Compact Chiller
Models CP2-10 and CP2-20

INSTALLATION AND OPERATION MANUAL

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Section 1.0 – Introduction

1.1 GENERAL

Mueller® compact chillers are designed to provide the efficient production of a chilled liquid cooling solution while requiring minimal installation time and maintenance.

1.2 TECHNICAL SUPPORT

This manual provides the basic installation and operating information for a Mueller compact chiller. Please contact your local Paul Mueller Company Sales and Service Representative if you require additional technical assistance pertaining to installation or operating procedures.

IMPORTANT: The information in this manual must be followed closely to prevent equipment damage.

Manufacturer's support is available by contacting the following:

Paul Mueller Company
Dairy Farm Equipment Service Department
1600 West Phelps Street
Springfield, Missouri 65802
Direct Telephone: 1-800-756-5991
Facsimile: 1-800-436-2466
Email: DFETechService@paulmueller.com

1.3 SAFETY STATEMENT

Electrical and refrigeration installation and service must be performed by an authorized service technician who has the proper training to install and service refrigeration and electrical equipment.

Local, state, and/or country electrical and refrigeration regulations must be followed during installation, service, and/or operation of this equipment.

1.4 INTENDED USE OF EQUIPMENT

The Mueller compact chiller is designed to be incorporated with a Mueller Accu-Therm® plate cooler and Mueller E-Star® HiPerForm® condensing unit of sufficient size to complete a complex assembly for cooling milk.

1.5 MISUSE OF EQUIPMENT

IMPORTANT: Any misuse of the Mueller compact chiller may result in damage to the unit and/or personnel. Do not allow objects to be placed on or around the chiller that block access.

Section 2.0 – Description of the Equipment

2.1 EQUIPMENT COMPONENTS

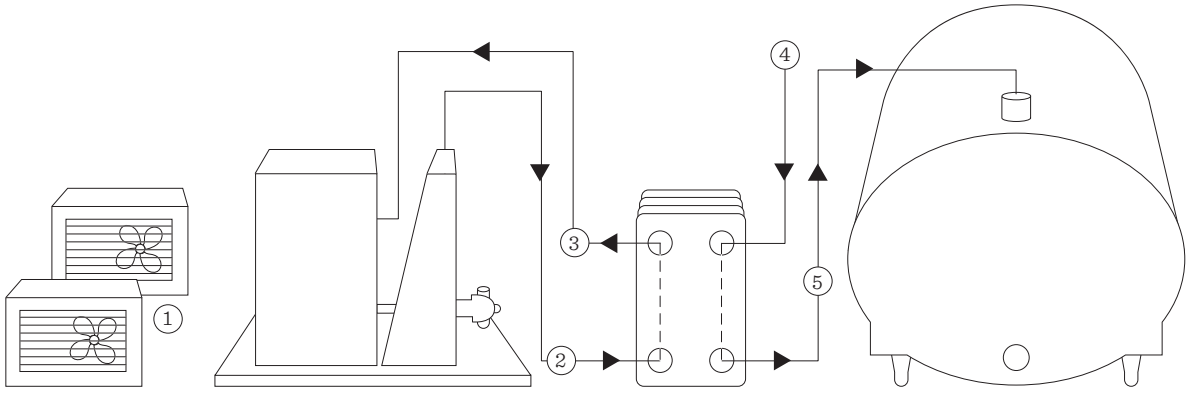
A. System Features

- One (1) 90-gallon insulated reservoir
- One (1) 3 hp circulator pump
- One flow switch
- Two (2) evaporator heat exchangers for two (2) 5 hp or two (2) 9 hp condensing units
- A control cabinet with temperature controls, circulator pump contactor, and ON/OFF switch

