E-Star® OESE Condensing Unit

3.5 and 5 HP HFC

INSTALLATION AND OPERATION MANUAL

Part No. 8828747

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E-Star OESE Condensing Unit 3.5 and 5 HP HFC

INSTALLATION AND OPERATION MANUAL

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Section 1.0 – Introduction

1.1 GENERAL SPECIFICATIONS

Mueller® E-Star OESE condensing units are engineered to maximize the energy efficiency and cooling capacity of a milk cooling system. Custom and specialized components consist of the following:

1. A quiet, energy-efficient Copeland® "ZB" scroll refrigeration compressor, designed for commercial refrigeration service rather than air conditioning, provides improved performance over the entire milk cooling temperature range. An oil sight glass, oil fill/drain port, and screw electrical terminals are added bonuses that ensure long-term reliability and serviceability.

2. An accumulator heat exchanger with a proprietary subcooling coil maximizes refrigeration capacity while protecting the compressor from liquid refrigerant.

3. A custom tube-and-fin condenser with rifled tubing and integral subcooling loop provides an enhanced heat exchange surface. The subcooling loop maintains subcooled liquid refrigerant to the thermal expansion valve, ensuring maximum evaporator efficiency.

4. A single, variable speed, high-efficiency fan motor provides maximum condensing efficiency over a wide range of ambient temperatures.

5. An electrical enclosure is designed for safety, ease of installation, and serviceability. A resistive heater is included for reeliable operation during colder ambient temperatures.

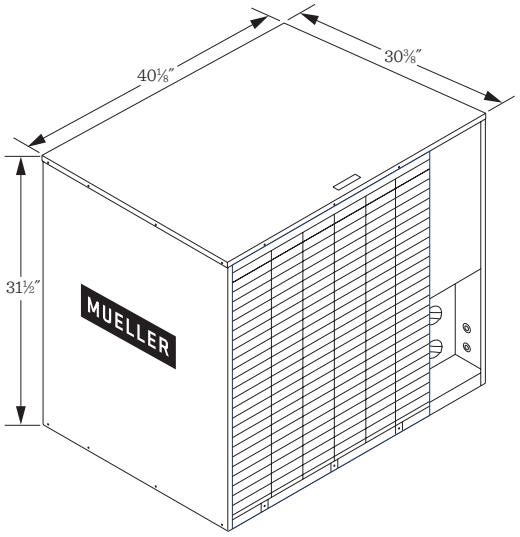
6. The three-piece galvanized steel cover with an attached steel grill provides safe operation plus offers easy service access.

7. Rust-resistant brass service valves are located for easy access without removing the cover.

TABLE 1: DIMENSIONS AND WEIGHT

Width		101.92 cm	40⅛ in
Depth		77.15 cm	30⅜ in
Height		80.00 cm	31½ in
Approximate Weight	**5 HP**	176 kg	388 lb
	3.5 HP	162 kg	358 lb

FIGURE 1: DIMENSIONS AND WEIGHT



1.2 TECHNICAL SUPPORT

This manual provides basic installation and operating information for Mueller E-Star OESE condensing units. Please contact your local Paul Mueller Company Sales and Service Representative if you require additional technical assistance pertaining to installation or operating procedures.

Manufacturer's support is available by contacting the following:

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

1.3 INSTALLATION INFORMATION

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

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

United States Environmental Protection Agency (EPA) regulations require that any technician performing refrigerant installation or service on a high-pressure appliance be certified as a Type II Technician in accordance with Section 608 of the Clean Air Act. Clean Air Act regulations may change or differ, depending on locality. It is the responsibility of the technician performing the refrigerant service and/or installation to abide by all regulatory requirements and procedures for the locality, state, and country.

Section 2.0 – Installation

2.1 INSPECTION

Each shipment should be carefully checked for shortages or concealed damage. Any shortage or damage must be reported to the delivery carrier at the time of delivery.

Damaged material becomes the delivery carrier's responsibility and should not be returned to the manufacturer unless prior approval is obtained.

2.2 HANDLING

IMPORTANT: Equipment used to move or lift this equipment must be rated for the weight of the equipment. See Table 1 for equipment weight.

2.3 LOCATION

When choosing a location for the Mueller E-Star OESE condensing unit, consider these items:

- **Environment:** The unit must be located where it is protected from extreme temperatures of –30°F (–34.4°C) and below or 115°F (46.1°C) and above.
- **Condenser Air Flow:** Ensure proper provisions for adequate air flow to the condenser. When installing the condenser facing a wall, the distance to the wall must be a minimum of 18 in (45.72 cm) with non-restricted air flow at the top, left, and right sides. Be especially cautious of installation methods that would allow the condenser air flow to recirculate and conditions that would allow dust or oil to enter the condenser.
- **Serviceability:** The condensing unit should be located with the compressor and electrical enclosure accessible for service. ***Do not*** pipe refrigerant lines in front of the electrical enclosure.
- **Efficiency:** Locate the condensing unit as close to the evaporator as possible. This will improve efficiency by reducing pressure drop in the refrigerant piping.
- **Lubrication:** For proper oil return, ***do not*** install the condensing unit above the height of the evaporator, and the suction line returning from the evaporator should be sloped towards the condensing unit.

