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SECTION 1.0 - GENERAL INFORMATION

1.1 Description of the System

Mueller HiPerForm® R-22 refrigeration system, a unique concept in milk cooling, is a true, high-performance package which includes a milk cooler of superior design and craftsmanship and the most efficient, trouble-free refrigeration system ever offered. Each Mueller Model “OH” HiPerForm Milk Cooler comes equipped with a Mueller Matic® Automatic Washing System.

1.2 The Cooler

The Mueller Model “OH” Milk Cooler is the most preferred milk cooler available today. It may be installed completely within the milk room or bulkheaded with only a portion in the milk room. The Model “OH” has features progressive dairymen want—smooth, clean lines, all stainless steel construction, and the exclusive Mueller Temp-Plate® Heat Transfer Surface (cooling plate). The enclosed top not only looks good, it offers the ultimate in sanitary design. Because Mueller Milk Coolers are so well designed and built to last, there is never any bulging or sagging. Their exclusive inflated type Mueller Temp-Plate Heat Transfer Surface makes the direct expansion/ flooded refrigeration system more efficient and much more economical than old-fashioned serpentine type coil or copper tubing.

1.3 The Refrigeration System

The Mueller HiPerForm R-22 refrigeration system is an exclusive adaptation of Westinghouse’s patented Hi/Re/Li System*. No other milk cooler manufacturer offers the unique advantages of HiPerForm. You get more efficient operation, more constant temperature control, and assured cold weather starting. Lower discharge temperatures and protection against liquid flood-back to the compressor assure you of longer compressor life.

1.4 The Pre-Insulated Refrigerant Tubing

The pre-insulated refrigerant line set will reduce heat gain, prevent sweating and condensation, and ensure subcooled liquid refrigerant to the evaporator.

1.5 The Mueller Matic Automatic Washing System

You will appreciate the new features of this labor- and time-saving, dependable washing system. The positive cleaning action of the Mueller Matic includes cold water acidified rinsing and sanitizing cycles for the most complete cleaning system ever offered for a milk cooler.

*A refrigerant control system licensed under and covered by Westinghouse Patent 3,264,837 and perhaps others. The system is identified by its trademark “Hi/Re/Li.”
Figure 1 - “OH” Cooler
SECTION 2.0 - MODEL “OH” INSTALLATION INSTRUCTIONS

The procedures described below have been carefully worked out to make installation of your Mueller HiPerForm Milk Cooling System as simple as possible. The ten steps will be covered in the following order:

2.1 Installing Cooler
2.2 Installing Agitator Motor and Assembly
2.3 Installing Mueller Matic Automatic Washing System and Control Cabinet
2.4 Installing Condensing Unit(s)
2.5 Connecting Pre-Insulated Refrigerant Tubing
2.6 Installing (Optional) Recording Thermometer Sensing Bulb
2.7 Wiring the System
2.8 Selecting Control Features
2.9 Test Running Cooler
2.10 Test Running Washing System

2.1 Installing Cooler

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

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

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

*Note:* 36” minimum distance required between the milk outlet ferrule and the wall on 300 to 1,600-gallon coolers, and 42” minimum distance required between the outlet ferrule and wall on 2,000 gallon and larger models.

2.1.4 Bulkheading:

2.1.4.1 If the cooler is to be bulkheaded, a structural steel wall support channel and sealing insulation strip are available (see Figure 2).

2.1.4.2 Build the slab or footings for the portion of the cooler which will be outside of the milk room in accordance with local construction codes and large enough for the loaded weight of the cooler.

2.1.5 Remove Skids:

2.1.5.1 Raise one end of cooler by lifting on the end cross-brace and remove the 3/16” self-tapping screws from legs on that end of the cooler using a 9/16” socket wrench.

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

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

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

2.1.5.5 Lower cooler and repeat procedure on other end.
2.1.6 Installing External Measuring Gauge (optional feature on all coolers):

2.1.6.1 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.

2.1.6.2 Place “O” ring in groove on the top part of upper channel adjuster fitting and push quick connect adapter onto the top of the fitting (early models only).

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

2.1.6.4 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 hose barb at bottom of gauge tube. Place “O” ring on quick connect to valve adapter. Install on outlet valve end with hex nut. Connect hose to outlet valve and tighten clamps.

2.1.7 Level Cooler:

2.1.7.1 Use a jack with cradle in the shape of the cooler to raise or lower each end of the cooler for leveling and to comply with local regulations concerning proper height of milk outlet and bottom of cooler from floor. Adjust legs to maintain this height.

On coolers with more than four legs, keep inner legs raised off the floor until the levels read level and front and rear legs are adjusted to maintain that position. Then extend inner legs to fit firmly against floor.

2.1.7.2 Double check height of outlet and bottom of cooler to be sure minimum clearance is still correct.

2.1.7.3 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.
2.1.7.4 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. Since a thin coating of powder gives the clearest reading, any excess powder should be removed by jarring the rod.

2.1.7.5 When surface of water is quiet, carefully lower measuring rod straight down into 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.

2.1.7.6 For external measuring gauge, attach lower hose to the outlet valve. 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 on front of cooler.

2.1.7.7 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.

2.2 Installing Agitator Motor and Assembly

2.2.1 120 Inch/Pound Agitator Motor Installation:

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

2.2.1.2 Place agitator assembly inside cooler and insert end of agitator shaft up through agitator opening. Slip neoprene agitator shaft seal and coupling ring over end of agitator shaft.

2.2.1.3 Remove agitator motor from shipping box.

2.2.1.4 Place the three motor sleeves over internally threaded mounting studs on the cooler.

2.2.1.5 Carefully place agitator motor on spacer sleeves and install mounting bolts with small amount of anti-seize compound on threads.

2.2.1.6 Place agitator shaft over motor shaft and insert coupling pin in hole; slide coupling ring over coupling pin to hold it in place.

2.2.2 120 Inch/Pound Agitator Motor Electrical Connections:

2.2.2.1 Thread the five parts of cable fitment (adapter with “O” ring installed, grommet, washer, and nut) onto 3-wire cable in the order shown in Figure 3.

2.2.2.2 Cut wire to proper length. Strip insulation and install wire terminals furnished in parts box.

2.2.2.3 Remove motor access plate, feed the 3-wire cable through knock-out in motor side, and attach quick connect terminals to motor posts (either wire to either post).

2.2.2.4 Secure ground wire under ground screw on motor housing.

2.2.2.5 Screw threaded adapter into motor housing.
2.2.2.6 Slide rubber grommet into adapter.

2.2.2.7 Slide washer into adapter.

2.2.2.8 Slide nut into position over rubber grommet and washer.

2.2.2.9 While holding 3-wire cable to prevent twisting, tighten nut.

2.2.2.10 Replace motor access plate.

2.2.3 Motor with Hollow Shaft Gear Reducer:

2.2.3.1 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. If external weather shield is used, install slinger at this time.

**Note:** Be careful not to damage internal finish of the cooler during installation of agitator.

2.2.3.2 Coat inside of hollow shaft and cap screws with anti-seize compound. 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.

2.2.3.3 Align hole in agitator shaft with hole in the hub of hollow shaft gear reducer and insert drive pin.

2.2.3.4 Install the Agitator Weather Shield Kit on coolers which are bulkheaded with the agitator outside of the milk room.

2.2.3.5 Follow instructions in Section 2.2.2 for electrical connections. Make wiring connections on side of motor as indicated on wiring diagram located in agitator electrical enclosure. See Figure 4.

---

**Figure 3 - 120 Inch/Pound Agitator Motor Installation**

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**Figure 4 - Hollow Shaft Gear Reducer Agitator Motor Installation**
2.3 Installing Mueller Matic Automatic Washing System and Control Cabinet

2.3.1 Remove milk outlet valve from cooler and insert Mueller Matic jet-tube into cooler until rubber adapter fits tightly over outlet ferrule. Adjust legs on pump until spray head of jet-tube is three inches above inside bottom of cooler.

2.3.2 Select a convenient location about five feet from the floor for the control box, keeping in mind the 13-foot length of the Mueller Matic hose and pump power cord, plus availability of water and electrical power.

2.3.3 Using the enclosed template as a guide, mark the location of the three screw holes on the wall and, following instructions on the template, fasten cabinet to the wall.