B. System Component Requirements

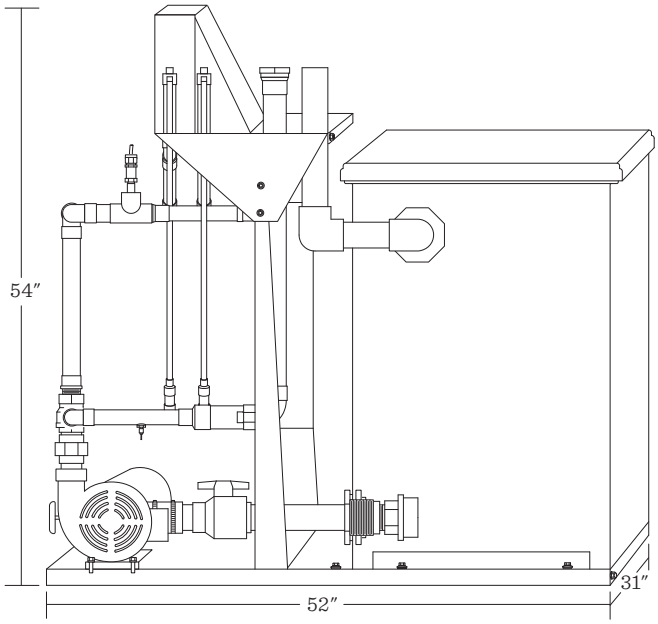
- One (1) Mueller CP2 compact chiller
- Two (2) 5 hp or 3.5 hp Mueller E-Star HiPerForm "OHSE" or "OESE" condensing units
  – or –
- Two (2) 9 hp Mueller E-Star HiPerForm "OHSE" or "OESE" condensing units
- Refrigerant piping
- One (1) Mueller Accu-Therm plate cooler

FIGURE 1: COMPACT CHILLER COOLING SYSTEM



1 - Mueller E-Star HiPerForm "OHSE" condensing units for chiller.
2 - Cold chiller water to the Mueller Accu-Therm plate cooler.
3 - Return water to the Mueller compact chiller.
4 - Warm milk to be cooled.
5 - Cooled milk to the Mueller milk cooler storage tank.

FIGURE 2: COMPACT CHILLER COOLING SYSTEM DIMENSIONS



2.2 REFRIGERATION COMPONENTS

The Mueller CP2-10 compact chiller is designed to operate with two Mueller 3.5 or 5 hp E-Star HiPerForm "OHSE" condensing units for maximum performance and efficiency or two 5 hp E-Star "OESE" thermal expansion valve condensing units. The Mueller CP2-20 compact chiller is designed to operate with two Mueller 9 hp E-Star HiPerForm "OHSE" condensing units for maximum performance and efficiency or two 9 HP E-Star "OESE" thermal expansion valve condensing units. Refer to the respective E-Star HiPerForm "OHSE" or "OESE" condensing unit manual for technical information.

2.3 EVAPORATOR

The Mueller compact chiller uses two totally enclosed, heavy-duty stainless steel evaporators that will provide years of trouble-free operation when properly installed and controlled; however, like any low temperature chiller evaporator, may be susceptible to non-warranted damage if the chilled liquid solution is allowed to freeze.

The Mueller compact chiller is not designed to operate at chilled solution temperatures below 34°F without properly protecting the system with a 20% (18.5°F) to 25% (14°F) mixture of Dowfrost propylene glycol. If a propylene glycol other than Dowfrost is used, the mix ratio must achieve a 15°F freeze point.

NOTE: Contact the Mueller Dairy Farm Equipment Service Department prior to making any temperature setpoint adjustments below 34°F.

IMPORTANT: The circulation of a controlled warm water or a completely drained evaporator is mandatory during pump down or refrigerant recovery to eliminate evaporator damage due to freezing.

2.4 LIQUID SOLUTION FLOW COMPONENTS

A 3 hp centrifugal pump circulates the chilled solution from the reservoir, through the evaporator heat exchangers and remote Accu-Therm plate cooler, and back to the reservoir.

The chilled-liquid circulation system incorporates a threaded suction screen located internally in the reservoir at the suction connection. This will prevent particulate matter from entering the circulation pump, evaporator heat exchanger, and Accu-Therm plate cooler. It should be removed and cleaned as necessary.

Isolation valves are provided in the liquid solution lines for servicing the pump.

The system has two liquid solution flow switches that utilize normally open (N.O.) contacts connected in series to the chiller control. In the event of a pump failure, flow blockage, or loss of liquid solution, the paddle in one of the flow switches will open and de-energize both condensing units. In the event that one of the flow switches breaks the control circuit and de-energizes the condensing units, the units will re-energize when the switch is closed again, indicating adequate fluid flow.

This condition indicates that there was a flow restriction and a service technician should be contacted to troubleshoot and repair the cause prior to multiple restarts.

IMPORTANT: The above condition could be caused by improper temperature settings of the electronic temperature control. Multiple restarts prior to repair or adjustment could cause a non-warranted failure of an evaporator due to expansion from freezing.

