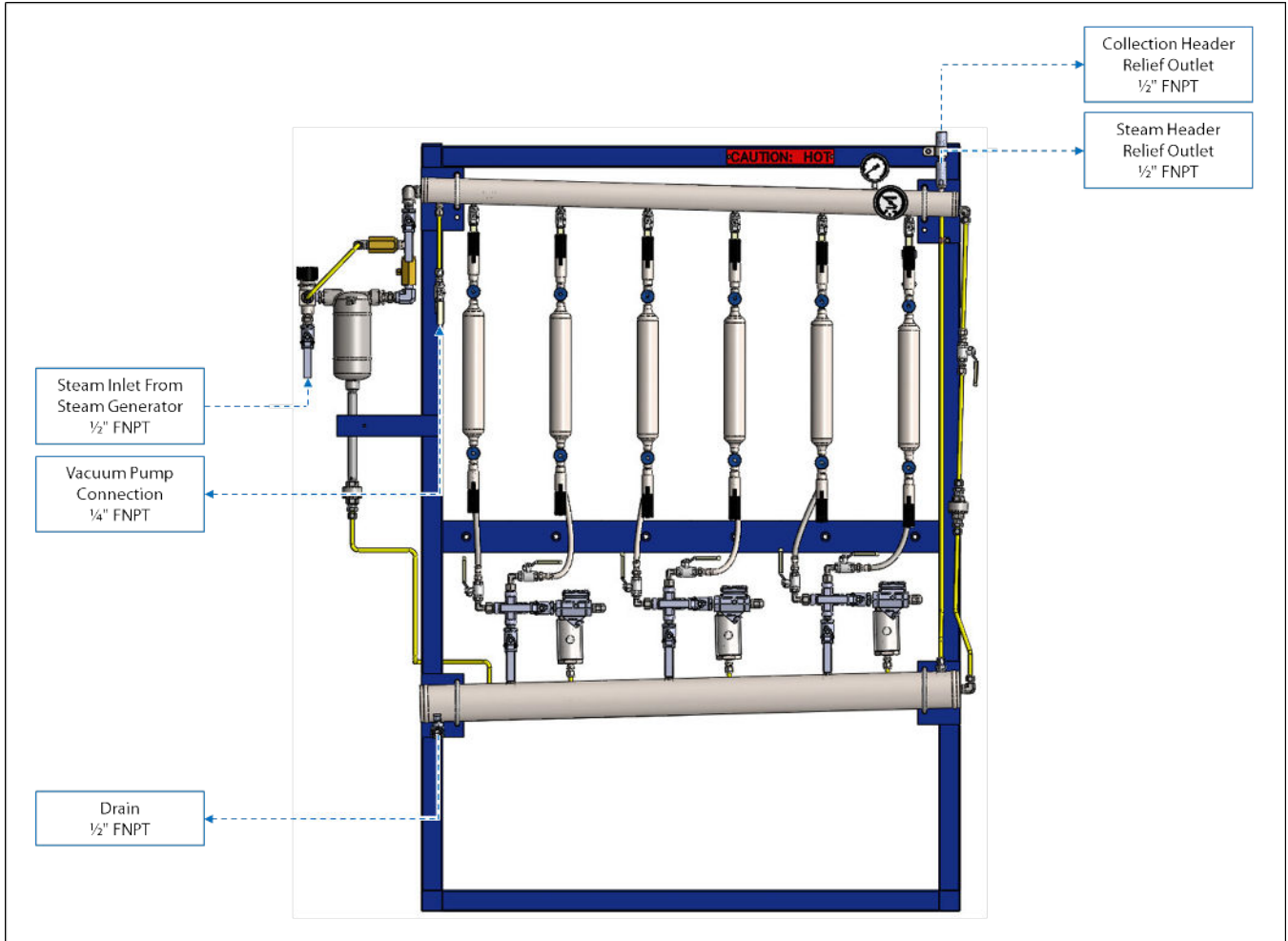


Figure 3: CSVC Valve Diagram (Shown With Optional FasMate® Quick-Connects)

