MODELS “M” AND “O”

INSTALLATION, OPERATION, AND MAINTENANCE INSTRUCTIONS

EFFECTIVE SEPTEMBER 21, 1979
REPRINT MARCH 20, 1999

THE MILK COOLING SYSTEMS SPECIALISTS™
Table of Contents

MODELS “M” AND “O”
INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

Section 1.0 - Installation Instructions

<table>
<thead>
<tr>
<th>Page Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 General Information</td>
</tr>
<tr>
<td>1.1 Installing Cooler</td>
</tr>
<tr>
<td>1.2 Installing Agitator Motor and Assembly</td>
</tr>
<tr>
<td>Figure 1—120 Inch/Pound Agitator Motor</td>
</tr>
<tr>
<td>Figure 2—Agitator Motor Electrical Connections</td>
</tr>
<tr>
<td>1.3 Installing Refrigeration Unit(s)</td>
</tr>
<tr>
<td>1.4 Refrigeration Connections</td>
</tr>
<tr>
<td>Figure 3—Refrigeration Controls Arrangement for Single Condensing Units</td>
</tr>
<tr>
<td>Figure 4—Refrigeration Controls Arrangement for Dual Condensing Units</td>
</tr>
<tr>
<td>Table 1—Refrigeration Line Sizes</td>
</tr>
<tr>
<td>Figure 5—Suggested Refrigeration Piping for Milk Coolers with Air-Cooled Refrigeration Units Model “O”</td>
</tr>
<tr>
<td>Figure 6—Suggested Refrigeration Piping for Mueller Milk Coolers with Air-Cooled Refrigeration Units Model “M”</td>
</tr>
<tr>
<td>1.5 Wiring the System</td>
</tr>
<tr>
<td>Figure 7—Wiring Diagram</td>
</tr>
<tr>
<td>1.6 Test Running the Cooler</td>
</tr>
</tbody>
</table>

Section 2.0 - Operating Instructions

<table>
<thead>
<tr>
<th>Page Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1 First Milking</td>
</tr>
<tr>
<td>2.2 Subsequent Milkings</td>
</tr>
<tr>
<td>2.3 External Measuring Gauge</td>
</tr>
<tr>
<td>2.4 Emptying the Cooler</td>
</tr>
</tbody>
</table>

Section 3.0 - General Maintenance Instructions

<table>
<thead>
<tr>
<th>Page Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1 Cooler Maintenance</td>
</tr>
<tr>
<td>3.2 Refrigeration Units Maintenance</td>
</tr>
<tr>
<td>3.3 How to Save Service Calls</td>
</tr>
<tr>
<td>3.4 Lubricating Hollow-Shaft Gear motor</td>
</tr>
</tbody>
</table>

Section 4.0 - Refrigeration Service Instructions

<table>
<thead>
<tr>
<th>Page Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1 Sequence of Operation</td>
</tr>
<tr>
<td>Table 2—Low Pressure Control Chart</td>
</tr>
<tr>
<td>4.2 Thermostatic Expansion Valve Adjustment and Service</td>
</tr>
<tr>
<td>4.3 Temperature Control and Thermometer Bulbs</td>
</tr>
<tr>
<td>Figure 8—Temperature Control and Thermometer Bulb Location</td>
</tr>
<tr>
<td>Figure 9—Dial Thermometer and Temperature Control Bulb Mounting</td>
</tr>
</tbody>
</table>
Section 5.0 - Refrigeration Troubleshooting
5.1 General Information ................................................................. 19
5.2 Service Checklist for Common Problems You May Encounter .......... 20

Section 6.0 - Cleaning and Maintenance of Milk Coolers
6.1 General Information ................................................................. 21
6.2 Suggested Cleaning and Bactericidal Treatment ........................... 21

Section 7.0 - How to Save Service Calls ........................................... 22
7.1 General Information ................................................................. 22
SECTION 1.0 - INSTALLATION INSTRUCTIONS

1.0 General Information

Years of careful study and experience in milk cooler installation have helped make installation of the Mueller Milk Cooling System as simple as possible. The six easy steps will be covered in the following order:

1. Installing Cooler
2. Installing Agitator Motor and Assembly
3. Installing Condensing Unit(s)
4. Piping the Refrigeration System
5. Wiring the System
6. Test Running the Cooler

1.1 Installing Cooler

1.1.1 Remove open-type crating and packaged parts. Do not remove skids at this time.

1.1.2 Inspect cooler and report any damage to transportation company delivering the cooler. *(File claim immediately.)*

1.1.3 Move cooler into milk house and position it according to approved milk house floor plans or local dairy regulations.

1.1.4 Remove skids:

1.1.4.1 Raise one end of cooler by lifting up on the end cross-brace and remove the 3/8" self-tapping screw from each leg on that end of the cooler using a 9/16" socket wrench.

1.1.4.2 Lower the cooler and repeat the procedure on the other end. (On larger coolers with more than four legs, be sure to check all legs for screws.)

1.1.4.3 Remove cross-bracing members of the skids, leaving only the two skids on which cooler rests.

1.1.4.4 Now raise one end of the cooler using a cradle block in the shape of the cooler and pivot the skids away from the cooler.

1.1.4.5 Lower cooler and repeat procedure on other end.

1.1.5 Installing External Measuring Gauge (Optional feature on Model “O” only, 300-1,500 Coolers):

1.1.5.1 The pyrex gauge tube is shipped in place in the gauge tube channel. Check upper channel adjuster fitting for tightness. It should be hand tight.

1.1.5.2 Slide two hose clamps onto the shorter hose. Slip one end of the hose over adapter at top of gauge tube, and other end of hose over the wash return tube on top of cooler. Tighten clamps.