2.4 REFRIGERATION PIPING AND EVACUATION

Refrigeration lines should be purged with dry nitrogen when brazing connections to prevent internal oxide formation. Proper refrigerant practices as outlined in ASHRAE 15-1994 should be followed.

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

Refrigerant piping should be installed with long-radius bends or fittings.

E-Star OESE condensing units are shipped with a dry nitrogen holding charge. The unit, refrigerant lines, and evaporator circuit will require a triple system 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: Installation technicians must follow proper refrigerant practices as outlined in ASHRAE 15-1994.

TABLE 2: LIQUID LINE SIZING

Compressor Horsepower	Equivalent Length of Pipe (Feet)		
	< 30′	30′ – 50′	50′ – 100′
3.5	½	½	½
5	½	½	⅝
7.5	⅝	⅝	⅝
9	⅝	⅝	⅞

Paul Mueller Company recommends the shortest pipe run possible.

TABLE 3: SUCTION LINE SIZING

Compressor Horsepower	Equivalent Length of Pipe (Feet)		
	< 30′	30′ – 50′	50′ – 100′
3.5	⅞	1⅛	1⅛
5	1⅛	1⅛	1⅜
7.5	1⅛	1⅜	1⅝
9	1⅜	1⅝	2⅛

Paul Mueller Company recommends the shortest pipe run possible.

TABLE 4: DISCHARGE LINE SIZING TO AND FROM THE FRE-HEATER®

Compressor Horsepower	Equivalent Length of Pipe (Feet)
	0′ – 50′
3.5	⅞
5	⅞
7.5	1⅛
9	1⅛

Paul Mueller Company recommends the shortest pipe run possible.

TABLE 5: CONDENSING UNIT CONNECTION SIZES

Compressor Horsepower	Liquid Line	Suction Line	Discharge Line (Fre-Heater®)
3.5	½	⅞	½
5	⅝	⅞	½
7.5	⅝	1⅝	1⅛
9	⅝	1⅝	1⅛

2.5 ELECTRICAL CONNECTIONS

Prior to installation, verify equipment is compatible with site electrical requirements (e.g., voltage, phase, and hertz). Ensure that all electrical connections are secure and correspond with wiring schematics.

Following local and National Electrical Code (NEC) regulations and procedures, connect a fused-disconnect power supply of the proper voltage and phase to the condensing unit's electrical enclosure.

The control circuit is designed to be operated by a 24-VAC supply. See warning statement below.

Refer to the electrical schematics in Section 7 for connection details.

WARNING: Mueller E-Star OESE condensing units are prewired for low-voltage, 24-VAC control circuit input. Connecting high-voltage control to this circuit will cause equipment failure and a possible electrical hazard.

The control circuit can be modified for high-voltage supply in installations that do not utilize a Mueller low-voltage refrigeration control. Refer to Section 7.0 for details.

2.6 PUMP-DOWN INSTALLATIONS

An optional hard start kit is available for single-phase models utilizing a refrigerant pump-down solenoid. refer to Section 7.0 for details and part numbers.

A discharge check valve, Part No. 8820260 for 5-HP models and 8820255 for 3.5-HP models, must be installed in the compressor's discharge line for pump-down installations.

Section 3.0 – Refrigerant Charging

3.1 EPA REFRIGERANT REGULATIONS[1]

Mueller E-Star OESE condensing units are designed to operate with R-507 refrigerant. R-507 is specified by the ASHRAE Standard 34 Safety Classification as an A-1 refrigerant with low-flame propagation and low toxicity.

EPA regulations require that any technician performing refrigerant installation or service on a high-pressure appliance be certified as a Type II Technician in accordance with Section 608 of the Clean Air Act.

[1] *As adopted for the United States and Canada. These regulations may change or differ for your locality. It is the responsibility of the technician performing the refrigerant service and/or installation to abide by all regulatory requirements for the installation locality, state, and country.*

3.2 INITIAL REFRIGERANT CHARGE

IMPORTANT: E-Star OESE condensing units must be triple evacuated to 500 microns before refrigerant charging.

The most efficient and reliable method to charge the condensing unit is to weigh in the charge, ensuring it matches the startup charge recommendations in Table 6. Section 3.3 outlines the weigh-in procedure.

IMPORTANT: The recommended startup charge is only an initial charge; more refrigerant may be necessary to have a properly charged system. Refer to Section 3.3 for final charge information.

TABLE 6: RECOMMENDED STARTUP REFRIGERANT CHARGE

Condensing Unit Size	Recommended Startup Charge	
	Milk Cooler	Chiller
3.5 HP	13.5 lbs / 6.12 kg	11.5 lbs / 5.22 kg
5 HP	15 lbs / 6.8 kg	13 lbs / 5.9 kg

NOTE: R-507 is recommended for use with E-Star OESE condensing units. Other refrigerants may be compatible; contact Paul Mueller Company's Dairy Farm Equipment Service Department for more information.

3.3 WEIGH-IN REFRIGERANT CHARGING

The following steps outline the procedure to weigh in the refrigerant startup charge. Refer to the refrigerant piping schematic shown in Figure 2.