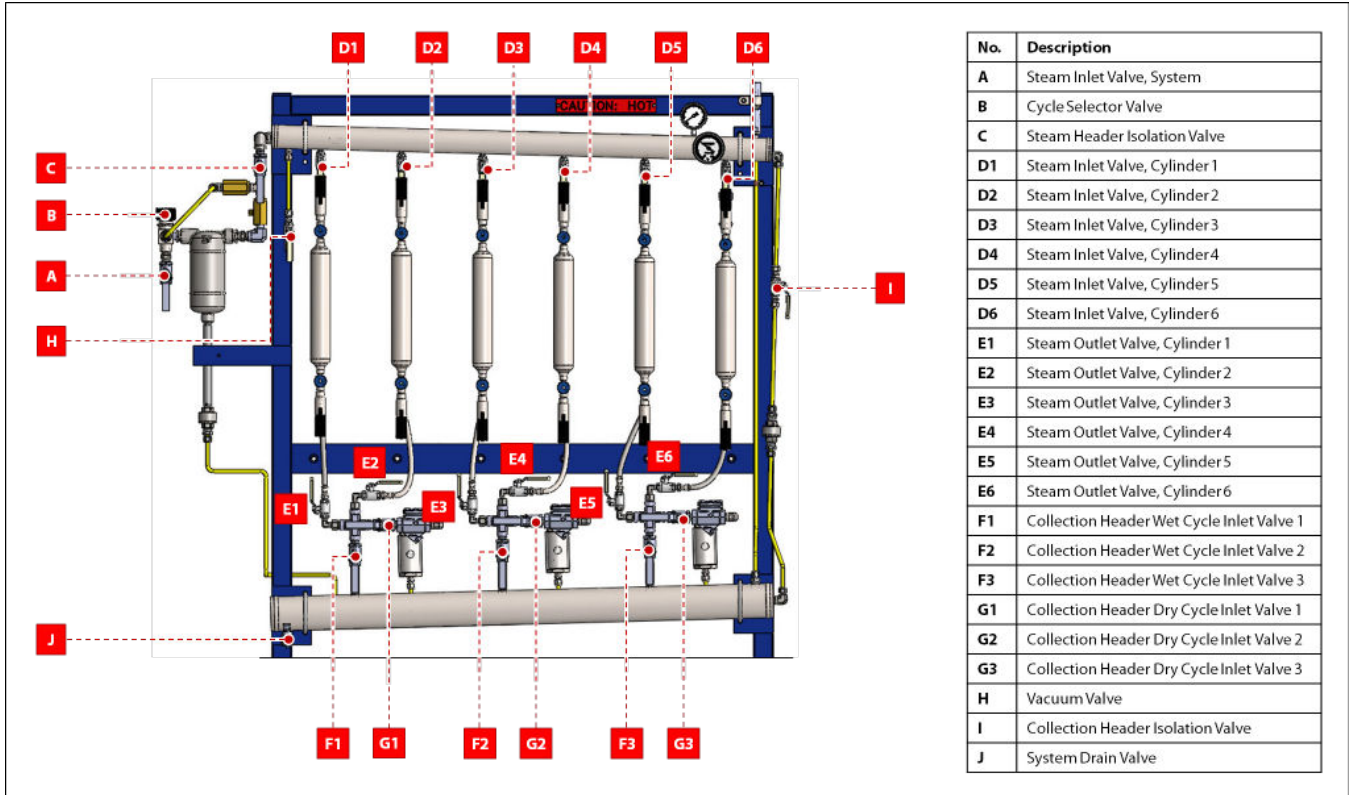
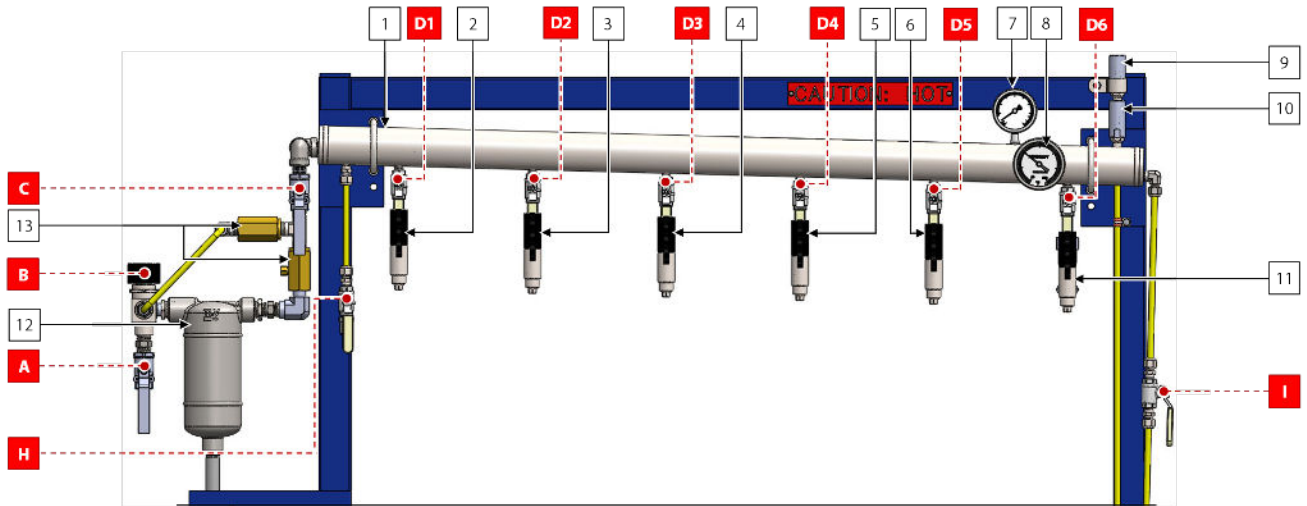