The 90-gallon insulated reservoir is constructed of polyethylene. The cover should remain on the reservoir at all times to prevent particulate and contaminants from entering the liquid solution.

2.5 ELECTRICAL COMPONENTS

The Mueller compact chiller comes with a complete electrical control system. The electronic temperature control is housed in a separate enclosure. The multi-stage chiller control must be mounted and wired to the flow switches condensing units, temperature sensors, and pump.

The power supply must be connected to a 240 volt, 60 hertz, single-phase fused disconnect, fused at a maximum of 20 amps.

IMPORTANT: Do not expose the electrical control enclosure to ambients above 140°F or below 32°F.

All wiring must be performed in accordance with the National Electric Code (NEC) or regulatory agency for the installation locality.

2.6 CONTROL OPERATION

See the Mueller multi-stage chiller control manual (Part No. 8825582) for control operation.

Section 3.0 – Installation

3.1 INSPECTION

Due to the possibility of equipment damage during shipment, it is recommended that you make a thorough inspection of all equipment before it is unloaded from the freight carrier. Carefully inspect equipment for hidden damage. It may be difficult to collect for damage if it is not found prior to unloading. If any damage is found, it is very important to note the damage on the bill of lading and have the driver sign the bill of lading.

3.2 LOCATION

When choosing a location for the Mueller compact chiller, consider these items:

- **Environment:** An indoor location will be necessary where the chiller is protected from freezing temperatures.
- **Serviceability:** The chiller should be located with the circulating pump and the electronic temperature control accessible for service. Keep in mind the chiller will require field connections to the main electrical supply and the liquid solution reservoir may require a drain for maintenance.
- **Condensing Units:** The condensing units must be located where they are protected from the environment and have adequate air flow for the condensers. Be especially cautious for conditions that would allow dust or oil to enter the condenser.
- **Efficiency:** Locate the chiller as close to the Mueller Accu-Therm plate cooler as possible. This will improve efficiency by reducing heat gain and flow restrictions in the chilled liquid solution piping.

3.3 CHILLED SOLUTION PIPING

The piping between the Mueller compact chiller and the Mueller Accu-Therm plate cooler should be a minimum of 3″ Schedule-40 or -80 PVC, stainless steel, or copper pipe. Make any reducer connections at the Accu-Therm and install a union and shut-off valve in each line for service.

If PVC plastic pipe is used with solutions containing propylene glycol, the manufacturers' of PVC or CPVC pipe recommend that Schedule-80 purple primer and Schedule-80 gray adhesive be used. The following procedure should be used to assemble PVC or CPVC:

1. Scour primer with a hard bristle brush. It should be alternately applied to the surface of the pipe once and to the fitting socket twice.
2. Solvent cement should be applied with a stiff bristle brush while the primer is wet. It should be alternately applied to the surface of the pipe twice and to the fitting socket once.

IMPORTANT: Galvanized pipe should not be used for applications with propylene glycol, as propylene glycol can strip the zinc coating from galvanized pipe.

To provide efficient, chilled liquid solution flow to the Accu-Therm plate cooler, utilize long-radius fittings and 45-degree elbows where possible. A non-absorbent pipe insulation should be installed on both pipes to reduce sweating and heat gain of the chilled liquid solution piping.

3.5 CONDENSING UNIT INSTALLATION

Refer to the Mueller E-Star HiPerForm "OHSE" or "OESE" condensing unit manual for installation information.

The condensing units, pre-assembled line sets, and compact chiller refrigeration circuit will require a triple evacuation to 500 microns prior to refrigerant charging. The system must hold below 1,000 microns in a standing vacuum test, ensuring that it is leak free.

Mueller E-Star HiPerForm condensing units require a refrigerant charge correction for use with the Mueller compact chiller. Table 1, "E-Star HiPerForm Refrigerant Charge," should be followed. The table displays only a startup refrigerant charge. Normal refrigeration unit startup procedures, located in the condensing unit manual, should be followed when adjusting to final operating charge. Refer to the respective E-Star HiPerForm "OHSE" or "OESE" condensing unit manual for technical information.