**Note:** Water pressure at the Mueller Matic cabinet must be between 10 psig minimum and 75 psig maximum.

2.3.4 Connect backflow preventer to cold water hose assembly and attach to existing cold water supply.

2.3.5 Attach cold water hose assembly to front solenoid valve connection on bottom of control cabinet.

2.3.6 Attach backflow preventer to hot water hose assembly, then connect to existing hot water supply (140°F minimum and 170°F maximum).

**Note:** Because wire strainers in the solenoid valves require periodic cleaning, shut-off valves should be installed in the connecting water lines.

2.3.7 Connect hot water assembly hose to rear solenoid valve connection on bottom of control cabinet.

2.3.8 Connect drain valve assembly hose to water manifold connection on bottom of control cabinet.

2.3.9 Pull pump power cord with grommet through opening in back of control cabinet and insert into hole provided in bottom of top compartment. Connect wires according to wiring diagram (see Figure 9 or Figure 10).

2.4 Installing Refrigeration Unit(s)

2.4.1 Locate refrigeration unit(s) close enough to cooler so that pre-insulated tubing can easily reach from unit(s) to cooler without requiring sharp bends in the lines (see Figure 5).

2.4.2 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 “Fre-Heater Installation, Operation, and Maintenance Instructions.”

2.4.3 Air-Cooled Units:

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

**Note:** See “Refrigeration Installation, Operation, and Maintenance Instructions.”

2.4.3.2 Condenser face must be accessible for periodic cleaning and located at least 18 inches from any wall. Permanently anchor refrigeration units to the base.

**Note:** Do not install condensing unit(s) in area of vacuum pump exhaust.
2.5 Connecting Pre-Insulated Tubing

2.5.1 Place entire coil of 7/8" or 5/8" suction line tubing beside 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.

2.5.2 Carefully bend tubing around corners, being sure to keep each radius more than 12" for the 7/8" and 5/8" lines, and 3" in the 3/8" line. Severe bends may crimp tubing and restrict refrigerant flow. The 7/8" line is a softer, bendable tubing.

2.5.3 Bring tubing down through ceiling opening to refrigerant connection on rear of cooler.

2.5.4 Relieve dry nitrogen charge from cooler and cut copper fittings to remove sealed ends.

2.5.5 Prepare copper tubing on cooler and pre-insulated tubing for soldering. Swedge pre-insulated tubing or use a coupling or reducer fitting and solder with 15% silver solder while purging with dry nitrogen to prevent internal oxide formation. Perform same procedure for connecting the refrigeration unit.

2.5.6 The refrigeration unit, refrigerant lines, and evaporator circuits will require an 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.

**Note:** See "Refrigeration Unit Installation and Operation Manual" for refrigerant charging instructions.
Figure 5 - Suggested Refrigeration Piping for Mueller HiPerForm with Air-Cooled Refrigeration Unit
2.6 Installing (Optional) Recording Thermometer Sensing Bulb

2.6.1 Remove rubber grommet covering the raceway provided for recording thermometer sensing bulb at rear of cooler between conduit connector and refrigerant connections (see Figure 6). Coolers 800 gallon and larger have an additional raceway at the front of cooler, accessible from the bottom, approximately 6 inches to the right of milk outlet ferrule (prior to 1989).

**Note:** Mueller coolers manufactured after 1989 have one raceway at the rear of the cooler and two raceways accessible from the front right-hand leg channel.

2.6.2 Insert sensing bulb into raceway and push bulb into raceway with wire as shown in Service Bulletin 1098. Bulb will be felt to firmly seat at the end of raceway.

2.6.3 Mount and wire recording thermometer according to instructions provided.

![Figure 6 - Recorder or Sensor Channel](image)

2.7 Wiring the System

2.7.1 In the Mueller HiPerForm system, all internal control wiring on the control cabinet and cooler is complete. It is only necessary to connect the control cabinet to a 230/60/1 or 200/50/1 separately fused power supply and to connect various components of the HiPerForm system to the control cabinet.

2.7.2 Select a main circuit breaker or fused disconnect switch and service wires of sufficient size to carry the total load and comply with local regulations. Install a separate circuit breaker or fused disconnect switch for the control cabinet with sufficient capacity for the agitator motor and Mueller Matic. Do not include any other appliances or outlets on these circuits. For increased safety and improved appearance, enclose all external wiring in electrical conduit.

**Note:** The electronic temperature control/thermometer circuit is controlled by a low voltage temperature sensor in the cooler. Be certain that the low-voltage circuit is not subject to line voltage through improper field wiring. See Service Bulletins 998 and 595 for proper circuit board and sensor wiring.
2.8 Selecting Control Features

2.8.1 The HiPerForm microprocessor control cabinet has a variety of selections available by the positioning of rocker switches on the Digital Electronic Circuit Board (see Figure 8).

2.8.1.1 Digital temperature control has the following selectable features: Fahrenheit or Celsius temperature scale, eight temperature set points, and two selections for temperature control differential (see Tables 2 and 3).

Digital temperature display flashes in the “OFF” and “WASH” mode, and is on steady in the “COOL” mode. “LO” or “0.0.” will be displayed if the temperature goes below 30°F and “HI” or “9.9.” will be displayed if the temperature is above 185°F.

2.8.1.2 Alarm light functions in “COOL” mode. It flashes when the temperature is above the high alarm point or below the low alarm point, and is on steady when the temperature is in the safe range. Low temperature alarm point is 34°F (1°C). High temperature alarm point is dependent on the set point and differential selections.

2.8.1.3 Prestart switch has time cycle selections of 30 minutes or 60 minutes for agitation only or cooling and agitation. In the “COOL & AGITATE” mode, cooling will cut off at 34°F and cut on at 36°F.

2.8.1.4 Agitate switch has selectable time cycles of 2, 5, 10, or 60 minutes.

2.8.1.5 Automatic interval agitate cycle can be set for either 15 minutes off and 3 minutes on, or 27 minutes off and 3 minutes on.

Figure 7 - HiPerForm Control Cabinet
Table 1 - Selections Available

<table>
<thead>
<tr>
<th>Switch Number</th>
<th>Feature</th>
<th>Rocker Switch</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Temperature Control Differential</td>
<td>4°F (1°C)</td>
</tr>
<tr>
<td>2, 3, &amp; 4</td>
<td>Temperature Control Set Point Selection</td>
<td>(See Table 3)</td>
</tr>
<tr>
<td>5</td>
<td>Temperature Scale Fahrenheit or Celsius</td>
<td>°C</td>
</tr>
<tr>
<td>6 &amp; 7</td>
<td>Agitate Switch Time Cycle</td>
<td>°F</td>
</tr>
<tr>
<td>8</td>
<td>Prestart Switch</td>
<td>Agitate Only</td>
</tr>
<tr>
<td>9</td>
<td>Prestart Switch Time Cycle</td>
<td>60</td>
</tr>
<tr>
<td>10</td>
<td>Power Supply Frequency</td>
<td>50 Hz.</td>
</tr>
<tr>
<td>11</td>
<td>Automatic Interval Timer Cycle</td>
<td>3 minutes out</td>
</tr>
<tr>
<td></td>
<td></td>
<td>of every 18</td>
</tr>
<tr>
<td></td>
<td></td>
<td>minutes</td>
</tr>
</tbody>
</table>

*In this mode, cooling will automatically cut off at 34°F and cut on at 36°F.

Note: The power supply frequency feature has been eliminated on circuit boards with 10 switches, and the #10 switch controls the automatic interval time cycle feature.