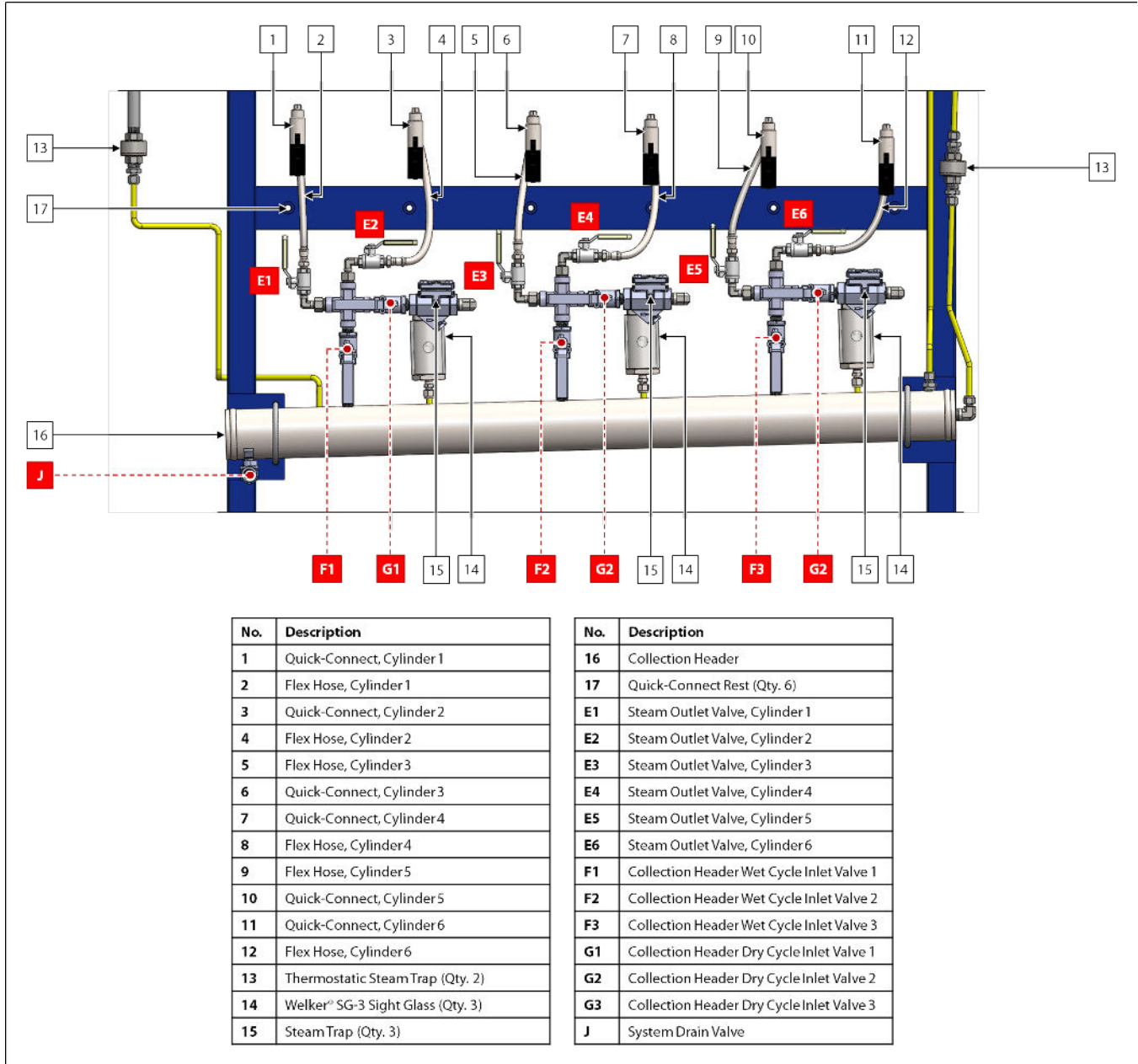
Figure 4: Steam Header Diagram (Shown With Optional FasMate® Quick-Connects)