1.1.5.3 Slide two hose clamps onto the longer hose. Slip end of the hose over the end of the quick connect adapter. Slip other end of the hose over adapter at bottom of gauge tube. Place “O” ring on quick connect to valve adapter and install on outlet valve end with hex nut. Connect hose to outlet valve and tighten clamps.
1.1.6 Level Cooler:

1.1.6.1 Use a jack with a cradle in the shape of the cooler to raise or lower the cooler to comply with local regulations, especially with respect to the height of the outlet and clearance between the bottom of the cooler and the floor. Adjust the legs to maintain this height.

1.1.6.2 Using the jack, bring the cooler into position so that the level(s) read level. Adjust the legs to maintain this position. On coolers with more than four legs, keep the inner legs raised off the floor until the levels read level and the front and rear legs are adjusted to maintain that position. Then, extend the inner legs to fit firmly against the floor.

1.1.6.3 Double check the height of the outlet and the bottom clearance of the cooler to be sure all measurements conform to minimum standards.

1.1.6.4 As a final check, pour into cooler the exact amount of water indicated in lower left hand corner of calibration chart which reads “Tank must be leveled to a gauge reading of _______ with ________ gallons of water in the tank. Bon Ami Powder (plain white without bleach) must be used on an internal measuring stick during installation.” To assure accuracy, use calibrated measuring cans inspected and approved by a weights and measures inspector.

1.1.6.5 Thoroughly wash internal measuring rod with warm, soapy water. Rinse off all traces of detergent, dry it and dust graduated surface with Bon Ami* powder in the general area of measurement called for on calibration chart. Any excess powder should be removed by jarring the rod, since a thin coating of powder gives the clearest reading.

1.1.6.6 When the surface of water is quiet, carefully lower measuring rod straight down into the water so as not to disturb the surface in any way. If water surges after rod is seated in its bracket or support a false reading will be given. Once measuring rod is firmly seated in its bracket or support, it should then be withdrawn promptly for reading.

1.1.6.7 For external measuring gauge, attach lower gauge hose coupling to valve adapter. When surface of water is quiet, open outlet valve slowly and let water flow into gauge tube. After water stabilizes in tube, line up the level gauge with water level in the tube and take reading from gauge bar.

1.1.6.8 If reading shows less than that called for on calibration chart, adjust rear legs of cooler to raise the end opposite the outlet. If reading too high, lower back end of cooler by adjusting rear legs.

*There are two types of Bon Ami now available on the market. The new type, containing bleach, should be avoided as it will not give an accurate reading. In most areas the old type is difficult to obtain, but it is available from Paul Mueller Company. Always insist on the Bon Ami in the red and yellow can—the one without bleach.

1.2 Installing Agitator Motor and Assembly

1.2.1 120 Inch/Pound Agitator Motor Installation:

1.2.1.1 Arrange for easy access all cap screws, lock washers, and spacer sleeves.

1.2.1.2 Remove agitator motor from shipping box.

1.2.1.3 Place the three motor sleeves over internally threaded agitator mounts on the cooler.
1.2.1.4 Carefully place agitator motor in mounting position. Secure it with the three cap screws and lock washers furnished. Apply a small amount of anti-seize compound to cap screw threads.

1.2.1.5 Place agitator assembly inside cooler and insert end of agitator shaft up through round opening directly under agitator motor. Slip neoprene agitator shaft seal and coupling pin ring over end of agitator shaft.

1.2.1.6 Place agitator shaft onto motor output shaft and connect them with agitator coupling pin and slide coupling ring over ends of pin.

1.2.1.7 Wire agitator motor and install lid support rods (on Model “M”). See instructions below.

**Figure 1 - Electrical Connections (120 Inch/Pound Agitator Motor):**

---

### Agitator Motor Electrical Connections

1. Thread the 5 parts of cable fitment (adapter with “O” ring installed, grommet, washer, and nut) onto 3-wire cable in the order shown.
2. Remove motor access plate. Feed the 3-wire cable through knockout in motor side, and attach quick connect terminals to motor posts (either wire to either post).
3. Screw threaded adapter into motor housing.
4. Slide rubber grommet into adapter.
5. Slide washer into adapter.
6. Slide nut into position over rubber grommet and washer.
7. While holding 3-wire cable to prevent twisting, tighten nut.
8. Replace motor access plate.

### Installation of Lid Support Rods on Mueller Model “M” Milk Coolers:

1. Position stainless steel band around motor just below electrical cord opening as shown.
2. Attach support rods with bolts, nuts, and lock washers. Hook should be in a downward position with lock washers between motor band and support rods.
3. Raise both lids and fasten support rods in open position.
4. Tighten nuts firmly on motor band. This will hold support rods in “up” position at all times.
5. To release, raise lid slightly, push hook on lid support up and lower lid.

---

1.2.2 Motor with Hollow Shaft Gear Reducer

1.2.2.1 Position agitator assembly in cooler up through agitator opening in the top of cooler. Slip neoprene shaft shield over the end of the agitator shaft. Coat inside of hollow shaft and cap screw threads with an anti-seize compound.

**Note:** Be careful during this operation to not damage internal finish of the cooler.

1.2.2.2 Position spacer sleeves on studs. Place motor and gear reducer in mounting position by slipping the hollow shaft gear reducer over the agitator shaft and secure with cap screws and lock washers.
1.2.2.3 Align hole in agitator shaft with hole in the hub of hollow shaft gear reducer and insert drive pin.

1.2.2.4 Make wiring connections as indicated on wiring diagram on motor electrical cover plate.

1.2.2.5 The gear reducer has been filled with an extended life lubricant. Further lubrication instructions are outlined in Section 6.0, “Maintenance Instructions.”

**Note:** Before operating, remove plastic plug and replace with the vent plug attached to the gear reducer.

**Figure 2 - Agitator Motor Electrical Connections**

![Agitator Motor Electrical Connections Diagram]

1.3 **Installing Refrigeration Unit(s)**

1.3.1 Mueller Fre-Heater Units:

Provide a suitable solid base in a location which is protected from freezing temperatures and accessible to water and electrical connections.