Table 2 - Set Point Selections

<table>
<thead>
<tr>
<th>Switch</th>
<th>Fahrenheit</th>
<th>Celsius</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Switch 1 “OFF” 2°F Diff.</td>
<td>Switch 1 “ON” 4°F Diff.</td>
</tr>
<tr>
<td></td>
<td>Alarm Condensing Unit</td>
<td>Alarm Condensing Unit</td>
</tr>
<tr>
<td>4</td>
<td>Low</td>
<td>Hi</td>
</tr>
<tr>
<td>Off</td>
<td>34</td>
<td>42</td>
</tr>
<tr>
<td>Off</td>
<td>34</td>
<td>43</td>
</tr>
<tr>
<td>Off</td>
<td>34</td>
<td>44</td>
</tr>
<tr>
<td>Off</td>
<td>34</td>
<td>45</td>
</tr>
<tr>
<td>On</td>
<td>34</td>
<td>46</td>
</tr>
<tr>
<td>On</td>
<td>34</td>
<td>47</td>
</tr>
<tr>
<td>On</td>
<td>34</td>
<td>48</td>
</tr>
<tr>
<td>On</td>
<td>34</td>
<td>49</td>
</tr>
</tbody>
</table>

Table 3 - Agitate Switch Time Cycle Selections

<table>
<thead>
<tr>
<th>Switch 6</th>
<th>Switch 7</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off</td>
<td>Off</td>
<td>2 minutes</td>
</tr>
<tr>
<td>On</td>
<td>Off</td>
<td>5 minutes</td>
</tr>
<tr>
<td>Off</td>
<td>On</td>
<td>10 minutes</td>
</tr>
<tr>
<td>On</td>
<td>On</td>
<td>60 minutes</td>
</tr>
</tbody>
</table>

Note: Standard switch settings for 1,350 gallon and smaller are 3, 6, and 8 “ON” and all others are “OFF.” Standard switch settings for 1,600 and larger coolers are 3, 7, and 8 “ON” and all others “OFF.”
2.9 Test Running Cooler

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

2.9.2 Move selector switch to “COOL” position. (Green pilot light will come on.)

Note: On coolers with dual or triple condensing units, one or all units may be turned on. When switches are in the position for all units cooling, both green pilot lights will come on.

2.9.3 Agitator will turn and refrigeration unit(s) will start. Slowly open suction service valve and liquid line 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 approximately the temperature control cut-out point that has been selected.

2.9.4 After water has been cooled and unit(s) stop, press the pressure-sensitive agitate switch on the front of the cabinet. The agitator will run for the time cycle selected, but the condensing 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). The temperature control set point and differential can be changed by changing the “ON” and “OFF” combinations of rocker switch numbers 1, 2, 3, and 4 on the digital circuit board. See Tables 1 and 2 for rocker switch settings.

2.9.5 To test prestart feature, with rocker switch number 8 in the “OFF” position, press the pressure-sensitive prestart switch on the front of control cabinet. Refrigeration unit(s) and agitator will run for the time cycle selected with rocker switch number 9 unless the milk is cooled to 34°F (1°C). Refrigeration unit(s) will cut off at 34°F, and cut on at 36°F. The prestart feature will only bring the refrigeration unit(s) on if the selector switch is in the “COOL” position.

2.10 Test Running Washing System

2.10.1 Remove outlet valve from cooler and insert jet-tube into cooler outlet until rubber adapter fits tightly over outlet ferrule.

2.10.2 Ensure that vent assembly is in place over milk inlet opening.

2.10.3 Remove the bowl labeled “Detergent,” add detergent, and replace bowl.

2.10.4 Remove the bowl labeled “Acid or Sanitizer,” add non-foaming food-grade acid cleaner, and replace bowl.

2.10.5 Move control cabinet selector switch to “WASH” position and advance Mueller Matic timer knob on control cabinet clockwise only to start system.

2.10.6 Observe entire operation through one complete cycle to see that each function takes place as marked on the Mueller Matic timer dial plate. Check all water connections for leaks. Observe spray pattern to see that all areas of cooler are being covered. Direction of spray can be changed by raising or lowering the pump on the adjustable leg stand. After locating pump assembly in the proper position, drill two No. 20 holes (with drill bit provided) in the tubular legs through the holes in the leg bracket. Install self-tapping screws to prevent leg slippage and misalignment of the pump assembly.

Note: Amber pilot light on control cabinet operates when selector switch is in “WASH” position.
2.10.7 If at any time your Mueller Matic does not operate properly, consult “Mueller Matic Troubleshooting Chart” in the “Maintenance Instructions.”

2.10.8 **Important Notes:**

2.10.8.1 To stop operation of the Mueller Matic, move timer knob on control cabinet *clockwise only* to “OFF” position.

2.10.8.2 The Automatic Washing System will not operate when the selector switch on the control cabinet is in the “OFF” or “COOL” positions.
Figure 9 - Single Unit Wiring Diagram Part No. 8800349
After the HiPerForm System has been installed and checked according to the preceding “Installation Instructions,” take the following steps for satisfactory operation of the cooler and washing system.

3.1 First Milking

Approximately 10 to 15 minutes prior to milking, sanitize cooler in the following manner:

3.1.1 Remove the bowl labeled “Acid or Sanitizer,” discard its contents, and rinse the bowl. Add the proper amount of sanitizing solution based on the concentration (ounces per gallon) recommended for the brand used. The concentration should be based on the gallons of rinse water shown in Table 4, “Water Consumption Chart.” Do not empty detergent bowl at this time.

3.1.2 With Mueller Matic pump and jet-tube in the washing position and selector switch on control cabinet in “Wash” position, advance Mueller Matic timer knob to the position marked “Acid Rinse.” While preparations are being made for milking, sanitizing will be completed, and the Mueller Matic will automatically drain the cooler and shut off.

Note: If preferred, sanitizing solution may be placed directly in the cooler by advancing Mueller Matic timer knob to the position marked “Acid Rinse,” and after water has started to enter the cooler, placing into the cooler the proper amount of sanitizing solution.

3.1.3 Move selector switch to “OFF” position, remove Mueller Matic pump and jet-tube from cooler, and replace outlet valve.

3.1.4 Move selector switch to “COOL” position no more than 5 minutes before adding warm milk.

3.1.5 Leave selector switch in “COOL” position. Automatic timer will operate agitator independently of refrigeration unit(s) for the time cycle selected with rocker switches on the Digital Circuit Board. The temperature control will operate agitator(s) and refrigeration unit(s) whenever cooling is required.

Table 4 - Mueller Matic Water Consumption Table

Use this chart for calculating the proper amount of detergent, acid, or sanitizer.

<table>
<thead>
<tr>
<th>Model</th>
<th>Orifice</th>
<th>Orifice Color Code</th>
<th>Water Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Detergent Wash Cycle</td>
</tr>
<tr>
<td>76 Series</td>
<td>1.2 gpm</td>
<td>HN</td>
<td>9.4 gallons</td>
</tr>
<tr>
<td></td>
<td>1.5 gpm*</td>
<td>HM</td>
<td>11.7 gallons</td>
</tr>
<tr>
<td></td>
<td>2.6 gpm*</td>
<td>HR</td>
<td>20.3 gallons</td>
</tr>
<tr>
<td></td>
<td>3.0 gpm*</td>
<td>HH</td>
<td>23.5 gallons</td>
</tr>
<tr>
<td>326 Series</td>
<td>1.5 gpm</td>
<td>HM</td>
<td>11.7 gallons</td>
</tr>
<tr>
<td></td>
<td>1.8 gpm*</td>
<td>HY</td>
<td>14.0 gallons</td>
</tr>
<tr>
<td></td>
<td>2.6 gpm*</td>
<td>HR</td>
<td>20.3 gallons</td>
</tr>
<tr>
<td></td>
<td>3.0 gpm*</td>
<td>HH</td>
<td>23.5 gallons</td>
</tr>
<tr>
<td>727 Series</td>
<td>1.5 gpm</td>
<td>HM</td>
<td>23.4 gallons</td>
</tr>
<tr>
<td></td>
<td>1.8 gpm*</td>
<td>HY</td>
<td>28.0 gallons</td>
</tr>
<tr>
<td></td>
<td>2.6 gpm*</td>
<td>HR</td>
<td>40.6 gallons</td>
</tr>
<tr>
<td></td>
<td>3.0 gpm*</td>
<td>HH</td>
<td>46.8 gallons</td>
</tr>
</tbody>
</table>

* Optional Orifice
3.2 Subsequent Milkings

3.2.1 Just prior to milking, press either of the pressure-sensitive switches on the front of the control cabinet labeled “Agitate” or “Prestart.” The “Agitate” switch (or the “Prestart” switch in the agitate only mode) will cause the agitator to run continuously for the time cycle that has been selected, blending warm and cold milk. During this period, warm milk entering cooler will cause refrigeration unit(s) to start. Agitator and refrigeration unit(s) will continue to run until milk is cooled to the temperature control cut-out.