1. With a clean, evacuated system, connect the manifold gauges to the suction service valve (P2) and the high-side service valve (P6).
2. Connect the center charging hose to a cylinder of new or reclaimed ARI 700-88 specifications refrigerant.
3. Weigh and record the gross weight of the refrigerant cylinder.
4. Purge any air from the manifold gauge hoses, as specified by EPA Section 608, de-minimus release.
5. Break the refrigeration system's vacuum with liquid refrigerant, charging into the Schrader port at the suction service valve (P2).

3.3 WEIGH-IN REFRIGERANT CHARGING (CONTINUED)

6. When the system pressure equalizes with cylinder pressure, energize the compressor.

7. Monitoring the weight of the refrigerant cylinder, weigh in the remaining refrigerant charge, in liquid state, at the suction service valve (P2).

IMPORTANT: Liquid refrigerant must always be charged upstream of the accumulator heat exchanger, to ensure the compressor is protected from liquid refrigerant slugging.

3.4 FINAL OPERATING CHARGE

The refrigerant charge should be fine-tuned for the best operating efficiency of the cooling system. The exact charge will vary, depending on the evaporator size and the refrigerant line length.

1. With the milk cooler's evaporator covered with milk/water or the chilled solution circulating through the chiller, operate the cooler or chiller with the startup refrigerant charge until the product is cooled to a temperature below 45°F (7.2°C).

2. Check the evaporator's superheat, ensuring it is properly adjusted. The milk coolor's evaporator superheat should be set at 4–6°F (2.2–3.3°C), and the chiller's evaporator superheat should be set at 10–12°F (5.6–6.7°C). Refer to Section 5.0 for superheat adjustment.

3. Check the sight glass installed at the TEV inlet. If the sight glass shows vapor refrigerant (bubbles), go to step 4. If the sight glass is clear with liquid refrigerant, slowly recover refrigerant from the system at the high-side service valve (P6), until an occasional bubble of vapor is seen in the sight glass.

4. Slowly add refrigerant at suction service valve (P2), until the sight glass becomes clear with liquid refrigerant.

5. Check the superheat a second time to ensure the proper setting.

IMPORTANT: Liquid refrigerant must always be charged upstream of the accumulator heat exchanger, access port P2, to ensure the compressor is protected against liquid refrigerant slugging.

3.6 REFRIGERANT TESTING

When removing refrigerant from a system that has had a compressor failure, the refrigerant should be tested for acid to ensure that it has not been contaminated by a burnout. If any contamination is found, recover the entire refrigerant charge, replace the filter drier, triple evacuate, and recharge with new or recycled refrigerant to meet ARI 700-88 specifications.

3.7 SAFETY ALERT

Technicians should wear side-shielded safety glasses and butyl-lined gloves when handling refrigerants.

Liquid refrigerant will cause frostbite.

When refrigerants come in contact with an open flame or a high heat source, dangerous gases will form. This is characterized by a strong acidic odor. Immediately vacate the area and ventilate prior to reentry.

Section 4.0 – Operating Features

4.1 REFRIGERANT CYCLE

Mueller E-Star OESE condensing units utilize an thermal expansion valve (TEV) that controls the evaporator's superheat. The expansion valve must be field adjusted to maintain the milk coolor's evaporator's superheat at 4–6°F (2.2–3.3°C) or the chiller's superheat at 10–12°F (5.6–6.7°C).

Refer to Figure 2, "Refrigeration Piping Schematic." Subcooled liquid refrigerant leaves the condenser coil and flows through the heat exchanger coil in the accumulator, where it is subcooled an additional 5–15°F (2.7–8.5°C). This heat exchange also evaporates any liquid refrigerant in the suction accumulator, protecting the compressor against liquid flood-back.

As the liquid refrigerant, now subcooled a total of 10–25°F (5.6–13.9°C), passes through the expansion valve, its pressure is reduced to an evaporative pressure. Since the liquid refrigerant was subcooled in the accumulator heat exchanger coil before entering the evaporator, there will be less flash gas at the inlet of the expansion valve.

Any liquid refrigerant returned from the evaporator is evaporated into vapor when it contacts the warmer heat exchanger coil in the bottom of the suction accumulator. Vapor leaving the accumulator heat exchanger will be superheated an additional 2–5°F (1.1–2.8°C) prior to entering the compressor's suction intake. This minimal superheat provides protection against liquid refrigerant entering the compressor, while providing exceptional refrigerant cooling of the compressor.