**Note:** See separate sheet, “Fre-Heater Installation, Operation, and Maintenance Instructions.”

1.3.2 Air-Cooled Units:

1.3.2.1 Provide a suitable solid base under protective shelter with adequate air circulation.

**Note:** See “Refrigeration Unit Installation.”

1.3.2.2 Condenser face must be accessible for periodic cleaning and located at least 18" from any wall. Permanently anchor condensing units to the base.

**Note:** Do not install refrigeration unit(s) in the same area with vacuum pump exhaust.

1.3.2.3 Anchor the refrigeration unit(s) to the concrete pad with \( \frac{3}{8} \)" bolts in holes provided in the base plate. If only two bolts are used to anchor the unit, place them diagonally opposite each other.
1.4 **Refrigeration Connections**

Always install same size refrigerant tubing as condenser inlet and outlet. **Avoid short radius bends** to prevent restriction of refrigerant flow (see “Refrigerant Line Size Chart”).

All Model “M” and “O” coolers are shipped with a nitrogen charge, as are air-cooled condensers and Fre-Heaters. Check compressor nameplate or label for correct charge and evacuate and charge system as required.

1.4.1 Place entire coil of 5/8", 3/4", or 7/8" suction line tubing beside the refrigeration unit(s), and carefully straighten tubing and feed toward cooler through pre-cut openings in milk house wall and ceiling. Repeat above steps using 3/8" liquid line tubing.

**Note:** Do not remove protector caps until tubing is ready to be connected.

1.4.2 Carefully bend tubing around corners, being sure to keep each radius more than 6" in the 5/8" and 3/4" line, 7" in the 7/8" line, and 4" in the 3/8" line. The 7/8" line is a softer, bendable tubing. Severe bends may crimp tubing and restrict refrigerant flow.

1.4.3 Bring tubing down through ceiling opening to refrigerant connection on rear of cooler. Remove protector caps.

1.4.4 Clean all mating surfaces of couplings with a wire brush or clean cloth.

1.4.5 Solder copper tube connection using solder with low percentage of silver.

1.4.6 Repeat entire procedure for remaining refrigerant line.
Figure 3 - Refrigeration Controls Arrangement for Single Refrigeration Units

1. Temperature Controller
2. Expansion Valve
3. Heat Exchanger
4. Sight Glass
5. Solenoid Valve
6. Manual Agitator Timer
7. "Off-On" Switch
8. Automatic Agitator Interval Timer (Optional)

Note: Liquid line filter-drier is included but not installed for “Remote” installations. Suction line filter-drier is included but not installed for “Remote” installations on 7½ and 10 hp only.
Figure 4 - Refrigeration Controls Arrangement for Dual Refrigeration Units

Model “O” shown

1. Temperature Controller
2. Expansion Valve
3. Heat Exchanger
4. Sight Glass
5. Solenoid Valve
6. Manual Agitator Timer
7. “Off-On” Switch
8. Automatic Agitator Interval Timer (Optional)

Note: Liquid line filter-drier is included but not installed for “Remote” installations. Suction line filter-drier is included but not installed for “Remote” installations on 7½ and 10 hp only.

Table 1 - Refrigeration Line Sizes

Model “O” (Lengths up to 50 feet).

<table>
<thead>
<tr>
<th>Refrigeration Unit Size</th>
<th>Recommended Liquid Line Size</th>
<th>Recommended Suction Line Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>HP</td>
<td>R-12</td>
<td>R-22</td>
</tr>
<tr>
<td>1½ to 2</td>
<td>¼” O.D.</td>
<td>⅛” O.D.</td>
</tr>
<tr>
<td>3</td>
<td>⅛” O.D.</td>
<td>⅜” O.D.</td>
</tr>
<tr>
<td>4 to 5</td>
<td>⅛” O.D.</td>
<td>⅜” O.D.</td>
</tr>
<tr>
<td>7½</td>
<td>⅜” O.D.</td>
<td>1⅛” O.D.</td>
</tr>
<tr>
<td>10</td>
<td>⅜” O.D.</td>
<td>1⅛” O.D.</td>
</tr>
</tbody>
</table>
Figure 5 - Suggested Refrigeration Piping for Mueller Milk Coolers with Air-Cooled Refrigeration Units - Model “O”

All horizontal tubing should be slightly pitched toward refrigeration unit.

Use large radius bends to avoid crimping tubing. Minimum radius for \( \frac{7}{8} \) tube is 4", for \( \frac{3}{4} \) tube is 3", and for \( \frac{3}{8} \) tube is 2".

On suction risers longer than 6 feet use next smaller size tubing.

Cut processing tubes from heat exchanger and connect liquid and suction lines.

Use solder fittings to form trap in suction line of vertical risers.

Figure 6 - Suggested Refrigeration Piping for Mueller Milk Coolers with Air-Cooled Refrigeration Units - Model “M”

All horizontal tubing should be slightly pitched toward refrigeration unit.

Use large radius bends to avoid crimping tubing. Minimum radius for \( \frac{7}{8} \) tube is 4", for \( \frac{3}{4} \) tube is 3", and for \( \frac{3}{8} \) tube is 2".

On suction risers longer than 6 feet use next smaller size tubing.

Cut processing tubes from heat exchanger and connect liquid and suction lines.

Use solder fittings to form trap in suction line of vertical risers.
1.5  **Wiring the System**

All internal control wiring on Mueller coolers is installed at the factory.

1.5.1  Select a main circuit breaker or fused disconnect switch and service wires of sufficient size to carry the load in compliance with local regulations.

To select correct size circuit breaker and service wire, add the amperage of other loads on circuit.