The “Prestart” switch in the agitate and cool mode will override the temperature control causing agitator and refrigeration unit(s) to run continuously unless milk temperature reaches the low alarm point, 34°F (1.0°C). Condensing unit(s) will be automatically cut-off at 34°F (1.0°C) and cut-on at 36°F (1.5°C). Once the prestart time cycle expires, agitation and cooling will be controlled according to temperature control set point.

3.3 Butterfat Sampling

3.3.1 After pick-up tank truck driver records the temperature and amount of milk in the cooler, he will want to agitate milk for a butterfat sample.

3.3.2 To agitate milk for a sample, press the pressure-sensitive switch labeled “Agitate” on the front of the cabinet. The agitator will run for the time cycle that has been selected before shutting off automatically. Agitator can be stopped by pressing the pressure-sensitive switch again.

3.4 External Measuring Guide

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

3.4.2 Disconnect hose from fitting on outlet valve and dispose of the milk which drains from the hose and the tube.

3.4.3 Remove hex nut and quick-connect tube coupling from outlet valve and place in wash vat for hand cleaning.

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

3.4.5 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 from cooler and flushing from the top to remove milk residue, then reconnect the hoses.

3.5 Emptying Cooler

The following steps must be taken before pumping milk out of the cooler.

3.5.1 Move “Selector” switch on control cabinet to “OFF” position.

Caution: Be sure vent assembly is over milk inlet opening and release hold-down clamps on manhole cover to provide additional venting. To equalize pressure inside and outside of cooler during filling and emptying, it is recommended that vent assembly be kept on the inlet at all times.

3.5.2 Empty cooler and rinse out remaining milk solids with tepid water.
3.6 Washing Cooler

After cooler has been emptied, it should be washed in the following manner:

3.6.1 Remove outlet valve from cooler and insert jet-tube into cooler outlet until rubber adapter fits tightly over outlet ferrule.

3.6.2 To wash external 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 on top of cooler.

3.6.3 Be sure the vent assembly is properly installed to equalize pressure inside and outside of cooler during washing.

3.6.4 Remove the dispenser bowl labeled “Detergent” and discard its contents. Add the proper amount of detergent recommended for the brand used. The concentration should be based on the gallons of wash water shown in the Water Consumption Chart, Table 4.

Note: Save yourself repeated measuring by marking proper detergent and acid levels on bowls.

Caution: Never mix chlorinated sanitizers or detergent with acid. Be sure that there is no previous product residue in the bowl before adding acid.

3.6.5 Move Selector switch on control cabinet to “WASH” position and turn Mueller Matic timer knob clockwise only to automatically start system. The Mueller Matic will pre-rinse, wash, rinse, and acid rinse, then turn off automatically.

Note: During operation of the Mueller Matic, the pump will run for 30 seconds after the drain valve is opened. This is normal (see Chart 1, “Time Cycle Chart”) and serves to flush out small particles of sediment remaining in the cooler.

3.6.6 Sanitizing should be done immediately before milking according to procedures outlined under “Operating Instructions.”

3.6.7 If at any time the Mueller Matic does not operate properly, consult the “Mueller Matic Troubleshooting Chart.”

Chart 1 - 36-Minute Time Cycle Chart

<table>
<thead>
<tr>
<th>Circuit</th>
<th>0</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>25</th>
<th>30</th>
<th>35</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A Rinse Water</td>
<td>On</td>
<td>On</td>
<td>On</td>
<td>On</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
</tr>
<tr>
<td>2A Wash Water</td>
<td>Off</td>
<td>On</td>
<td>On</td>
<td>On</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
</tr>
<tr>
<td>3A Rinse-Acid/Sanitizer</td>
<td>Off</td>
<td>On</td>
<td>On</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
</tr>
<tr>
<td>6 Pump</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
<td>On</td>
<td>Off</td>
<td>On</td>
<td>Off</td>
<td>On</td>
</tr>
<tr>
<td>4A TM</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
<td>Off</td>
<td>On</td>
<td>Off</td>
<td>On</td>
<td>Off</td>
</tr>
</tbody>
</table>

Note: Times are double on Model 727 Series with 72-minute timer.
SECTION 4.0 - GENERAL MAINTENANCE INSTRUCTIONS

4.1 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:

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

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

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

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

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

4.1.6 For detailed cleaning and maintenance instructions, see section entitled, “Cleaning and Maintenance of Mueller Milk Coolers.”

4.2 Refrigeration Unit(s) Maintenance

Mueller HiPerForm refrigeration units require little maintenance. However, to ensure that they are able to do 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. A water filter and, in “hard” water areas, a water softener is recommended.

4.3 How to Save Service Calls

If your Mueller Model “OH” Milk Cooler fails to operate, consult “How to Save Service Calls” in this manual before calling your serviceman.

4.4 Adjusting Electronic Temperature Control Set Point

4.4.1 Turn off all electrical power to the cooler and refrigeration units.

4.4.2 Open wall-mounted control cabinet cover and locate rocker switches 1 through 4 on the circuit board on the front cover of the cabinet. Set point adjustment is accomplished by selecting the various combinations of “ON” and “OFF” positions of rocker switches 1 through 4 shown in Tables 1 and 2 in “Installation Instructions.”

4.4.3 Close control cabinet cover and turn on power to the cooler and condensing units.
4.5 **Mueller Matic Automatic Washing System Maintenance**

Your Mueller Matic is engineered to give you maximum service with minimum care. In order to ensure years of trouble-free service, the following periodic inspections and servicing should be performed:

4.5.1 Check hose for breaks or cracks and hose clamps for loose connections.

4.5.2 Clean water supply strainers regularly as follows:
   - 4.5.2.1 Close water supply valves and remove hose assemblies.
   - 4.5.2.2 Remove, clean, and replace strainers.
   - 4.5.2.3 Reinstall hose assemblies.
   - 4.5.2.4 Open water supply valves.

4.5.3 Clean dispenser bowl strainers as follows:
   - 4.5.3.1 Remove bowl.
   - 4.5.3.2 Remove bowl strainer retainer ring and bowl strainer.
   - 4.5.3.3 Clean strainer screen and install in the reverse order.

4.5.4 Auto-drain valve assembly:

   The auto-drain valve assembly (see Figure 11) is activated by water pressure. It can be disassembled for service or replacement of parts.

   The drain valve assembly controls the flow of water into the washing system. Amounts are metered by a neoprene flow-control orifice and will deliver proper amounts of water with pressures from 10 psig minimum to 75 psig maximum.

   **Note:** Water pressures over 75 psig will require a pressure regulator; otherwise, damage to the water solenoid valves and drain valve may result.

4.5.5 The timer is a precision electrical instrument. **Do not attempt** to disassemble the timer.

4.5.6 Oil top bearing in the pump motor once per year.

4.5.7 If at any time your Mueller Matic does not operate, consult the “Troubleshooting Chart” in this manual.
Figure 11 - Mueller Matic Pump Assembly
<table>
<thead>
<tr>
<th>Trouble</th>
<th>Cause</th>
<th>Correction</th>
</tr>
</thead>
</table>
   b. Selector switch on control cabinet in “OFF” or “COOL” position.  
   c. Main switch open.  
   d. Loose wire.  
   e. Light defective. | a. Replace fuse.  
   b. Move selector switch to “WASH” position.  
   c. Close switch.  
   d. Open control cabinet and check using wiring diagram.  
   e. Test by applying 230V directly to light terminals. Replace if defective. |
| 2. Drain valve will not stay closed. | a. Insufficient or irregular water pressure.  
   b. Defective timer.  
   c. Defective drain valve. | a. Increase water supply pressure.  
   b. Check for correct time interval as shown on “Time Cycle Chart,” Chart 1.  
   c. See Figure 11. |
| 3. Drain valve will not open. | a. Weak or broken water valve spring.  
   b. Diaphragm binding in piston jacket or stem binding in stem guide.  
   c. Obstruction in orifice. | a. Replace spring.  
   b. Lubricate diaphragm and stem or replace the diaphragm.  
   c. Disassemble and remove obstruction. |
| 4. Pump will not prime. | a. Insufficient water.  
   b. Water pressure too low. | a. Knob turned too far. (First rinse only affected.)  
   Clean screens; straighten hose.  
   Check timer against time cycle chart in manual. See Chart 1.  
   b. Raise pressure at water supply pump control if necessary. |
   b. Loss of water around cooler cover. | a. Check water pressure.  
   Check water pressure tank.  
   b. Adjust spray to minimize loss of water at cooler openings.  
   Note: Larger flow control(s) are provided for special field problems where an excessive amount of water is lost around the covers. See Table 4. |
   b. Irregular lid.  
   c. Dry gasket. | a. Replace.  
   b. Replace.  
   c. Moisten bowl lip (lubricate with food-grade lubricant). |
| 7. Pump will not start. | a. No power to pump.  
   b. Defective motor or capacitor. | a. Check pump electrical connections. Check wiring against diagram. Check timer.  
   b. Check for open winding, shorts, or grounds. |
| 8. Water not hot enough. | a. Too small or defective hot water heater.  
   b. Long piping run from hot water heater. | a. Repair or replace heater.  
   b. Insulate pipes or raise temp. setting at hot water tank. |
   b. Solenoid not opening.  
   c. Drain valve leaking.  
   d. Strainer plugged.  
   e. Plugged pipe or hose. | a. Remove drain valve assembly and clean orifice.  
   b. Check solenoid coil. Check wiring.  
   c. Increase water pressure to close plug.  
   d. Remove and clean.  
   e. Remove and clean. Align plug with seat. |
| 10. Areas of cooler not being cleaned. | a. Improper spray pattern.  
   b. Plugged spray head.  
   c. Incorrect spray head. | a. Adjust legs on pump and observe spray pattern.  
   b. Reverse flush.  
   c. See “Sizing Chart” and parts list for correct Jet-Tube assembly. |
5.1 Subcooling Valve