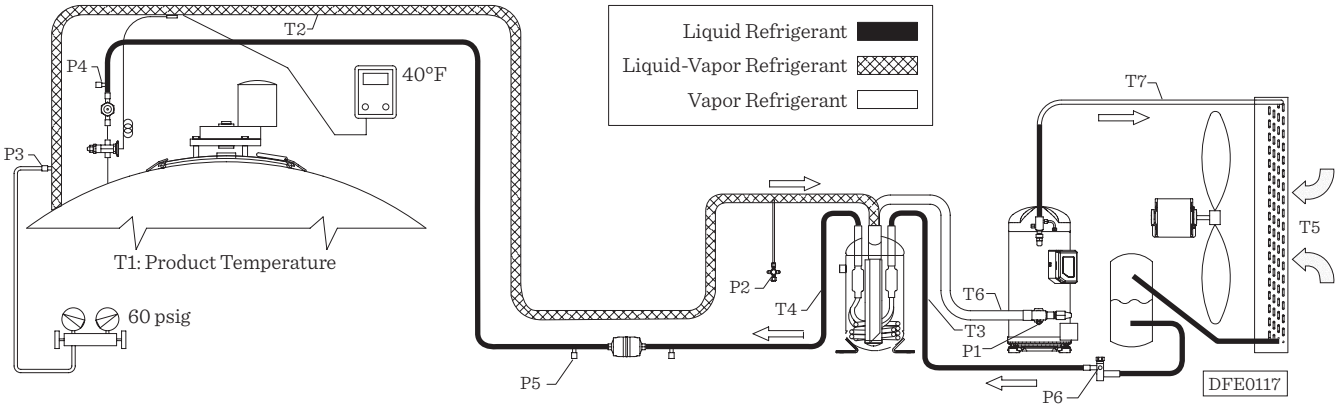
4.2 OIL RETURN

Refrigerant oil returning from the evaporator drops into the accumulator where the oil separates from the refrigerant and settles to the bottom of the accumulaotr. This oil is metered back into the compressor through the oil pickup orifice, located in the bottom of the accumulator's suction outlet "J" tube. Refer to Section 6.0, "Accumulator Heat Exchanger."

4.3 INCREASED OPERATING EFFICIENCY

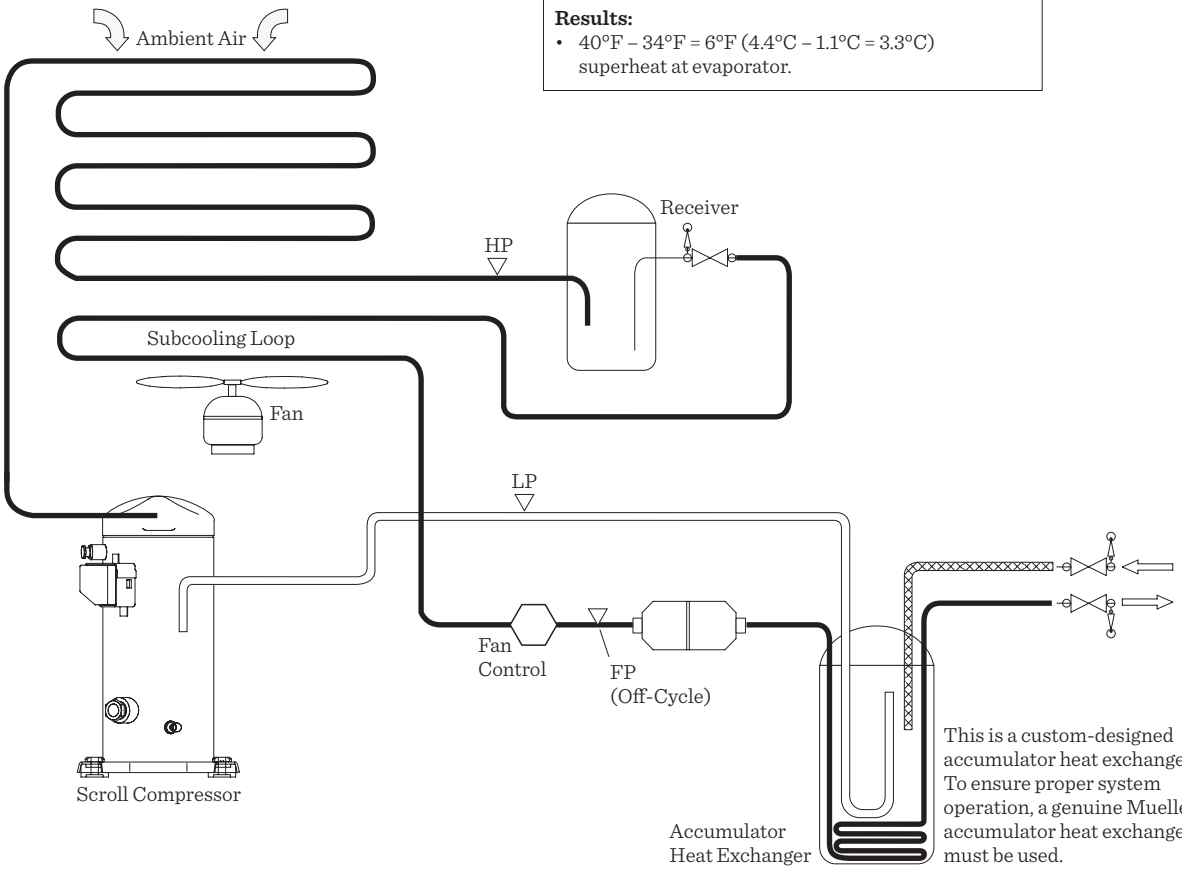
Mueller E-Star OESE condensing units incorporate a receiver and condenser subcooling loop to maintain proper subcooled liquid refrigerant to the TEV, which ensures optimum evaporator efficiency.