1.5.2  Connect either a 200/50/1 or 230/60/1 power source to the junction box terminals in the control cabinet. Use 3-wire cable and securely anchor the green wire to a ground connection in the junction box.

Complete the wiring of the system according to the suggested electrical wiring arrangements, Figure 7.
Figure 7- Wiring Diagram

Models “M”, “MC”, and “O”

Notes:
1. Wiring shown dotted is furnished by installer.
2. For dual controls, connect additional solenoid wires to Terminals 4 and 5.
3. For additional agitator motor connect wires to Terminals 4 and 6.
1.6 Test Running Cooler

1.6.1 With control cabinet selector switch in “OFF” position and timer knob in “OFF” position, turn disconnect switches to the “ON” position.

1.6.2 Move selector switch to “COOL” position. Agitator will turn and refrigeration unit(s) will start. Slowly open suction service valve for normal operation of refrigeration unit(s). Place sufficient water in cooler to cover agitator blade. The temperature control will shut off unit(s) when the water is cooled to the temperature control cut-out point (37°F recommended).

1.6.3 After water has been cooled and unit(s) stop, advance agitator timer knob to “ON” position. The agitator will run for 3½ minutes, but the refrigeration unit(s) will not start until the water is warmed to approximately the temperature control cut-in point. Add warm water very slowly to restart unit(s), which should occur at approximately 40°F. Adjustment of temperature control may be necessary. Consult “Maintenance Instructions” for proper procedure.
SECTION 2.0 - OPERATING INSTRUCTIONS

After the Mueller milk cooler has been installed and checked according to the preceding “Installation Instructions,” take the following steps for satisfactory operation of the cooler.

Remember, the compressor will usually operate by itself for a few seconds at regular intervals during the shut-off periods. This is normal.

2.1 First Milking

2.1.1 If the cooler is to be sanitized, use an approved sanitizing solution no more than 15 minutes before adding milk to the cooler.

2.1.2 Begin adding warm milk. As soon as milk covers the agitator blade, turn the cooler toggle switch to “ON.”

2.1.3 When the milk has been cooled to the cut-off setting of the automatic temperature control (usually 38°F), the unit will shut off automatically.

2.1.4 DO NOT turn the power off at the main disconnect switch (power supply) unless the cooler is being serviced because:

2.1.4.1 The cooler is automatic and must have a constant power supply to function effectively.

2.1.4.2 The crankcase heater furnished with each compressor is ineffective unless the main power sources REMAINS ON.

2.1.4.3 When the power is turned back on, there could be liquid slugging of the compressor valves.

2.1.4.4 When servicing the cooler, first turn the cooler’s control panel switch to “OFF” then turn the disconnect switch to “OFF.” When servicing is completed, switch the main disconnect switch to “ON” then turn the cooler’s control panel switch to “ON.”

2.2 Subsequent Milkings

2.2.1 Approximately 5 minutes before milk begins to enter the cooler for the second (or any subsequent) milking, turn the manual agitator timer to the “30-Minute” position. The agitator will start and continue to run until the timer returns to the “OFF” (or “0-Minute”) position.

2.2.2 Begin adding milk. The refrigeration unit will start soon after the warm milk enters the cooler and will continue to run, along with the agitator, as long as the temperature control calls for cooling.

2.2.3 When milk is cooled to the cut-off setting of the automatic temperature control (usually 38°F) the unit will shut off automatically.

2.3 External Measuring Gauge

2.3.1 After determining milk volume, close milk outlet valve on cooler.

2.3.2 Disconnect hose from fitting on outlet valve and dispose of the milk which drains from the hose and the tube.
2.3.3 Remove hex nut and quick-connect tube coupling from outlet valve and place in wash vat for hand cleaning.

2.3.4 After milk has been removed from cooler, remove outlet valve and place in wash vat for hand cleaning.

2.3.5 To wash gauge tube during cooler wash with Mueller Matic®, connect lower gauge hose to fitting on side of Mueller Matic pump assembly. Be sure upper hose is inserted in opening in manway cover.

2.3.6 If gauge is used between milkings and cooler will not be washed immediately, close outlet valve and dispose of milk in gauge tube. Properly clean and sanitize the gauge tube by disconnecting hoses and flushing from the top to remove any milk residue. Then reconnect the hoses.

2.4 **Emptying the Cooler**

2.4.1 The tank pick-up truck driver will record the temperature and amount of milk in the cooler as indicated by the measuring stick and calibration charts.

2.4.2 To agitate the milk for sampling, set the timer to run the agitator for either 5 or 10 minutes.

2.4.3 When the agitator stops, move the toggle switch to the “OFF” position. The milk is then ready to be pumped out.

! Caution: Model “O” series coolers must be vented before pumping milk out of the cooler and during the washing process.

2.4.4 When the cooler is empty, rinse it out with tepid water, then thoroughly wash the inside with hot water and detergent.

2.4.5 If the cooler is to be sanitized, use an approved sanitizing solution no more than 15 minutes before adding milk to the cooler.
SECTION 3.0 - GENERAL MAINTENANCE INSTRUCTIONS

3.1 Cooler Maintenance

Although Mueller Milk Coolers are designed and built to provide years of trouble-free service, the following precautions and maintenance schedule should be observed:

3.1.1 Always rinse out cooler immediately after emptying to be sure that milk does not dry on the cooler surface.

3.1.2 Keep all surfaces of cooler, inside and outside, clean and free of deposits of foreign matter.

3.1.3 Do not allow tools, clamps, or any wet objects to lie on the surface for a prolonged period of time.

3.1.4 Do not enter cooler with shoes on or allow surface to be scratched in any way.

3.1.5 Use only those cleaning solutions or materials specifically recommended for use on stainless steel. Never use steel wool, files, coarse sandpaper or emery cloth.

3.1.6 For detailed cleaning and maintenance instructions, see Section 6.0, “Cleaning and Maintenance of Mueller Milk Coolers.”