| No. | Description |
|-----|--|
| 1 | Steam Header |
| 2 | Quick-Connect, Cylinder 1 |
| 3 | Quick-Connect, Cylinder 2 |
| 4 | Quick-Connect, Cylinder 3 |
| 5 | Quick-Connect, Cylinder 4 |
| 6 | Quick-Connect, Cylinder 5 |
| 7 | Steam Header Pressure Gauge |
| 8 | Steam Header Temperature Gauge |
| 9 | Welker® RV-1 Relief Valve, Collection Header |
| 10 | Welker® RV-1 Relief Valve, Steam Header |
| 11 | Quick-Connect, Cylinder 6 |
| 12 | Steam Separator |

| No. | Description |
|-----|-----------------------------------|
| 13 | Check Valve (Qty. 2) |
| A | Steam Inlet Valve, System |
| B | Cycle Selector Valve |
| C | Steam Header Isolation Valve |
| D1 | Steam Inlet Valve, Cylinder 1 |
| D2 | Steam Inlet Valve, Cylinder 2 |
| D3 | Steam Inlet Valve, Cylinder 3 |
| D4 | Steam Inlet Valve, Cylinder 4 |
| D5 | Steam Inlet Valve, Cylinder 5 |
| D6 | Steam Inlet Valve, Cylinder 6 |
| H | Vacuum Valve |
| I | Collection Header Isolation Valve |

Figure 5: Collection Header Diagram (Shown With Optional FasMate® Quick-Connects)



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.



The Cylinder Steam & Vacuum Cleaner will ship skid-mounted and "hard-tube" connected with manufacturer-supplied fittings and hardware. However, the customer will need to supply some tubing and fittings in order to complete the installation of the system.