FIGURE 2: REFRIGERANT PIPING SCHEMATICS



Example (R-507):
- 60 psig converted to saturation temperature on refrigerant pressure temperature table equals 34°F.
- Actual suction line temperature equals 40°F.

Results:
- 40°F – 34°F = 6°F (4.4°C – 1.1°C = 3.3°C) superheat at evaporator.



IMPORTANT: When charging the system with liquid refrigerant, always charge upstream of the accumulator heat exchanger (access ports P2) to ensure the compressor is protected against damage caused by liquid refrigerant slugging.

Section 5.0 – Expansion Valve

5.1 THERMAL EXPANSION VALVE (TEV) SELECTION AND INSTALLATION

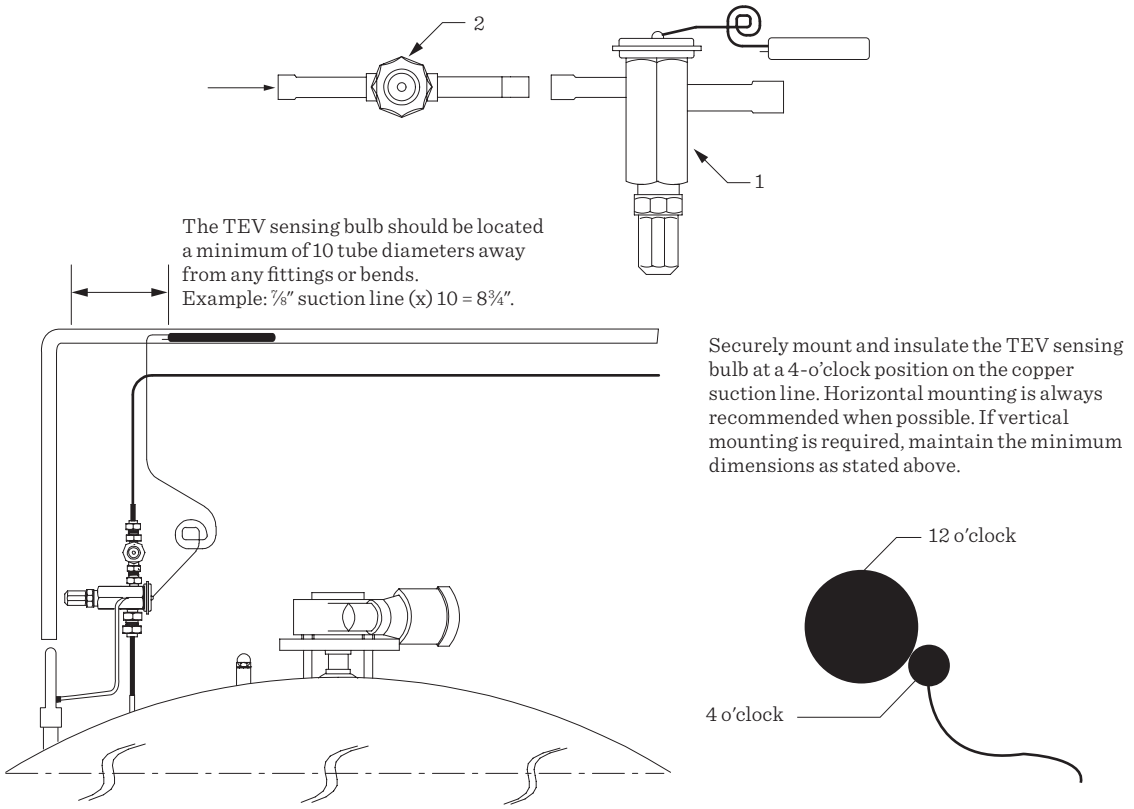
The E-Star's TEV must be field adjusted to maintain milk cooler evaporator superheat at 4–6°F or chiller evaporator superheat at 10–12°F. Proper location and sizing of the thermal expansion valve is critical. Refer to Section 5.2 for the superheat adjustment procedure.

An externally equalized TEV must be used on Mueller milk cooling applications. A sight glass must be installed at the TEV inlet.

TABLE 7: THERMAL EXPANSION VALVE (TEV) SELECTION

No.	Description	Specifications	Part No. for Milk Cooler Applications	Part No. for Chiller Applications
1A	R-22 (5 HP)	½" ODF inlet x ⅝" ODF outlet solder	8824492	8824511
1B	R-22 (3.5 HP)	½" ODF inlet x ⅝" ODF outlet solder	8824490	N/A
1C	R-507 (5 HP)	½" ODF inlet x ⅝" ODF outlet solder	8825503	9843711
1D	R-507 (3.5 HP)	½" ODF inlet x ⅝" ODF outlet solder	8825505	N/A
1E	R-404a (5 HP)	½" ODF inlet x ⅝" ODF outlet solder	9844469	N/A
1F	R-404a (3.5 HP)	½" ODF inlet x ⅝" ODF outlet solder	9844468	N/A
2	Sight Glass, All	½" ODF x ½" ODM solder	8824494	8824494

FIGURE 3: THERMAL EXPANSION VALVE (TEV) INSTALLATION



5.2 CHECKING AND ADJUSTING SUPERHEAT

Take the following readings with the cooler's evaporator completely covered with milk or water, or with the chilled water solution circulating through the chiller, at a temperature below 45°F.