3.2 Refrigeration Unit(s) Maintenance

Refrigeration units require little maintenance. However, to ensure the best cooling job possible, air-cooled condensers must be kept clean and well-ventilated and Mueller Fre-Heaters must have a continuous supply of clean water.

3.3 How to Save Service Calls

If your Mueller Model “M” or “O” milk cooler fails to operate, consult “How to Save Service Calls” in this manual before calling your serviceman.

3.4 Lubricating Hollow-Shaft Gear Motor

3.4.1 The gear reducer has been filled with an extended-life lubricant.

**Note:** The vent plug furnished with reducer must be installed before starting operation of the cooler.

3.4.2 Greased fittings are used to lubricate bearings above the oil level. Grease every 100 hours running time. (Gear motors manufactured before 1976.)
4.1 Sequence of Operation

4.1.1 All Mueller milk coolers in the “M” and “O” series feature the “Pump-down” type refrigeration system. In this type of system most of the refrigerant is removed from the evaporator when the refrigeration unit shuts down. Removing the refrigerant eliminates the possibility of accumulating liquid refrigerant in the evaporator which, on start-up, could flow into the compressor with the probability of damaging it.

4.1.2 The inside of the cooler can be washed with hot water without danger of building up high pressure in the system which could distort the evaporator.

4.1.3 Refer to Figure 7, “Wiring Diagram.” Trace the sequence of operation as follows:

4.1.3.1 Move the switch on the control panel to the “ON” position.

4.1.3.2 Begin adding warm milk to the cooler.

4.1.3.3 When the temperature control sensing bulb (located behind a round rubber grommet near the bottom edge of the cooler on the control cabinet end) senses a rise in temperature, it causes the temperature control to close two separate contacts.

4.1.3.3.1 One contact closes the circuit to the agitator motor causing it to start.

4.1.3.3.2 The other contact closes the circuit to the refrigerant solenoid valve causing it to open. This starts the flow of refrigerant to the evaporator.

4.1.3.4 As the liquid refrigerant flows into the evaporator it absorbs heat from the milk, vaporizes, and builds up pressure in the “Low” side of the system. When this pressure rises to the cut-in setting of the low pressure control, the circuit to the condensing unit will close, causing the unit to start (see chart below).

<table>
<thead>
<tr>
<th></th>
<th>PSIG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start (Cut-In) @</td>
<td>17</td>
</tr>
<tr>
<td>Stop (Cut-Out) @</td>
<td>2</td>
</tr>
</tbody>
</table>

4.1.3.5 The refrigeration unit and the agitator will continue to operate until the temperature of the milk reaches the “cut-off” setting on the temperature control (see 4.1.3.3). When the milk has been cooled to this point (usually 38°F) the temperature control breaks the two contacts which were closed.

4.1.3.4.1 One contact breaks the circuit to the agitator motor causing it to stop.

4.1.3.4.2 The other contact breaks the circuit to the refrigerant solenoid valve causing it to close. This stops the flow of refrigerant to the evaporator.

4.1.3.6 The refrigeration unit will continue to run for a short time, thus removing most of the refrigerant from the evaporator and reducing the pressure on the low pressure control. When the pressure drops to the cut-out setting of the low pressure control, the circuit to the refrigeration unit will break, causing the unit to stop (See Table 2).
4.1.4 The manual agitator timer, standard equipment on Mueller Coolers in the “M” and “O” series, permits the agitator to be operated for periods up to 30 minutes by merely turning the knob to the desired time interval. The agitator can be operated for an indefinite period by advancing the timer knob past the “30-Minute” mark to the “HOLD” position.

Caution: Be sure to move the timer knob from the “HOLD” position when continuous agitator is not required.

4.1.4.1 An optional automatic timer is also available, on order, that will cause the agitator to operate approximately 3 minutes out of every 30 minutes.

4.1.5 For a more detailed discussion of refrigeration problems, refer to “Refrigeration Troubleshooting” on the following pages.

4.2 Thermostatic Expansion Valve Adjustment and Service

4.2.1 The thermostatic expansion valve ensures that the correct amount of liquid refrigerant is delivered to the evaporator coil by sensing and controlling the super-heated vapor in the evaporator coil. An under-supply of refrigerant will starve the coil and decrease its efficiency. An over-supply of refrigerant reduces the capacity of the compressor and can damage the compressor’s mechanical parts if excess liquid refrigerant is being pumped from the evaporator coil. Compressors are not designed to pump liquid refrigerant and can be damaged. For this reason it is very important that only gaseous refrigerant be returned to the compressor. The expansion valves on Mueller milk coolers are factory set for a nominal 10°F superheat.

4.2.2 For best performance, the superheat should be checked and, if necessary, adjusted on each installation. It should never be lower than 6°F at the end of the cooling cycle.

4.2.3 A superheat setting that is too low will usually cause the coil to be overfed causing high suction pressures and very little temperature difference between the milk and refrigerant. Cooling will be very slow. Also, there can be damage to the compressor due to liquid flood-back to the compressor. To determine what superheat the valve is operating, install a suction pressure gauge at the compressor suction valve on close-coupled systems or, if the compressor is more than 6 feet from the cooler, install a suction gauge in the external equalizer line of the expansion valve. With the machine running and the suction pressure stable, take an accurate suction line temperature reading at the expansion valve bulb location. At the same time, take a suction pressure reading. Refer to a refrigerant “Temperature-Pressure Chart” and convert the suction pressure reading to an equivalent saturation temperature. Subtract this reading from the suction line temperature reading and the difference will be the operating superheat. For example:

### REFRIGERANT-12
Suction Line Temperature . . . . . . . . . . . 37°F
Suction Pressure . . . . . . . . . . . . . . . .26 psig
Equivalent Saturation Temperature . . . .27°F

37°F — 27°F = 10°F Superheat

### REFRIGERANT-22
Suction Line Temperature . . . . . . . . . . . 37°F
Suction Pressure . . . . . . . . . . . . . . . .51 psig
Equivalent Saturation Temperature . . . .27°F

37°F — 27°F = 10°F Superheat

4.2.4 As a guide, when the temperature of milk in the cooler is 38°F, normal suction pressure in the equalizer line will range from 25 to 27 psig for Refrigerant-12 and 51 to 54 psig for Refrigerant-22. If the suction pressure at this temperature (38°F) drops below 20 psig for R-12 or 41 psig for R-22, immediate steps should be taken to determine the cause. Usually is will be found that the superheat is too high. Important points to remember about checking expansion valves include:
4.2.4.1 There must be good thermal contact between the expansion valve bulb and the suction tube.