2.2 Installation

1. Install the CSVC in the desired location.



Welker recommends the CSVC be installed in a location where access to valves, cylinders, auxiliary equipment, and utilities is not restricted and where relief valves can be safely vented to prevent potential injury.

2. Ensure that all valves are closed (*Figure 3*).
3. Set the relief valve on the steam header to the appropriate pressure (*Figure 4*). Refer to the *Installation, Operation, and Maintenance (IOM) Manual* for the Welker® RV-1 Relief Valve for instructions on setting the relief.
4. Set the relief valve on the collection header (*Figure 4*). This relief should be set approximately 10 psig below the relief valve on the steam header. Refer to the *Installation, Operation, and Maintenance (IOM) Manual* for the RV-1 for instructions on setting the relief.



Setting the relief on the collection header to a pressure lower than that of the relief on the steam header ensures proper functioning of the steam traps.

5. If desired, use ½" tubing to connect from the relief valves to an appropriate venting location (*Figure 2*).
6. Using ½" tubing, connect from system drain valve J to an appropriate container (*Figure 2*).
7. Using the provided ½" steam hose, connect from the steam generator to the steam inlet (*Figure 2*).
8. Using the provided ½" vacuum hose, connect from the vacuum pump to vacuum valve H (*Figure 2*).
9. Connect the customer-supplied water supply to the inlet on the steam generator (*Figure 1*).



There is a 10 psig pressure drop across the steam generator from the water inlet to the steam outlet.

10. Connect the customer-supplied cold water supply to the inlet on the blowdown separator (*Figure 1*).



This unit requires a cold water connection. Welker recommends that the inlet to the blowdown separator be lower than the sight glass of the steam generator to ensure safe drainage during blowdown.



The blowdown separator reduces temperatures and pressures to safe levels for discharge to the drain or sewer. During blowdown, the blowdown separator separates liquid from vapor to prevent live steam discharge to city drains.

2.3 Operation

Steam Generator



To ensure safe operation of the steam generator, follow all manufacturer instructions, including PPE recommendations and safety instructions. Refer to the *Installation, Operation, and Maintenance (IOM) Manual* for the steam generator for operating instructions.

1. Ensure that all valves are closed (*Figure 3*).
2. Close the drain valve and steam outlet valve on the steam generator, and then turn on the customer water supply. Allow the water level to rise approximately halfway up the steam generator sight glass before operating the steam generator. This may take several minutes.
3. Connect an appropriate electrical supply to the steam generator. Refer to the *Installation, Operation, and Maintenance (IOM) Manual* for the steam generator for the manufacturer's wiring instructions.
4. Set the thermostat to the desired steam temperature, and then turn ON the boiler switch to start the steam generator (*Table 2*). Allow at least thirty (30) minutes for the steam to reach the desired temperature.

Table 2: Steam Temperature Settings

| Water Inlet Pressure (psig) | Steam Temperature (°F) | Water Inlet Pressure (psig) | Steam Temperature (°F) |
|-----------------------------|------------------------|-----------------------------|------------------------|
| 0 | 212 | 30 | 274 |
| 1 | 216 | 35 | 281 |
| 2 | 219 | 40 | 287 |
| 3 | 222 | 45 | 292 |
| 4 | 224 | 50 | 298 |
| 5 | 227 | 55 | 303 |
| 6 | 230 | 60 | 307 |
| 7 | 232 | 65 | 312 |
| 8 | 235 | 70 | 316 |
| 9 | 237 | 75 | 320 |
| 10 | 240 | 80 | 324 |
| 15 | 250 | 85 | 328 |
| 20 | 259 | 90 | 331 |
| 25 | 267 | – | – |

5. Once the steam has reached the desired temperature, open the steam outlet valve on the steam generator.

Steam System



Failure to properly follow the manufacturer's recommended procedures for the care, maintenance, and storage of the steam hoses may result in serious bodily injury and/or property damage.



Only specially trained personnel should engage in operating or testing procedures that require particular skills and/or training. Failure to comply may result in damage to the hoses, other property damage, and/or serious bodily injury.