1. Take an accurate suction pressure at the evaporator outlet.

IMPORTANT: The suction pressure must be taken at the evaporator outlet, rather than the suction service valve, due to the unknown pressure drop in the refrigerant line between the evaporator and compressor. The technician should also make certain the system is properly charged with refrigerant as described in Section 3.

2. Using an accurate electronic thermometer, take the actual suction line temperature near the TEV sensing bulb.

3. Utilizing the pressure temperature chart, convert the suction pressure reading from step 1 to the saturation temperature (dew point).

4. The superheat value is calculated by subtracting the saturation temperature (dew point) determined in step 3 from the actual suction line temperature taken in step 2.

5. If the superheat is not in the proper range, 4–6°F (2.2–3.3°C) for milk coolers and 10–12°F (5.6–6.7°C) for chillers, at conditions as described above, adjust the TEV.

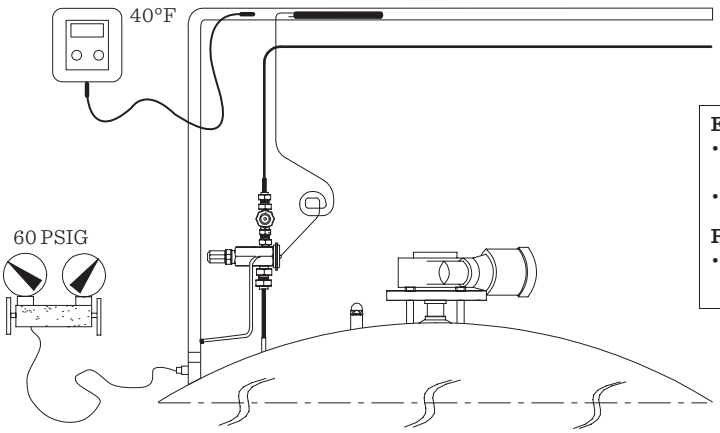
6. If the superheat is below the proper range, turn the TEV's adjustment stem clockwise ⅛ to ¼ of a turn. Allow the system to operate for five minutes before repeating the test.

7. If superheat is above the proper range, turn the TEV's adjustment stem counterclockwise ⅛ to ¼ of a turn. Allow the system to operate for five minutes before repeating the test.

8. Any time adjustment is made to the TEV, the refrigerant charge should be checked as described in Section 3.0.

9. Check the superheat setting and make final adjustments at a product temperature near setpoint for best performance.

FIGURE 4: CHECKING AND ADJUSTING SUPERHEAT



Example (R-507):
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- Actual suction line temperature equals 40°F.

Results:
- 40°F – 34°F = 6°F (4.4°C – 1.1°C = 3.3°C) superheat at evaporator.

Section 6.0 – Accumulator Heat Exchanger

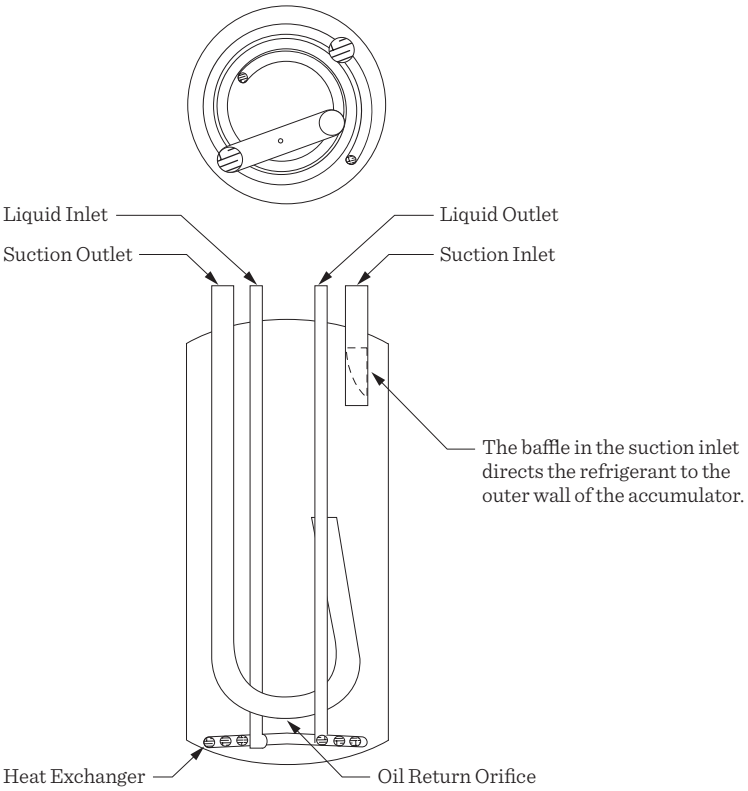
6.1 ACCUMULATOR HEAT EXCHANGER FUNCTIONS

The accumulator heat exchanger performs several functions on the E-Star OESE condensing unit:

- **Additional Subcooling:** The high-pressure liquid refrigerant from the condenser is subcooled 5–15°F (2.7–8.5°C) as it passes through the heat exchanger coil in the bottom of the accumulator heat exchanger, which is submerged in cold liquid refrigerant that has returned from the evaporator.
- **Vapor Return to the Compressor:** The accumulator heat exchanger evaporates accumulated liquid returning from the evaporator, providing cool vapor refrigerant to the suction inlet of the compressor.
- **Oil Return to the Compressor:** Oil settles to the bottom of the accumulator and is returned to the compressor through an orifice in the accumulator's suction outlet.