4.2.4.2 The maximum operating superheat should not exceed 15°F. Minimum operating superheat should be no lower than 6°F with the lowest value occurring just before the condensing unit stops at 38°F milk temperature.

4.2.4.3 Increased superheat reduces the suction pressure. Decreased superheat setting will raise the suction pressure; however, do not lower the superheat to less than 6°F.

4.2.4.4 Suction temperature readings for determining the superheat should be taken on the suction line at the expansion valve bulb location. The evaporator surface should be at least 85% covered with water or milk when taking superheat readings. Never take this reading on the compressor side of the heat exchanger.

4.2.4.5 Make any necessary adjustment of the expansion valve when the milk is in the low temperature range (38° to 42°F) and suction pressure is stable. Turn the adjusting screw one half turn at a time and observe the reaction to avoid over-adjusting the valve.

**Note:** If the expansion valve is to be removed or installed, disassemble if it is of the three-piece type or, if not, wrap with wet cloth or heat absorbing material before applying heat to solder joints. This is required to protect diaphragm, gaskets, springs, and moving parts.

4.2.5 Thermostatic expansion valves (T.E.V.) are selected for their ability to provide the proper flow of refrigerant to the cooling surface under usual operating conditions. In cold weather when refrigerant head pressure becomes less, the valve will open to supply the required amount of refrigerant. However, in extremely cold weather, especially if the condensing unit is mounted outside, the head pressure can drop to a point where the valve opening is no longer large enough to permit a sufficient quantity of liquid refrigerant to flow into the evaporator coil. This results in lowered suction pressure and possible freezing of milk on the evaporator coil.

To solve this problem, raise the head pressure enough to maintain adequate refrigerant flow across the valve. This can be accomplished in several ways:

4.2.5.1 Block off part of the air-cooled condenser.

4.2.5.2 Install fan control switches to cycle fans on and off to hold a reasonably constant head pressure. Some units are supplied with this automatic control.

**Note:** Refrigeration units furnished by Paul Mueller Company have such condenser fan controls as standard equipment.

4.2.5.3 If the refrigeration unit is adjacent to the milk house, arrange duct work to the air-cooled condenser that will circulate air from the milk house through the condenser, and back into the milk house. (Check with local health authorities before setting up refrigeration unit(s) to recirculate air in the milk house.)

4.2.6 As warmer weather returns, change the unit back to the normal operating settings with a free flow of air across the condenser.

4.2.7 In general, any time the refrigerant head pressure drops below 80 psig for Refrigerant-12 or 130 psig for Refrigerant-22, there is a possibility that capacity will be lost across the expansion valve.

4.2.8 An expansion valve sometimes freezes shut due to moisture in the system. To temporarily get the valve operating again, apply hot rags to the valve until it is functioning normally. However, valve freezing indicates the presence of moisture in the system which should be removed immediately.
4.2.9 Moisture can greatly reduce compressor life and may damage mechanical parts. After drying the system, install a new refrigerant drier in the liquid line for future protection from moisture.

4.3 Temperature Control and Thermometer Bulbs

The temperature control and dial thermometer bulb is located behind 2" rubber grommets near the bottom of the cooler head, at the lower edge of the control panel (see Figure 8).

4.3.1 To remove temperature control bulb, remove grommet and fiberglass insulation covering bulb. Slide bulb out to release it from holding clip as shown in Figure 9.

4.3.2 Insert new bulb through access hole and push into bulb clip. Be sure to coat bulb with a heat conductive compound (such as Presstite No. 446) before pushing it into place.

**Note:** Temperature control sensing bulb must be installed with indentation away from cooler liner.

4.3.3 Replace fiberglass insulation and grommet and seal slit for sensing tube with Permagum or equivalent.

4.3.4 Remove dial thermometer sensing bulb using same procedure as temperature control bulb.

4.3.5 Remove screws holding dial thermometer and pull sensing tube and bulb out through opening in cabinet.

4.3.6 Insert new bulb and thermometer in reverse order.

4.3.7 Replace fiberglass insulation, access grommet, and dial thermometer screws.

---

**Figure 8 - Temperature Control and Dial Thermometer Bulb Location**

[Diagram showing temperature control and dial thermometer bulb location]

**Figure 9 - Temperature Control and Dial Thermometer Bulb Mounting**

[Diagram showing grommet location]
5.1 General Information

Following are some problems that occasionally arise in the operation of the refrigeration system on milk coolers and their possible remedies. These suggestions are offered as a guide only for the benefit of the refrigeration serviceman or dealer.

There are very few service functions that an owner should attempt to perform on the refrigeration system other than such normal maintenance as removing dirt from an air-cooled condenser. For a more thorough analysis of the electrical and mechanical difficulties which may develop in a condensing unit, the serviceman or dealer should consult the Sales/Service Manual.