5.1.1 The unique feature of the HiPerForm R-22 refrigeration system is the use of a subcooling valve which controls the condenser liquid subcooling rather than evaporator superheat as is accomplished by the expansion valve in the conventional system. The subcooling valve is factory adjusted to maintain 10°F subcooling of the liquid leaving the condenser coil which effectively keeps the condenser coil drained of excess liquid, utilizing maximum coil surface for condensing purposes.

**Note:** Even though the subcooling valve is factory set to maintain 10°F subcooling, the service technician should check the subcooling before leaving the installation.

5.1.2 Referring to the cooling cycle (Figure 13): 10°F sub-cooled liquid leaves the condenser coil and flows to a section of the liquid line in contact with the suction line leading to the compressor. Liquid refrigerant is sub-cooled approximately another 10°F at this point by vapor in the suction line leading to the compressor.

5.1.3 Liquid then flows to the accumulator-heat exchanger which provides a further 30°F to 40°F of liquid subcooling and separates the liquid from the suction vapor. This protects the compressor against flood-back by returning only dry, essentially saturated vapor to the compressor together with the oil in normal circulation.

5.1.4 As the liquid, now sub-cooled a total of 50°F to 60°F, passes through the subcooling valve, its pressure is reduced to approximately the evaporator pressure. Since the flow control sensing element is near the condenser outlet and liquid refrigerant is greatly sub-cooled in the accumulator-heat exchanger before entering the evaporator, the evaporator will be flooded during operation.

5.1.5 Liquid carried over from the flooded evaporator is separated from the vapor in the accumulator-heat exchanger. Therefore, vapor leaving the accumulator-heat exchanger will be saturated, but it is superheated 2°F to 5°F where the suction line entering the compressor contacts the warm liquid line from the condenser.
5.2 Benefits of HiPerForm

The unique functions of the subcooling valve and accumulator-heat exchanger eliminate many problems inherent with conventional systems, and provide increased efficiency.

5.2.1 Longer compressor life is assured:

5.2.1.1 Because the evaporator is flooded during operation, compressor suction superheat is held to 2°F to 5°F, compared to 10°F to 40°F in conventional systems. The lower initial refrigerant temperature permits the compressor to operate cooler with less likelihood of failure due to excessive heat.

5.2.1.2 Positive Oil Return: As a direct result of the flooded evaporator, suction vapor returning from the evaporator is wet with liquid carry-over. This mixture carries oil in suspension much more readily than the dry, superheated suction gas in a conventional system. This mixture is then dumped into the accumulator-heat exchanger which separates the liquid from the vapor and also positively regulates the flow of the refrigerant-oil mixture to the compressor.

5.2.1.3 Lower head pressure is maintained because the subcooling valve controls the quantity of liquid in the condenser.

5.2.2 Increased operating efficiency is experienced under all conditions with HiPerForm because:

5.2.2.1 The flooded evaporator utilizes all of its surface for cooling without wasting valuable area for superheating. Since refrigerant flow is well in excess of the evaporation rate, maximum evaporator effectiveness is obtained.

5.2.2.2 Head pressure does not have to be raised at low ambient temperatures (down to -10°F). With HiPerForm, both efficiency and capacity are sharply increased at lower outdoor temperatures since head pressure can seek its own level and does not have to be raised. If this is hard to visualize, perhaps Figure 14, plotted with actual tests, will help.

Instructions:

1. Determine high-side pressure at P6 with accurate gauge.
2. From Refrigerant Pressure-Temperature Table, determine saturation temperature of high-side pressure.
3. Measure temperature of high-side liquid at subcooling valve remote bulb location T3.
4. Subtract temperature measured in Step No. 3 from saturation temperature read from tables in Step No. 2.

The difference is the amount of subcooled refrigerant.

Note: The above readings must be taken with the evaporator completely covered with milk or water at a product temperature below 45°F, and a condensing temperature of at least 95°F.

Example:

- P6 is 226 psig.
- Convert P6 pressure to saturation temperature which is 110°F.
- Line temperature at T3 is 100°F.

Results:

110°F - 100°F = 10°F subcooling
5.3 Difference Between HiPerForm and Conventional Systems

The essential difference between HiPerForm and conventional systems is important. In conventional systems the evaporator operates “starved” for refrigerant at low ambient temperatures because the head pressure, without being raised artificially, cannot force refrigerant through the expansion valve fast enough to meet cooling requirements. In HiPerForm, the evaporator operates flooded at all times because the subcooling valve prevents refrigerant from collecting in the condenser.

5.3.1 Dual and triple unit HiPerForm systems are available on larger coolers.

5.3.1.1 Each dual or triple unit application incorporates a selector switch allowing use of one unit for low milk level periods or all units for higher or normal milking periods. This reduces operating costs.

5.4 Important Notice!

Although the HiPerForm R-22 refrigeration system is one of the most dependable systems known and will operate safely over wide variations of outdoor ambient conditions, like any mechanical device, it will from time to time require service attention. In our discussion up to this point, we have tried to provide essential background information so that the serviceman can intelligently diagnose the trouble and make the proper corrections. The following is a more detailed description of the components and troubleshooting information.
5.5 HiPerForm Components

5.5.1 Subcooling Valve:

5.5.1.1 Probably the single most important system component, whose function must be thoroughly understood by the serviceman, is this valve. This is especially true, since it physically resembles a thermostatic expansion valve, but its operation is radically different. The manufacturer's model number stamped on the valve is the key to identification. The second letter, “S”, designates this as a subcooling type valve. The sensing bulb of the subcooling valve is clamped to the liquid line leaving the condenser in contrast to the suction vapor line location of a standard thermostatic expansion valve bulb.

5.5.1.2 Liquid R-22 refrigerant is metered and expanded to approximately evaporating pressure as it passes through the subcooling valve (see Figure 15). The subcooling valve is internally equalized to sense condenser pressure on the underside of the diaphragm and sensing bulb pressure on the top side.

5.5.1.3 At a given condensing pressure, should the bulb temperature rise, the subcooling valve throttles to a more nearly closed position so more liquid will accumulate in the condenser to satisfy the subcooling requirement. If the liquid R-22 refrigerant is subcooled more than 10°F the temperature of the sensing bulb will cause a reduced pressure on top of the diaphragm. The condensing pressure on the underside of the diaphragm, aided by a spring, opens the subcooling valve further to reduce the amount of liquid held back in the condenser, and this reduces the amount of liquid subcooling.

In other words, the subcooling valve opens as its bulb becomes cooler, just the opposite from the conventional expansion valve, which opens as its bulb becomes warmer.

5.5.1.4 The bleed port (shown in Figure 15) is essential to valve operation and overall system performance. It has two very important functions:

5.5.1.4.1 The bleed port permits rapid equalization of suction and discharge pressure following shutdown (approximately 4 minutes).