TABLE 1: E-STAR HIPERFORM REFRIGERANT CHARGE (CP2-10 ONLY)

Unit Size	R-507 Refrigerant Charge
3.5 hp	12.0 lbs
10 hp	13.0 lbs

IMPORTANT: The circulation of controlled warm water or a completely drained evaporator is mandatory during pump down or refrigerant recovery to eliminate evaporator damage due to freezing.

3.6 CONDENSING UNIT EXPANSION VALVE SIZING

Unit Size	Part No.	R-507
5 hp	9843711	Y573-SPE-4-PC
10 hp	8825850	EBSPE-7.5-PC

Section 4.0 – Cleaning the System

4.1 FIRST TIME START-UP

IMPORTANT: Clean the system before filling the reservoir to retard the growth of algae and bacteria in the chilled liquid solution.

4.2 LEAK TESTING PROCEDURE

1. Remove all dirt, paper, and other debris that accumulated during shipment and installation.

2. Fill the reservoir with 30–50 gallons of cold water and operate the circulating pump with the condensing units turned off. Check all liquid solution piping and components for leaks.

3. After confirming there are no leaks, drain the reservoir and proceed with the outlined cleaning procedure.

4.3 CLEANING PROCEDURE

1. Fill the reservoir with a mixture of about 45 gallons of 160°F water and 8 pounds of trisodium phosphate.

2. Operate the circulating pump for 15 minutes with the condensing units off. During this time, brush the inside of the reservoir to clean the areas that are not submerged.

3. Drain the wash solution and fill with 30–50 gallons of lukewarm rinse water.

4. Operate the circulating pump for 10 minutes while manually rinsing the reservoir walls that are not submerged. Drain the rinse water completely.

4.4 FILLING THE RESERVOIR

Fill the reservoir to within three inches of the top with deionized water. Do not use softened water from a standard water softener as there is an increased possibility of chloride corrosion to the stainless steel evaporator or Accu-Therm plate cooler.

Never use chlorine as a bacteria inhibitor or cleaning agent as it will cause premature failure of the evaporator and plates within the Accu-Therm plate cooler. A food-grade inhibitor, methylparaben, Part No. 9840964, is available through Paul Mueller Company.

The water quality must meet the following standards:

- Chlorides: 25 ppm maximum
- Sulfates: 25 ppm maximum
- Calcium: 50 ppm maximum
- Magnesium: 50 ppm maximum
- Total Hardness: 100 ppm maximum

PROHIBITION: Never use chlorine as a bacteria inhibitor or cleaning agent, as it will cause premature failure of the evaporator and plates within the remote, secondary plate cooler.

4.5 LIQUID SOLUTION FOR INSTANT COOLING

IMPORTANT: If the system is to be used for instant cooling and operated at a liquid solution temperature at or below 34°F, the liquid solution must be protected with an approved propylene glycol to prevent failure of the evaporator by freezing. The propylene glycol liquid solution must be concentrated to obtain a minimum of 17°F freeze point.

Paul Mueller Company recommends Dowfrost™ propylene glycol, manufactured by Dow Chemical Company. Table 2 provides freeze points of Dowfrost solutions at specific concentration percentages. Please contact the Mueller Dairy Farm Equipment Service Department for assistance in locating a local Dow Chemical dealer.

TABLE 2: TYPICAL FREEZING POINTS OF AQUEOUS SOLUTION OF DOWFROST

Volume % Dowfrost	Freezing Point °F (°C)
0.0	32.0 (0.0)
5.0	29.1 (–1.6)
10.0	26.1 (–3.3)
15.1	22.9 (–5.1)
20.3	19.2 (–7.1)
21.3	18.3 (–7.6)
22.4	17.6 (–8.0)
23.4	16.6 (–8.6)
24.5	15.6 (–9.1)
25.5	14.7 (–9.6)
26.5	13.7 (–10.2)
27.6	12.6 (–10.8)
28.6	11.5 (–11.4)
29.7	10.4 (–12.0)
30.7	9.2 (–12.7)

IMPORTANT: A refractometer designed for testing the freeze point of propylene glycol solutions should be used to determine the actual freeze point of the solution. Please contact the Mueller Dairy Farm Equipment Service Department for assistance in locating a supplier of propylene glycol refractometers.

Section 5.0 – Evacuation, Charging, and Start-Up of System

5.1 SYSTEM EVACUATION

With refrigerant piping completed and leak tested, equipment is ready to evacuate. A quality vacuum pump capable of 500 micron vacuum is necessary for adequate and dependable system evacuation. Moisture in a refrigeration system can cause corrosion, expansion valve freeze-up, and oil sludge.