IMPORTANT: The Mueller accumulator heat exchanger utilizes a special "pancake" heat exchange coil. The use of a generic (spiral) accumulator heat exchanger will severely reduce cooling capacity of the E-Star OESE condensing unit and may cause premature compressor failure. Use genuine Mueller replacement parts only.

FIGURE 9: ACCUMULATOR HEAT EXCHANGER



Section 7.0 – Electrical Schematics

7.1 OESE 5 HP, 460/60/3 WIRING SCHEMATIC (EFFECTIVE AFTER SEPTEMBER 1, 2007)

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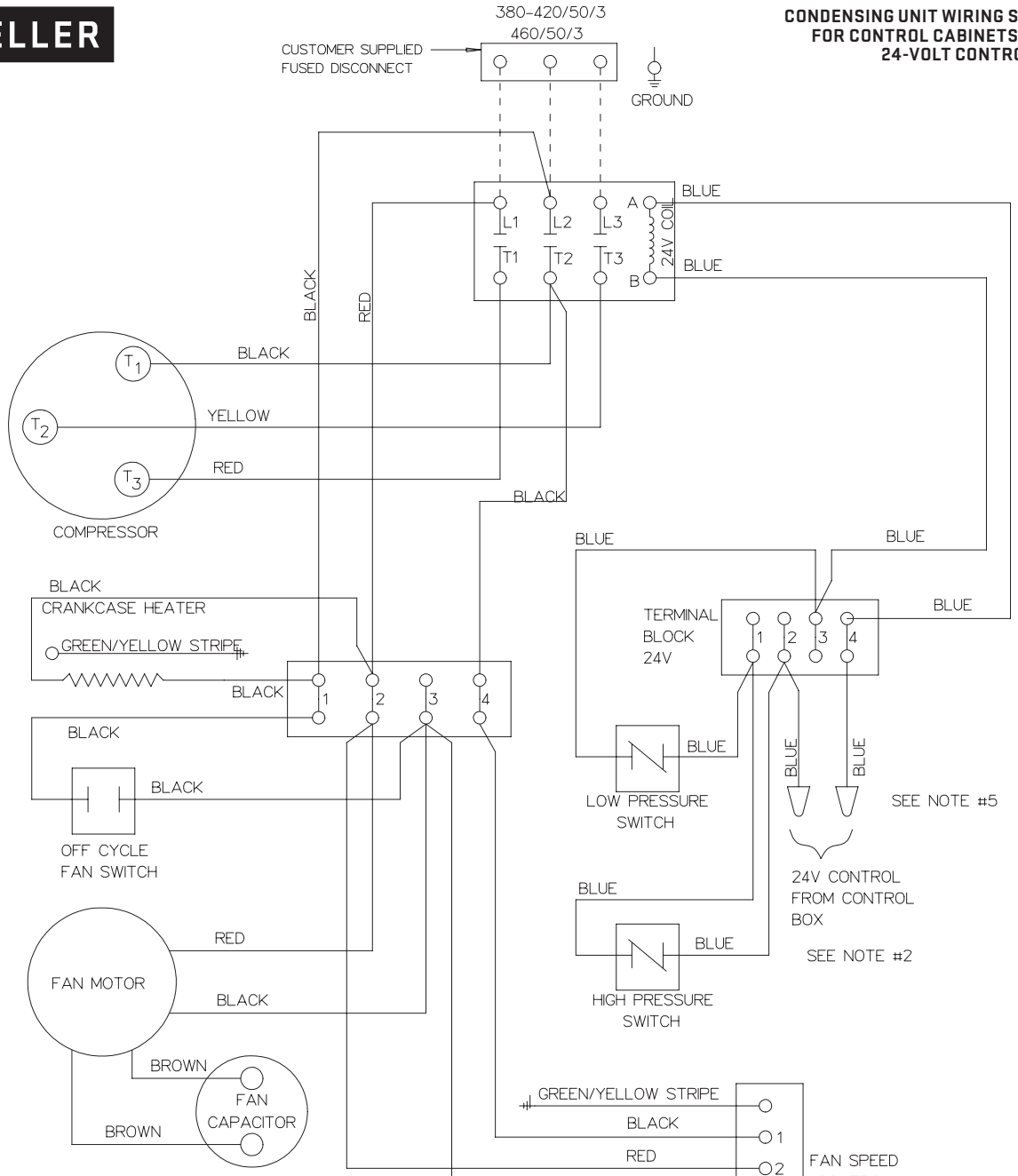
CONDENSING UNIT WIRING SCHEMATIC FOR CONTROL CABINETS UTILIZING 24-VOLT CONTROL OUTPUT



NOTES:

1. CAUTION: The side of the control circuit employing the safety device shall not be grounded.
2. Minimal 20 VA transformer required for control voltage.
3. Use minimum of 75°C insulated copper wire on field wiring.
4. Fan motor is internally thermal protected.
5. Connect 24-volt control wiring to leads with supplied wire nuts.
6. Field wiring not to come in contact with control box heater.
7. All enforced electrical codes must be followed during installation, service, and/or operation of this equipment.
8. All grounds terminate in the control box except the crankcase heater which terminates next to the compressor on the base plate.