6. Ensure that the steam has reached the desired temperature.
7. Connect the inlet of the customer-supplied Welker® SC Single Cavity Sample Cylinder to the quick-connect on the steam header (*Figure 4*).
8. Connect the outlet of the customer-supplied SC to the flex hose with quick-connect on the collection header (*Figure 5*).



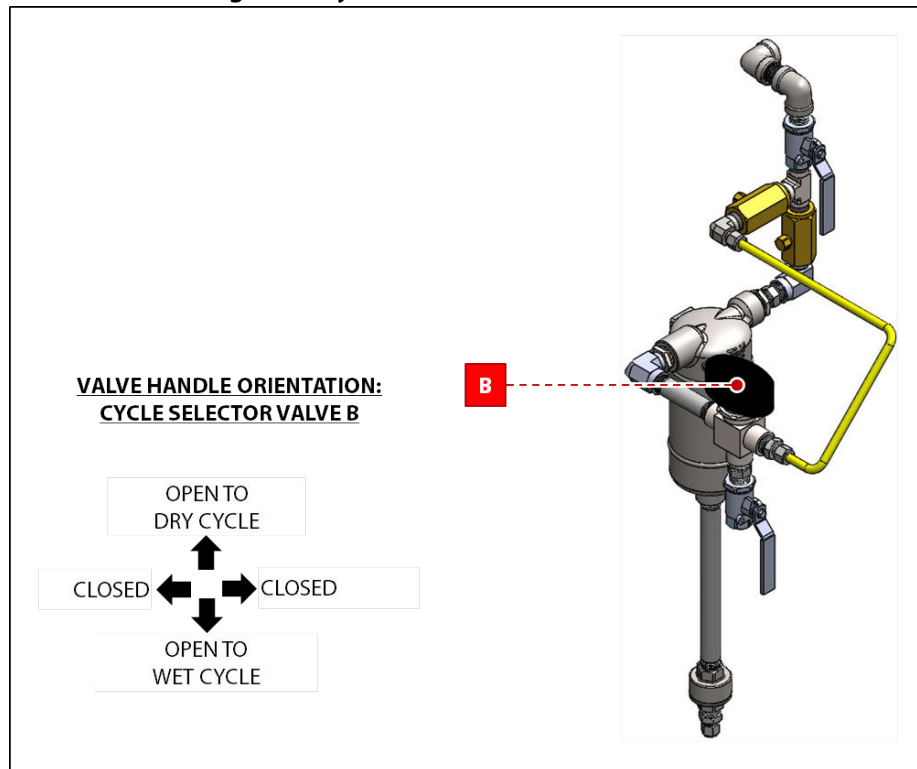
When connecting the outlet of the SC to the collection header, Welker recommends positioning the flex hose so that access to the collection header valves is not restricted.

9. Open both valves on the SC.
10. Open system drain valve J on the collection header (*Figure 3* or *Figure 5*). If the CSVC is equipped with a second collection header, open system drain valve J on the second collection header as necessary.
11. Open steam outlet valve E for the installed SC (*Figure 3* or *Figure 4*).
12. Open steam inlet valve D for the installed SC (*Figure 3* or *Figure 4*).
13. As necessary, repeat steps 7-12 for any additional SCs.
14. Open steam header isolation valve C and collection header isolation valve I (*Figure 3* or *Figure 4*).

Wet Cycle

15. Manually turn the handle on cycle selector valve B so that the arrow on the handle points away from the steam separator (*Figure 6*). This will open the valve to the wet cycle.

Figure 6: Cycle Selector Valve B Orientation



16. Open collection header wet cycle inlet valve F for all installed SCs (*Figure 3* or *Figure 5*).
17. Open steam inlet valve A to start the wet cycle (*Figure 3*). Saturated contaminants will drain to the container connected to the drain.