Attach vacuum pump to both high and low side of system through compressor service valves and evacuate to 500 microns. (All service valves, hand valves, and solenoids must be open during evacuation.)

NOTE: Service valves are back seating valves and must be in mid-position to open both sides of the system to the evacuation pump.

IMPORTANT: As a final leak test, close the valve to the vacuum pump and ensure vacuum is maintained below 1,000 microns for five minutes.

5.2 SYSTEM CHARGING (ALSO REFER TO CONDENSING UNIT MANUAL)

With the system wired, plumbed, and evacuated, the unit is ready to charge with the appropriate refrigerant. All charging lines and manifolds must be evacuated prior to admitting refrigerant into the system to prevent contaminating the system with non-condensable.

1. Place the rotary switch in the pump position and ensure liquid solution circulation through the brazed plate evaporators. Admit liquid refrigerant into the evacuated system until low and high side pressure is above the freeze point of the liquid solution or 32°F.

2. With the charging line connected to the receiver service valve, admit liquid refrigerant into the high side of the system until the flow stops due to pressure equalization between high side and the refrigerant drum. Back seat service valve, close manifold valve, and disconnect charging line.

3. Energize equipment and continue to admit liquid into the low side of system until the liquid line sight glass clears, indicating a fully charged system (it may be necessary to bypass the low pressure control on initial start to prevent nuisance trips until low side pressure is above cut-out point of control).

NOTE: If utilizing a Mueller E-Star HiPerForm condensing unit, liquid may be charged upstream of the accumulator/heat exchanger. Refer to E-Star condensing unit manual for more detailed charging instructions.

5.3 SYSTEM START-UP

This is a continuation of system charging and must be performed before equipment can be left operating and unattended. This will involve checking and adjusting all safety and operating controls. Do not attempt to function safety controls without some means of stopping compressor in the event of extreme high or low pressure conditions that could damage the equipment. If controls fail to function at setpoints, determine the cause and correct.

CAUTION: Bypassing any safety control step, other than for testing purposes, is dangerous to personnel and equipment and nullifies equipment warranty.

NOTE: Energize crankcase heaters and allow a minimum of four hours of operation before a compressor start-up.

5.3 SYSTEM START-UP (CONTINUED)

A. High Pressure Control

To test the high pressure control, connect a gauge to the compressor discharge service valve and disable condenser fan(s) or water regulating valve(s). Control should open immediately when discharge pressure reaches control setpoint. Enable condenser fans or water regulating valve(s) and reset pressure control. Refer to the specific condensing unit manual.

B. Low Pressure Control

Ensure solution temperature is above 10°C (50°F) to prevent damage to evaporator by freezing. To test the low pressure control, connect a gauge to the compressor suction service valve. Throttle receiver outlet valve to lower suction pressure at compressor. The system should pump down and the compressor de-energize when suction pressure reaches the cut-out setting of control. Open receiver outlet valve and observe rise in pressure at compressor suction connections. Reset the low pressure control and the compressor should re-energize when pressure reaches cut-in setting of control. Refer to the specific condensing unit manual.

IMPORTANT: Controlled warm water circulation must be maintained through the evaporator to prevent damage caused by freezing when testing the low pressure switch.

C. Thermal Expansion Valve

Adjust superheat setting to 10–12°F.

To determine superheat correctly:

1. With an accurate set of manifold gauges, measure the suction pressure at the evaporator outlet.
2. Convert the suction pressure to a saturation temperature using a refrigerant pressure temperature table.
3. With an accurate thermometer, measure the temperature of the suction gas at the expansion valve's remote bulb location.
4. Subtract the saturation temperature read from the tables in step 2 from the temperature measured in step 3. The difference is the superheat of suction gas.

5.4 TEMPERATURE CONTROL CALIBRATION ACCURACY

Once the installation wiring is completed for the chiller control box, check the calibration accuracy of the temperature control as outlined below:

1. Allow the product temperature to stabilize for a minimum of 15 minutes.
2. Using an accurate electronic thermometer, determine the actual temperature of the solution.
3. If the known product temperature does not correspond with the temperature display, the temperature control will require a calibration correction. Refer to the multi-stage chiller control manual for sensor calibration.

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