5.5.1.4.2 The bleed port permits the valve bulb to sense any increase in subcooling even while the valve port is closed. Such an increase causes the valve to open and maintain approximately 10°F subcooling.

Without this bleed port there would be no refrigerant flow through the valve. With the flow of the refrigerant completely shut off, the valve bulb could not sense increasing subcooling and the valve would remain closed. Since the valve is closed at start-up, it is easy to see how important the bleed port is.

5.5.1.4.3 A liquid line dryer is installed ahead of the subcooling valve to protect the bleed port from being clogged. The dryer may be replaced if necessary.
5.5.2 Accumulator-Heat Exchanger:

In the accumulator-heat exchanger (Figure 16) high pressure liquid from the condenser coil is sub-cooled 30°F to 40°F while passing through a coil in the bottom of the accumulator. This heat exchanger, besides subcooling the high temperature liquid, boils off accumulated liquid returning from the evaporator. Oil is returned to the compressor through an orifice in the bottom of the U-tube. As it passes through the section of suction line soldered to the liquid line, any liquid refrigerant entering the U-tube with the oil is vaporized before it enters the compressor.
5.6 Importance of Proper Refrigerant Charge

While it is true that the amount of refrigerant charge in HiPerForm is less critical than in conventional systems, it must be held within specified limits. Most of the time only 80% or less of the specified charge is actually required for satisfactory operation at various operating temperatures. The storage capacity of the accumulator-heat exchanger which acts as a reservoir is important here.

5.7 Symptoms of Undercharge

Indications that a system may be undercharged include: the unit runs for excessively long periods of time, is unable to hold blend temperatures under 50°F, or the compressor cycles intermittently.

5.8 Checking for Undercharge

5.8.1 The most accurate way to check the refrigerant charge is the weigh-in/weigh-out method. See 5.9, “Refrigerant Charging” for proper procedures. See Table 6 for refrigerant charge.

5.8.2 For a quick check of the refrigerant charge, check the TD across the accumulator. With the product temperature below 45°F, the TD across the accumulator will be approximately 30°F to 40°F. If the TD is lower than 30°F to 40°F, then the weigh-in/weigh-out method should be used to assure the proper charge.

5.8.3 Table 7 is a comparison of milk temperature to a corresponding suction pressure on a system operating under normal conditions.

Table 5 - HiPerForm Refrigeration Units Valve Selection and Refrigerant Charge

<table>
<thead>
<tr>
<th>HiPerForm Refrigeration Units</th>
<th>Subcooling Valve Selection</th>
<th>Refrigerant Charge</th>
<th>Energy Star OHSE'</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subcooling Valve No.</td>
<td>Tri-Plate Fre-Heaters®</td>
<td>HPF Air-Cooled Units'</td>
<td></td>
</tr>
<tr>
<td>Unit Hp</td>
<td>Part No.</td>
<td>BS88429.**</td>
<td>BS88429.**</td>
</tr>
<tr>
<td>2.0 HPF</td>
<td>31431</td>
<td>10 lbs</td>
<td>11.0 lbs</td>
</tr>
<tr>
<td>3.0 HPF</td>
<td>31431</td>
<td>10 lbs</td>
<td>11.5 lbs</td>
</tr>
<tr>
<td>3.0 HPF*</td>
<td>31431</td>
<td></td>
<td>9.5 lbs</td>
</tr>
<tr>
<td>3.5 OHSE</td>
<td>8822369</td>
<td>BS94541.**</td>
<td></td>
</tr>
<tr>
<td>4.0 HPF</td>
<td>31429</td>
<td>BS94541.**</td>
<td>14 lbs</td>
</tr>
<tr>
<td>5.0 HPF(S)</td>
<td>31430</td>
<td>BS94555.**</td>
<td></td>
</tr>
<tr>
<td>5.0 OHSE</td>
<td>8822106</td>
<td>BS94555.**</td>
<td></td>
</tr>
</tbody>
</table>

* = 3 hp units with small condenser (34" x 20”).
' = Refrigerant charge is the same with or without Model “D” Fre-Heater.
(S) = Denotes scroll compressor models.

Table 6 - Milk Temperature—Suction Pressure

<table>
<thead>
<tr>
<th>Milk Temperature (Fahrenheit)</th>
<th>Normal Suction Pressure (psig)</th>
</tr>
</thead>
<tbody>
<tr>
<td>75°</td>
<td>95 - 105</td>
</tr>
<tr>
<td>60°</td>
<td>75 - 85</td>
</tr>
<tr>
<td>50°</td>
<td>63 - 73</td>
</tr>
<tr>
<td>40°</td>
<td>52 - 57</td>
</tr>
<tr>
<td>38°</td>
<td>49 - 55</td>
</tr>
</tbody>
</table>

Note: Suction pressure may vary depending on refrigeration unit horsepower.
5.9 Refrigerant Charging

The recommended method for adding refrigerant to the HiPerForm system is the “Weight-Out/Weight-In Method”.

5.9.1 Overcharge Caution!

Probably the most important precaution in charging the HiPerForm R-22 refrigeration system is to avoid overcharging. While there is good refrigerant capacity tolerance in the accumulator-heat exchanger, if one continues to add refrigerant once the accumulator-heat exchanger is full, there is nothing to prevent liquid carry-over to the compressor with the usual serious consequences. Furthermore, in the HiPerForm R-22 refrigeration system the discharge pressure does not rise sharply as in the conventional system to sound a warning of this danger. The best indication of such a condition is reduced temperature of the hot gas line leaving the compressor. (This line should normally be over 150°F.)

5.9.2 Refrigerant Charging - Weigh-Out/Weigh-In Method:

Refer to Figure 13, “Refrigerant Piping Schematics”, which displays the access port connections described below.

5.9.2.1 With a clean evacuated system, connect the manifold gauges to Access Ports P2 and P6.

5.9.2.2 Connect the center manifold hose to a cylinder of new or reclaimed, ARI 700-88 specifications, R-22.

5.9.2.3 Weigh and record the gross weight of the R-22 refrigerant cylinder.

5.9.2.4 Purge any air from the manifold gauge hoses, as specified by EPA Section 608, de-minimus release.

5.9.2.5 Break the refrigeration system’s evacuation with R-22 vapor, charging into access port at P2.

5.9.2.6 When the system pressure rises to approximately 30 psig, energize the compressor.

5.9.2.7 Monitoring the weight of the refrigerant cylinder, weigh in the remaining refrigerant charge, in liquid state, at Access Port P2.

**Service Note:** Liquid refrigerant must always be charged upstream of the accumulator heat exchanger, Access Ports P2 or P3, to ensure protection to the compressor against liquid refrigerant slugging.

5.9.2 Checking Refrigerant Charge, Weigh-Out Method

To confirm the refrigerant charge on an operating system, the charge should be weighed-out. Refer to Figure 13, “Refrigerant Piping Schematics,” which displays the access-port connections described below.

5.9.2.1 Connect the manifold suction gauge to Access Port P2 and high-side gauge to Access Port P6. Connect the center hose to the liquid access port of a clean evacuated 4BA or 4BW recovery cylinder.

5.9.2.2 Purge any air from the manifold gauge hoses, as specified by EPA Section 608, de-minimus release.
5.9.2.3 Weigh and record the gross weight of the refrigerant recovery cylinder.

5.9.2.4 Energize the OHSE compressor and open the valve on the recovery cylinder.

5.9.2.5 Open the high-side valve on the refrigerant manifold.

5.9.2.6 Completely close or front-seat the liquid service valve (P6) and then open it two turns counterclockwise.

5.9.2.7 Allow the system to operate until the compressor cycles off on the low-pressure switch, approximately 5 psig.

5.9.2.8 Completely close or front-seat the liquid service valve (P6) clockwise.

5.9.2.9 While monitoring the suction pressure at Access Port P2, manually operate the compressor by holding the contactor armature in until the suction pressure falls to 0 psig. Do not allow the system to pump into a vacuum.

5.9.2.10 When 0 psig is observed on the suction gauge at P2, de-energize the compressor and close the liquid valve on the recovery cylinder.

5.9.2.11 Allow the system to set idle for a few minutes and observe the suction pressure at P2. If it rises above 5 psig, reopen the recovery cylinder’s liquid valve and repeat the procedure starting at Step 5.9.2.9.