During the wet cycle, the steam generator generates saturated steam, which dissolves and flushes contaminants from the sample cylinders.

18. Allow the wet cycle to run for the appropriate amount of time.



The time required to completely clean the sample cylinders is dependent on the set temperature of the steam generator, the water inlet pressure, the type of contaminant(s), and the number of sample cylinders.

19. Once the sample cylinders are free of visible contaminants or considered clean in accordance with the end user's specifications, close steam inlet valve A (*Figure 3*). This ends the wet cycle.

Dry Cycle

20. Manually turn the handle on cycle selector valve B so that the arrow on the handle points toward the steam separator (*Figure 6*). This will open the valve to the dry cycle.



Cycle selector valve B will be HOT.

21. Open collection header dry cycle inlet valve G and close collection header wet cycle inlet valve F for the installed SCs (*Figure 3* or *Figure 5*).
22. Open steam inlet valve A to start the dry cycle (*Figure 3*).



During the dry cycle, saturated steam is diverted to the steam separator, which removes up to 99.8% of moisture. A steam trap downstream of the sample cylinders discharges condensate without allowing the escape of live steam. The steam trap and continued input of heat allow steam to be contained, increasing the temperature at which the cylinders are maintained. The cycle further heats the system to facilitate "baking" of any residue remaining in the sample cylinders.

23. Allow the dry cycle to run until the SCs are clean.



The time required to completely clean the sample cylinders is dependent on the set temperature of the steam generator, the water inlet pressure, the type of contaminant(s), and the number of sample cylinders.

24. Once the sample cylinders are considered clean in accordance with the end user's specifications, close steam inlet valve A (*Figure 3*). This ends the dry cycle.
25. Open collection header wet cycle inlet valve F and close collection header dry cycle inlet valve G for the installed SCs (*Figure 3* or *Figure 5*).



The sample cylinders must be drained prior to disconnecting the quick-connects. Failure to drain the sample cylinders prior to disconnecting the quick-connects may result in damage to the equipment and/or injury to the operator.

26. Close steam header isolation valve C on each steam header used (*Figure 3* or *Figure 4*).
27. If a vacuum will not be pulled on the SCs, continue to step 28. If a vacuum will be pulled on the SCs, proceed to step 35.

Vacuum System

No Vacuum



The SCs will be HOT. Allow the SCs to cool prior to proceeding.

28. Turn OFF the thermostat to the steam generator.
29. Close steam inlet valve D and close steam outlet valve E on the flex hose for all installed SCs (*Figure 3* or *Figure 5*).
30. Close both valves on each SC.
31. Disconnect the SCs from the CSVC. If applicable, install the quick-connects to the corresponding quick-connect rests (*Figure 5*).



The flex hoses will be HOT.

32. Open steam header isolation valve C and steam inlet valve A to relieve pressure in the steam header (*Figure 3* or *Figure 5*).
33. Once pressure has been relieved from the steam header, close steam inlet valve A (*Figure 3* or *Figure 4*).
34. Welker recommends a daily blowdown of the steam generator. Refer to the *Installation, Operation, and Maintenance (IOM) Manual* for the steam generator for instructions.



Power must be OFF when the steam generator is drained.

Pulling a Vacuum

35. Turn OFF the thermostat on the steam generator.
36. Close steam outlet valve E on the flex hose for all installed SCs (*Figure 3* or *Figure 5*).
37. Close collection header isolation valve I (*Figure 3* or *Figure 5*).
38. Close the bottom valve on all installed SCs.
39. Turn ON the vacuum pump.
40. Open vacuum valve H to pull a vacuum on the SCs (*Figure 3*). The steam header pressure gauge will display how much vacuum has been pulled on the SCs.



The time required to pull the desired vacuum is dependent on the sample cylinder volume.