One of the more common complaints is that the compressor is running an excessively long time in cooling milk down to the holding temperature. Sometimes the system is operating at or near peak efficiency and the owner has been misinformed as to the length of time the machine should run, or he has been comparing his cooler running time with a neighbor’s tank where the operating conditions may be different. Many factors can affect the length of time a compressor will run such as:

5.1.1 Total quantity of milk to be cooled:

The total quantity of milk to be cooled has a direct bearing on the condensing unit’s running time.

5.1.2 Temperature at which milk is cooled:

As milk in the tank approaches 38°F, the rate of cooling decreases. It becomes increasingly harder to cool milk as the temperature is lowered. In fact, it takes almost as long to cool the same volume of milk from 40° to 38°F as from 44° to 40°F. For this reason, if it is required to cool milk to temperatures as low as 35° or 36°F, compressor running time can be expected to be much longer than to 38° or 40°F. From a practical and economical standpoint, it is much preferred not to attempt to cool milk lower than 37° or 38°F.

5.1.3 Air temperature into condenser of air-cooled units:

In hot weather, refrigerant condensing temperatures are high which cause lower refrigeration capacity. In cool weather, condensing temperatures are lower which, all other things being equal, should shorten the running time.
# 5.2 Service Checklist for Common Problems You May Encounter

<table>
<thead>
<tr>
<th>Trouble</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Problem: Compressor “Running Too Long”</strong>&lt;br&gt;a. Low refrigerant charge will be indicated by bubbles or “smoky” condition in liquid sight glass, low suction, and head pressure.</td>
<td>a. Add refrigerant until sight glass shows column of liquid. In cold weather, condenser must be blocked to prevent overcharging when attempting to obtain clear sight glass. Maintain 100 psig for R-12 and 170 psig for R-22. Also check for clogged screen in solenoid valve or any restriction of solenoid or strainer.</td>
</tr>
<tr>
<td>b. High head pressure and long running time may be caused by dirty, clogged-up, or blocked air-cooled condenser, or condenser fan or fans not running.</td>
<td>b. Clean condenser. Check fans.</td>
</tr>
<tr>
<td>c. High head pressure caused by overcharge of refrigerant.</td>
<td>c. Gradually let refrigerant out of system until head pressure is normal.</td>
</tr>
<tr>
<td>d. High head pressure caused by air or other non-condensable gases in system.</td>
<td>d. Remove refrigerant charge, re-evacuate, and recharge.</td>
</tr>
<tr>
<td>e. High head pressure caused by scaling of Fre-Heater heat exchanger.</td>
<td>e. Descale heat exchanger as directed in Fre-Heater Instructions.</td>
</tr>
<tr>
<td>f. Loss of compressor pumping capacity due to leaky, burned, or worn out compressor valve reeds. This will be indicated by low head pressure and higher than normal suction pressure.</td>
<td>f. Consult the Sales/Service Manual to check on this. Replace compressor if required.</td>
</tr>
<tr>
<td>g. Tubing where refrigerant leaves cooler is too warm or too cold.</td>
<td>g. Expansion valve superheat improperly set or uneven refrigerant distribution to circuits (see Section 4.2).</td>
</tr>
<tr>
<td>h. Suction or discharge service valves on compressor partially closed or suction filter clogged.</td>
<td>h. Open service valves or test pressure drop across filter and replace if over 2 psig.</td>
</tr>
<tr>
<td>i. Shut-off valve on receiver partially closed or restricted causing “smoky” sight glass.</td>
<td>i. Open or clear valve.</td>
</tr>
<tr>
<td>j. Ice on evaporator causing loss of heat transfer efficiency.</td>
<td>j. Improperly adjusted expansion valve, poor contact between bulb and suction tube, or temperature control set too cold.</td>
</tr>
<tr>
<td><strong>2. Problem: High Blend Temperature.</strong> A high blend temperature of milk on subsequent milkings can be caused by one or more of the following problems:&lt;br&gt;a. Loss of refrigeration capacity.</td>
<td>a. Any one of the causes listed for “Compressor Running Too Long” could be applicable as a possible reason for loss of capacity.</td>
</tr>
<tr>
<td>b. Refrigeration unit not starting soon enough.</td>
<td>b. Temperature controller set too high, bulb not tight against liner, or defective temperature controller. Also, start agitator with switch at beginning of milk adding period.</td>
</tr>
<tr>
<td>c. Temperature of milk in cooler not low enough at beginning of the adding period.</td>
<td>c. Set temperature control dial colder. Check temperature of milk when condensing unit cuts “OFF” and “ON.” If differential is more than 4°F, inspect contact of bulbs against cooler. Recheck differential and replace temperature control if necessary.</td>
</tr>
<tr>
<td><strong>3. Problem: Compressor will not start, no motor hum, solenoid valve does not “click” open.</strong>&lt;br&gt;a. Tripped circuit breaker.</td>
<td>a. Reset. If it trips again, check for line shorts.</td>
</tr>
<tr>
<td>c. Open line circuit.</td>
<td>c. Check wiring and fuses.</td>
</tr>
<tr>
<td><strong>4. Problem: Compressor will not start.”</strong>&lt;br&gt;a. Low pressure switch cut-in point set too high.</td>
<td>a. Reduce cut-in point to 17 psig for R-12 or R-22.</td>
</tr>
<tr>
<td>b. Defective low pressure switch.</td>
<td>b. Replace.</td>
</tr>
<tr>
<td>c. Refrigerant will not flow to evaporator due to unusually low head pressure. This causes suction pressure to remain at a pressure too low to actuate low pressure switch. This situation occurs sometimes in extremely cold weather.</td>
<td>c. Remove cover from low pressure switch and close contacts with screwdriver. After a few moments the compressor should stay on the line of its own accord. Low pressure switch may be reset to cut-out at 1 psig.</td>
</tr>
<tr>
<td><strong>5. Problem: Compressor will not start; motor hums.”</strong>&lt;br&gt;a. This could be one of many things, but most probably electrical.</td>
<td>a. Check the Technical Data Section of the Sales/Service Manual.</td>
</tr>
<tr>
<td><strong>6. Problem: Compressor runs and stops intermittently before milk is cooled down.”</strong>&lt;br&gt;a. If compressor is starting and stopping and the refrigerant solenoid valve opening and closing, the trouble is probably a defective temperature controller. (When solenoid valve opens or closes a definite “click” will be heard.)</td>
<td>a. Check temperature controller and replace if required.</td>
</tr>
<tr>
<td>b. Compressor cycling on overload due to high operating pressures.</td>
<td>b. Clean the condenser. Make sure there is plenty of unrestricted air flow.</td>
</tr>
<tr>
<td>c. Cut-off point on low pressure switch set too high.</td>
<td>c. Set to cut-off at 2 psig for R-12 or R-22. Check for adequate refrigerant charge.</td>
</tr>
<tr>
<td>d. Defective low pressure switch.</td>
<td>d. Replace.</td>
</tr>
<tr>
<td>e. Moisture in system.</td>
<td>e. Replace drier (if filter-drier is in suction line add a drier to the liquid line).</td>
</tr>
</tbody>
</table>