5.9.2.12 Weigh the gross weight of the recovery cylinder, subtracting the initial gross weight recorded in Step 5.9.2.3. This will be the weight of refrigerant removed from the system.

5.9.2.13 This weigh-out procedure will leave approximately .68 kg (1.5 pounds) of refrigerant in the system which should be added to the weight removed to verify the actual refrigerant charge that was in the system.

**Service Note:** Remember that approximately .68 kg (1.5 pounds) will remain in the system after performing the weigh-out method described in this section. This must be subtracted from the recommended charge weight when recharging the system to prevent an overcharge of refrigerant.

### 5.10 Malfunction of Subcooling Valve

5.10.1 The HiPerForm system is designed so that if the subcooling valve malfunctions, it will fail in the open position so the compressor is inherently protected at all times. Here again remember that the control bulb is always clamped to the liquid line and the function of the subcooling valve is to maintain constant subcooling in the liquid refrigerant leaving the condenser, which is the unique feature of the HiPerForm system.

5.10.2 The most likely malfunctions in the subcooling valve are a ruptured diaphragm or loss of charge from the control element which will result in the valve failing in the open position (see Figure 15). A subcooling valve with its sensing element loose or detached from the liquid line will also permit the valve to open.

5.10.3 Determining whether or not a subcooling valve is good by looking at it when completely disconnected from the refrigeration system requires re-orientation from the characteristics of thermostatic expansion valves. For example, if a thermostatic expansion valve has lost its control element charge, the valve will be closed when it is disconnected from the system. Under similar conditions, a subcooling valve which has lost its control element charge will be fully opened when disconnected.
5.10.4 The following are typical symptoms of a subcooling valve which has failed in the “OPEN” position:

5.10.4.1 The most important indicator is significantly lower (30 to 50 psig) than normal discharge pressure (see Figure 17). This is due to the reduction in subcooling and condenser load (heat rejection), as some vapor is being condensed in the accumulator-heat exchanger.

5.10.4.2 Liquid tends to collect in the accumulator-heat exchanger. At higher outdoor temperatures vapor from the condenser may be condensing in the accumulator coil with a marked reduction of temperature differential through the accumulator. This will also cause a decrease in temperature difference between the milk and the evaporator temperature.

Note: To determine evaporator temperature, take suction pressure reading and convert to equivalent saturation temperature.

5.10.4.3 Liquid leaving the condenser will not be sub-cooled.

Figure 17 - Normal Operating Head Pressures for HiPerForm Air-Cooled Systems

5.11 Replacing Subcooling Valve

5.11.1 Pump the refrigerant charge into the high side of the system by closing the high side service valve. Close the low side service valve when the system shuts off at the low pressure setting. Recover the remaining refrigerant from the low side of the system with an approved recovery unit.

5.11.2 Remove defective subcooling valve and its sensing bulb.

5.11.3 Install new subcooling valve. Attach sensing bulb on a vertical liquid line from the condenser, with the capillary line pointed down (see Figure 18). Clamp sensing bulb securely to liquid line and insulate thoroughly.

5.11.4 Evacuate low side of system to 1000 microns.

5.11.5 Weigh in correct charge of R-22 refrigerant into system that was removed in 5.11.1, open service valves and return system to operation.
5.12 **Description of Digital Electronic Control System**

The electronic control circuit performs the functions of (1) sensing the product temperature, (2) displaying the temperature with a digital display, (3) starting and stopping the condensing unit and agitator to control the product temperature, (4) providing an alarm switch, and (5) automatically agitating the milk at the time interval selected.

A variety of selections are available in the features of the HiPerForm Micro Processor control cabinet, including the temperature control set point and differential, and the automatic interval time cycles. Different selections are obtained through various combinations of “ON” and “OFF” positions of the rocker switches on the circuit board. See Table 1, 2, and 3 for rocker switch settings.

The temperature control components are:

5.12.1 **Sensor:**

Located in a raceway at the front or rear of the cooler, it senses the product temperature. Electrical resistance through the sensor varies according to the temperature it senses.

5.12.2 **Circuit Board with Digital Display:**

Located in the HiPerForm control cabinet, the circuit board senses changes in resistance through the sensor by means of a low-voltage electrical signal across the sensor connections on the board. Based on the resistance it senses, the board displays the product temperature on its digital display and energizes and de-energizes the 24-volt output to the cooling relay coil and line voltage to one side of the agitator relay coil.

The circuit board intermittently closes the circuit between the terminals marked “Alarm Switch” to cause the alarm light to flash when the display reads above the high alarm point that is selected, or below 34°F. The switch closes so that the alarm light is on steady when the display temperature is in the safe range. This is a switch only; the alarm must be driven by its own power source.

The circuit board automatically energizes the agitate relay at the time interval selected, either 3 minutes out of every 18 minutes or 3 minutes out of every 30 minutes, to provide automatic interval agitation.
5.12.3 Cooling Relay:

Located in the HiPerForm control cabinet, its coil is energized by the 24-volt output from the circuit board. The relay opens and closes the line voltage circuit that starts and stops the refrigeration unit(s).

5.12.4 Agitator Relay:

Located in the HiPerForm control cabinet, its coil is energized by the T1 agitate output terminal on the circuit board. The T1 agitate terminal is internally switched in the circuit board to energize the agitator relay with the cooling relay simultaneously. It also energizes the agitator relay at the time cycle selected for automatic interval agitation.

5.13 Troubleshooting and Replacement of Electronic Components

5.13.1 Testing of Sensor:

5.13.1.1 The sensor can be checked by measuring the product temperature with a calibrated thermometer and then measuring the resistance through the sensor with an accurate ohmmeter. These readings should correspond to Table 7 (Fahrenheit) and Table 8 (Celsius).

5.13.1.2 To measure sensor resistance, disconnect sensor leads from circuit board and connect sensor leads to ohmmeter leads. (Do not hold sensor leads to ohmmeter leads with your fingers, since body resistance will introduce an error.)

**Note:** Allow at least 5 minutes for heat transfer through cooler line and sensor, especially when a sudden change in product or water temperature has occurred.

5.13.1.3 If the resistance reading of the sensor varies by more than 2°F (1.1°C), it should be replaced as follows:

The temperature sensor is located in the raceway in the front or rear of the cooler beneath the small access plate next to the conduit connector or the front right-hand leg channel (see Figure 6).

5.13.1.3.1 Turn off power to cooler and condensing units.

5.13.1.3.2 Remove access plate.

5.13.1.3.3 Disconnect temperature sensor leads.

5.13.1.3.4 Tug gently on sensor leads to dislodge sensor from its seat in bottom of raceway. Pull sensor up through raceway to remove it.

5.13.1.3.5 Lower new sensor into raceway and use 3/8” diameter flexible plastic hose to push it down into the raceway until it is felt to firmly seat in the bottom.

5.13.1.3.6 Connect new sensor leads to proper connections.

5.13.1.3.7 Replace access plate.

5.13.1.3.8 Turn on power.
5.13.2 Testing of Circuit Board:

The circuit board can be tested by substituting known resistance values for the sensor to stimulate the sensor resistance at various temperatures. This can be done by disconnecting the sensor leads from the circuit board and connecting in its place either a Mueller Electronic Control Temperature Sensor (Part Number 31392 for Fahrenheit, Part Number 31439 for Celsius) or a resistance decade box.

The Mueller Simulator Unit provides the necessary temperature settings for convenient calibration. If a decade box is used, refer to Table 7 (Fahrenheit) or Table 8 (Celsius) for resistance values and corresponding temperatures, then set decade box accordingly. Recommended temperature check points are 60°F, 30°F, and 36°F to 42°F (30°C, 0°C, and from 2°C to 6°C).

At selected settings, check digital display, 24-volt output and alarm switch. The alarm switch should close intermittently when the display reads above the selected high alarm point or below 34°F (1°C).

**Note:** If the alarm switch is checked with an ohmmeter, you will notice that when the switch closes the ohmmeter will read approximately 7,000 ohms instead of 0 ohms. This is due to the nature of the electronic switch and does not indicate a defect in the switch.