41. If desired, close the top valve on the SCs to maintain the vacuum on the SCs.
42. Close vacuum valve H (*Figure 3* or *Figure 4*).
43. Turn OFF the vacuum pump.
44. Close steam inlet valve D (*Figure 3* or *Figure 5*).
45. Disconnect the SCs from the CSVC. If applicable, install the quick-connects to the corresponding quick-connect rests (*Figure 5*).



The flex hoses will be HOT.

46. Open collection header isolation valve I (*Figure 3* or *Figure 4*).
47. Open steam header isolation valve C and steam inlet valve A to relieve pressure in the steam header (*Figure 3* or *Figure 4*).
48. Once pressure has been relieved from the steam header, close steam inlet valve A (*Figure 3* or *Figure 4*).
49. Welker recommends daily blowdown of the steam generator. Refer to the *Installation, Operation, and Maintenance (IOM) Manual* for the steam generator for instructions.



Power must be OFF when the steam generator is drained.

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. 10" Adjustable Wrench (Qty. 2)
 - b. Flat Head Screwdriver
 - c. Seal Pick
 - d. Tubing Cutters

3.2 Maintenance

1. Routinely inspect the steam separator and steam traps for buildup, clogging, corrosion, and other damage. Refer to the *Installation, Operation, and Maintenance (IOM) Manual* for the steam generator and for the steam traps for inspection and maintenance instructions.



Proper steam separator and steam trap maintenance is essential to a steam system. Faulty steam traps not only waste energy, but also can contribute to pipe erosion due to poor water quality and contaminants allowed to pass downstream. A poor maintenance program will increase energy losses, decrease reliability, reduce steam quality, and may affect production downtime.



The frequency of inspection should be determined by application.

2. Maintain the steam generator. Refer to the *Installation, Operation, and Maintenance (IOM) Manual* for the steam generator for maintenance instructions.

APPENDIX A: REFERENCED OR ATTACHED DOCUMENTS

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

- IOM-033: Welker® RV-1, RV-2, RV-2CP, and RV-3 Relief Valves
- IOM-146: Welker® SC Single Cavity Sample Cylinder
- IOM-172: Welker® SG-3 Sight Glass

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

- Apollo Valves 76-100 Series Stainless Steel Ball Valve with Mounting Pad 1/4" - 1" (Welker® IOM-V141)
- Ashcroft® BI Series Bi-Metal Thermometers (Welker® IOM-V235)
- Ashcroft® Type 1008S Stainless Steel Case Gauge with Stainless Steel System (Welker® IOM-V242)
- Chromalox® Type CMB Electric Steam Generator (Welker® IOM-V049)
- Chromalox® Steam Boilers (Welker® IOM-V052)
- Dekker Vacuum Technologies, Inc. DuraVane Lubricated Rotary Vane Pump for Saturated Air (Wet) Service RVL031W (Welker® IOM-V246)
- FasTest Inc. FasMate® FN and FX Series Connectors (Welker® IOM-V245)
- McMaster-Carr Supply Company Extra-Flexible Nylon Tubing (Welker® IOM-V248)
- McMaster-Carr Supply Company Red Steam Hose (Welker® IOM-V247)
- McMaster-Carr Supply Company Super High-Pressure Check Valves (Welker® IOM-V251)
- Swagelok® Hose and Flexible Tubing (Welker® IOM-V176)
- Swagelok® One-Piece Instrumentation Ball Valves 40G Series and 40 Series (Welker® IOM-V085)
- Swagelok® Quick-Connects QC, QF, QM, and QTM Series (Welker® IOM-V088)
- TLV® Balanced Pressure Thermostatic Steam Trap Model L21S/L32S (Welker® IOM-V249)
- TLV® Balanced Pressure Thermostatic Steam Trap Model LV21 (Welker® IOM-V051)
- TLV® Cyclone Separator Model DC7 (Welker® IOM-V050)

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

- Assembly Drawing: AD881CA (For up to 24 Sample Cylinders)
- Assembly Drawing: AD881CB (For up to 6 Sample Cylinders; With Optional FasMate® Quick-Connects and Welker® Sight Glasses)