*There are many different things that can cause a compressor not to run or to cycle periodically. Some of the more obvious ones are listed here. For a more detailed analysis of compressor starting and running problems, see the Technical Data Section of the Sales and Service Manual.*

The above list does not encompass all of the electrical and mechanical problems that may be encountered in servicing a refrigeration unit. 90% of compressor starting and running difficulties will normally be electrical. Start or run capacitors, relays, and overload protectors should be all carefully checked in accordance with the Technical Data Section of the Sales/Service Manual or replaced in case of doubt.
SECTION 6.0 - CLEANING AND MAINTENANCE OF MUELLER MILK COOLERS

6.1 General Information

All metal product contact surfaces of this equipment are manufactured from one of the 300 series stainless steels. These alloys are suitable for use with most food and similar products. Because it is easy to clean and maintain, it will remain bright and spotless by following these suggestions:

**DON'T** let deposits of foreign matter of any kind remain on the surface for more than a few hours at any one time.

**DON'T** let pails, tools, or wet objects lie on the surface.

**DON'T** enter the cooler with shoes on or scratch the surface with files, steel wool, coarse sand paper, or emery cloth. Use only stainless steel sponges (available at most hardware stores) for removing stubborn deposits.

**DON'T** use more detergent or sanitizing compound than called for in manufacturer's directions. This not only saves materials, but also prevents dulling the metal surface or possible corrosion.

**DON'T** put detergent or concentrated sanitizing compounds in empty cooler.

**HAVE WATER IN TANK FIRST.**

**DON'T** let cleaning or sanitizing solutions remain in cooler for more than 20 minutes.

**DON'T** splash or permit such solutions to dry on surface. It's good practice to sanitize just before product enters coolers.

**DON'T** let water evaporate in cooler. Salts settle out of most waters and may stain the surface. Drain completely.

**DON'T** apply pressure in cooler.

6.2 Suggested Cleaning and Bactericidal Treatment

6.2.1 Rinse out solids, foam, etc., with cold water immediately after product is removed.

6.2.2 Before washing, rinse with warm water.

6.2.3 Dissolve cleaner in container of warm water. Use the amount of cleaner recommended by the chemical manufacturer.

**Note:** If acid cleaners and milkstone removers are used, follow with alkaline wash and rinse with warm water.

6.2.4 Brush cleaning solution on all product contact surfaces. Drain.

6.2.5 Rinse with warm water. Drain dry.

**Note:** An acidified rinse may be used as a final rinse without harming the surface. Follow chemical manufacturer's instructions carefully.

6.2.6 Sanitize the tank immediately before product enters. Brush or spray all product contact surfaces with 200 ppm (maximum) chlorine solution or other approved sanitizing compounds.

6.2.7 If spray cleaning is used (such as the Mueller Matic Automatic Washing System) follow the spray equipment manufacturer's instructions.

The above suggestions are taken from publications of Allegheny Ludlum Steel Corporation, National Association of Dairy Equipment Manufacturers, Food Management, and the American Iron and Steel Institute.
SECTION 7.0 - HOW TO SAVE SERVICE CALLS

7.1 General Information

If your Mueller milk cooler fails to operate properly, check the following before requesting service:

7.1.1 Be sure main electrical switch is closed and switch on control box on wall is in “Cool” position.

7.1.2 Check all fuses, including the large cartridge fuses, in the main entrance panel. Keep extra fuses of the right size on hand.

7.1.3 If compressor will not start, check for a reset button, sometimes located on pressure control. Reset button can trip due to inadequate ventilation of air-cooled refrigeration unit.

7.1.4 Check air-cooled condenser to be sure it is not partially clogged with dust, lint, or debris. It can be brushed, vacuumed, or blow-out with compressed air to clean. It is important that the condenser be kept clean and well-ventilated. Condenser “fins” should be straight and in good condition.

7.1.5 After milk has been cooled and the unit has stopped running, it is normal for the refrigeration units on models “M” and “O” coolers to occasionally start and run for a few seconds. This is known as “pump-down” cycling.

7.1.6 If your cooler fails to operate during or immediately after an electrical storm, or milk house lights are dimmed by the cooler trying to run, place the selector switch in the “OFF” position and call your serviceman.

7.1.7 If the unit fails to start during extremely cold weather, place a heat lamp next to the condenser of the refrigeration unit. This should warm the refrigerant enough to start the unit.

7.1.8 If the compressor starts and stops every few minutes during the cooling period, or runs longer than normal, a competent refrigeration serviceman should check it out as soon as possible.

If you need service, call the following numbers in order listed. (Ask your Mueller dealer to fill in these phone numbers.

1. 

2. 

3. 

4. 