### Table 7 - Temperature Resistance Table (Fahrenheit)

<table>
<thead>
<tr>
<th>Temperature Degrees Fahrenheit</th>
<th>Resistance (Ohms)</th>
<th>Temperature Degrees Fahrenheit</th>
<th>Resistance (Ohms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>35,629</td>
<td>45</td>
<td>23,207</td>
</tr>
<tr>
<td>35</td>
<td>30,803</td>
<td>46</td>
<td>22,572</td>
</tr>
<tr>
<td>36</td>
<td>29,928</td>
<td>47</td>
<td>21,957</td>
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<td>37</td>
<td>29,082</td>
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</tr>
<tr>
<td>38</td>
<td>28,263</td>
<td>49</td>
<td>20,784</td>
</tr>
<tr>
<td>39</td>
<td>27,469</td>
<td>50</td>
<td>20,224</td>
</tr>
<tr>
<td>40</td>
<td>26,701</td>
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<tr>
<td>41</td>
<td>25,957</td>
<td>54</td>
<td>18,151</td>
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<td>42</td>
<td>25,236</td>
<td>56</td>
<td>17,207</td>
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<td>43</td>
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<td>44</td>
<td>23,862</td>
<td>60</td>
<td>15,482</td>
</tr>
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</table>

### Table 8 - Temperature Resistance Table (Celsius)

<table>
<thead>
<tr>
<th>Temperature Degrees Celsius</th>
<th>Resistance (Ohms)</th>
<th>Temperature Degrees Celsius</th>
<th>Resistance (Ohms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>33,600</td>
<td>9</td>
<td>21,240</td>
</tr>
<tr>
<td>1</td>
<td>31,890</td>
<td>10</td>
<td>20,220</td>
</tr>
<tr>
<td>2</td>
<td>30,270</td>
<td>11</td>
<td>19,260</td>
</tr>
<tr>
<td>3</td>
<td>28,750</td>
<td>12</td>
<td>18,350</td>
</tr>
<tr>
<td>4</td>
<td>27,310</td>
<td>13</td>
<td>17,480</td>
</tr>
<tr>
<td>5</td>
<td>25,960</td>
<td>14</td>
<td>16,660</td>
</tr>
<tr>
<td>6</td>
<td>24,670</td>
<td>15</td>
<td>15,890</td>
</tr>
<tr>
<td>7</td>
<td>23,470</td>
<td>16</td>
<td>15,160</td>
</tr>
<tr>
<td>8</td>
<td>22,320</td>
<td>30</td>
<td>8,110</td>
</tr>
</tbody>
</table>
5.14 **Calibration of Electronic Components**

Figure 24 illustrates the location of the digital display trim pot that is used for calibration of the temperature display.

Adjustment of the trim pot does not affect the settings of the temperature control set point.

5.14.1 Calibration procedure using simulator unit or decade box:

5.14.1.1 Turn off power to both the HiPerForm control cabinet and to the refrigeration units.

5.14.1.2 Disconnect yellow wires from circuit board terminals marked “Sensor.”

5.14.1.3 Connect simulator unit or decade box to terminals marked “Sensor.”

5.14.1.4 Turn on power to control cabinet.

5.14.1.5 Set simulator unit at any of the available temperature settings on the simulator.

5.14.1.6 If necessary, adjust trim pot to obtain correct reading on digital display.

5.14.1.7 Turn off power, remove simulator unit or decade box, and reconnect yellow wires.

5.14.1.8 Turn on power.

5.14.1.9 Add sufficient water or product to cover at least half of agitator blade and cool to 38°F to 40°F.

5.14.1.10 Allow five minutes for heat transfer through cooler liner and sensor, then check temperature with a calibrated thermometer.

5.14.1.11 If necessary, adjust trim pot until digital display agrees with calibrated thermometer.

5.14.2 Calibration procedure using calibrated thermometer (Fahrenheit):

**Note:** When observing digital display readings in this procedure, allow several minutes for heat transfer through cooler liner and sensor, especially when a sudden change in product or water temperature has occurred.

5.14.2.1 Add sufficient water or product to cover at least half of agitator blades.

5.14.2.2 If necessary, adjust trim pot on the circuit board until the digital agrees with calibrated temperature.

5.14.3 If the circuit board’s digital display cannot be calibrated or if the temperature control or alarm switch does not operate as indicated in these instructions, the circuit board may be replaced as follows:

5.14.3.1 Turn off power to the milk cooler and to the refrigeration units at main disconnect switches.

5.14.3.2 Remove cabinet cover screws and open the hinged cabinet cover.

5.14.3.3 Disconnect wires from terminal strip on digital circuit board, and pull flexible connector from socket on circuit board. Remove circuit board by deflecting the spring clips that hold it in place.
5.14.3.4 Reverse procedure to install new board.

**Caution:** Polarity of power supply connections at circuit board must be strictly followed as shown in wiring diagram. Reversed polarity will damage the circuit board.

5.14.3.5 Turn on power. Wait a few minutes. Check temperature cut-in and cut-out to ensure proper operation.

**Figure 19 - Digital Electronic Circuit Board**

- **Alarm Switch** - (Switch closure only.)
- **Low Voltage Sensor** - Use caution **not** to apply line voltage to sensor circuit.
- **230 Volt Line** - Note that polarity of the power supply must be strictly followed as shown in the wiring diagram. Reversed polarity will result in damage to the circuit board.
- **T1 Agitate** - Internally switched to provide L1 power at this terminal for automatic interval agitation and simultaneously with 24 volt output.
- **Cool** - 24 Volt D.C. Output
- **Trim Pot**
- **Flexible Connector Socket**

See Tables 1, 2, and 3.
### Chart 3 - Troubleshooting Chart for Electronic Components

<table>
<thead>
<tr>
<th>Complaint or Symptom</th>
<th>Possible Causes</th>
<th>Verification Procedure</th>
<th>Remedy</th>
</tr>
</thead>
</table>
| 1. Digital display shows “PF”. | a. Open sensor.  
b. Open sensor circuit.  
c. Open in board circuitry.  
d. Shorted sensor circuit.  
e. Shorted sensor circuit.  
f. Short in board circuitry. | a. Check resistance through the sensor (see Table 7 or 8).  
b. Check for Open in Sensor Circuit from the cooler to the HiPerForm cabinet.  
c. Check board with simulator unit (see 5.14.2).  
d. Check resistance through the sensor.  
e. Check for short in sensor circuit from the cooler to the HiPerForm cabinet.  
f. Check board with simulator unit (see 5.14.2). | a. Replace sensor if open.  
b. Repair break in the circuit.  
c. Replace circuit board.  
d. Replace sensor if shorted.  
e. Repair short in the circuit.  
f. Replace circuit board. |
| 2. Cooling relay won’t close. | a. Temperature control set point selector set too high.  
b. Defective cooling relay.  
c. Defective circuit board. | a. Check temperature control setting (see 5.14.2).  
b. Check for 24-volt at relay coil.  
c. Check 24-volt output on circuit board with simulator unit (see 5.14.2). | a. Lower temperature control.  
b. Replace relay.  
c. Replace circuit board. |
| 3. Digital display doesn’t agree with calibrated thermometer in the milk. | a. Circuit board out of calibration.  
b. Sensor out of tolerance. | a. Check circuit board (see 5.15.2).  
b. Replace sensor. |
| 4. Alarm on, milk temperature too low, condensing unit won’t shut off. | a. Contacts on cooling relay arced. | a. Turn off power to control cabinet and condensing units, remove wires from terminals 4, 6, 7, and 9 on relay and check for continuity with ohmmeter between 4 and 7, and 6 and 9. | a. Replace relay. |
| 5. Digital display shows “LO” or “0.0.” | a. Temperature below 30°F.  
b. Open or disconnected sensor. | a. Check milk temperature.  
b. See Symptom 1, Verification Procedure b and c. | a. Allow milk to warm above 30°F.  
b. See Symptom 1, Remedy b and c. |
| 6. Digital display shows “HI” or “9.9.” | a. Temperature above 185°F.  
b. Shorted sensor. | a. Check temperature.  
b. See Symptom 1, Verification Procedure d, e, and f. | a. Allow temperature to lower.  
b. See Symptom 1, Remedy d, e, and f. |
SECTION 6.0 - CLEANING & 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 several hours at any one time.
DON'T let pails, tools, or wet objects lie on the surface even overnight.
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 clean 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 the 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.
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 Check air-cooled condenser to be sure it is not partially clogged with dust, lint, or debris. It can be brushed, vacuumed, or blown-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.

7.1.4 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.

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

7.1.6 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. 