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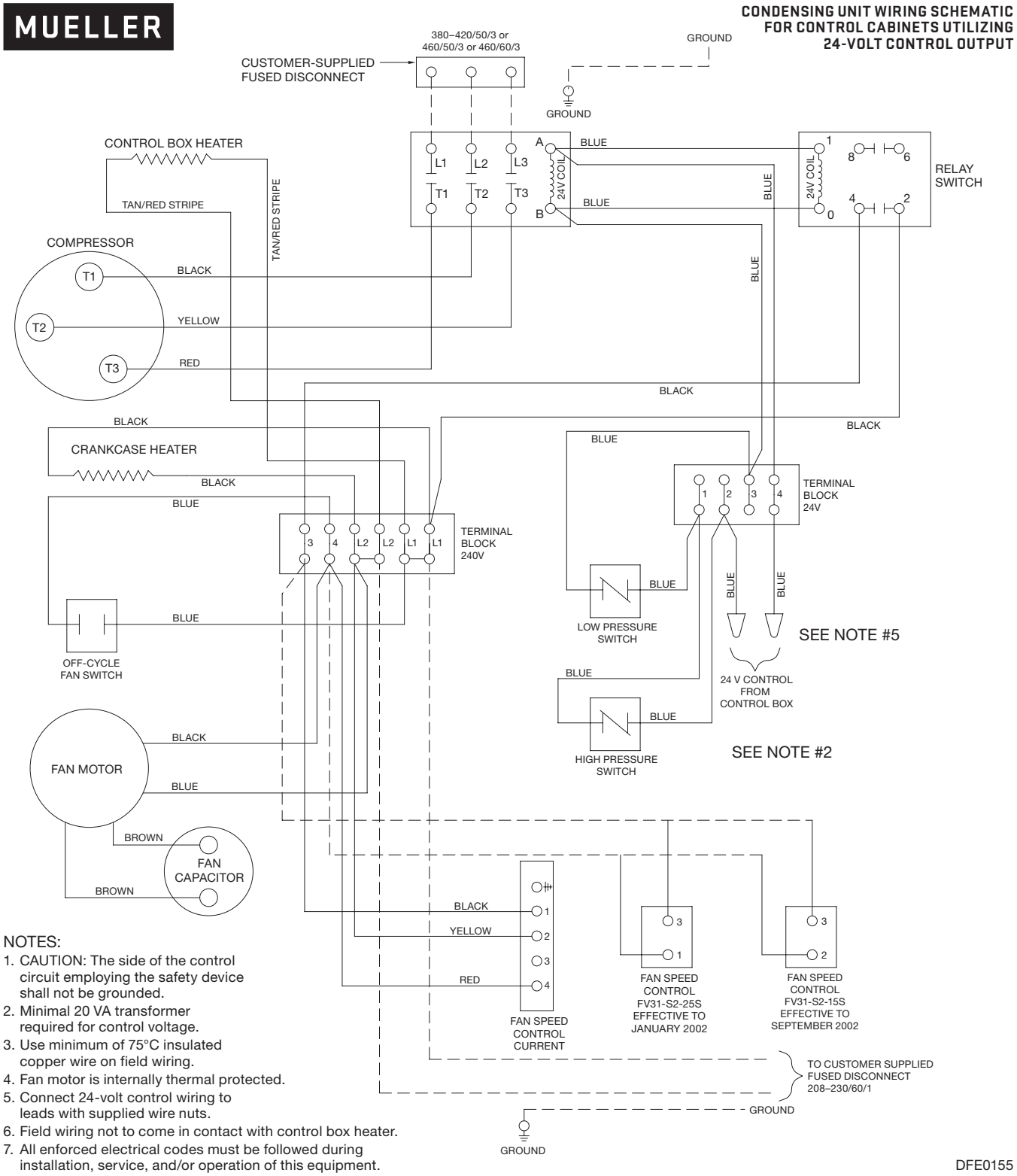
7.2 OESE 5 HP, 460/60/3 WIRING SCHEMATIC (EFFECTIVE UNTIL AUGUST 31, 2007)



NOTES:

1. CAUTION: The side of the control circuit employing the safety device shall not be grounded.
2. Minimal 20 VA transformer required for control voltage.
3. Use minimum of 75°C insulated copper wire on field wiring.
4. Fan motor is internally thermal protected.
5. Connect 24-volt control wiring to leads with supplied wire nuts.
6. Field wiring not to come in contact with control box heater.
7. All enforced electrical codes must be followed during installation, service, and/or operation of this equipment.

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7.3 OESE 3.5 AND 5 HP, 200–220/50/1, 208–230/60/1 WIRING SCHEMATIC

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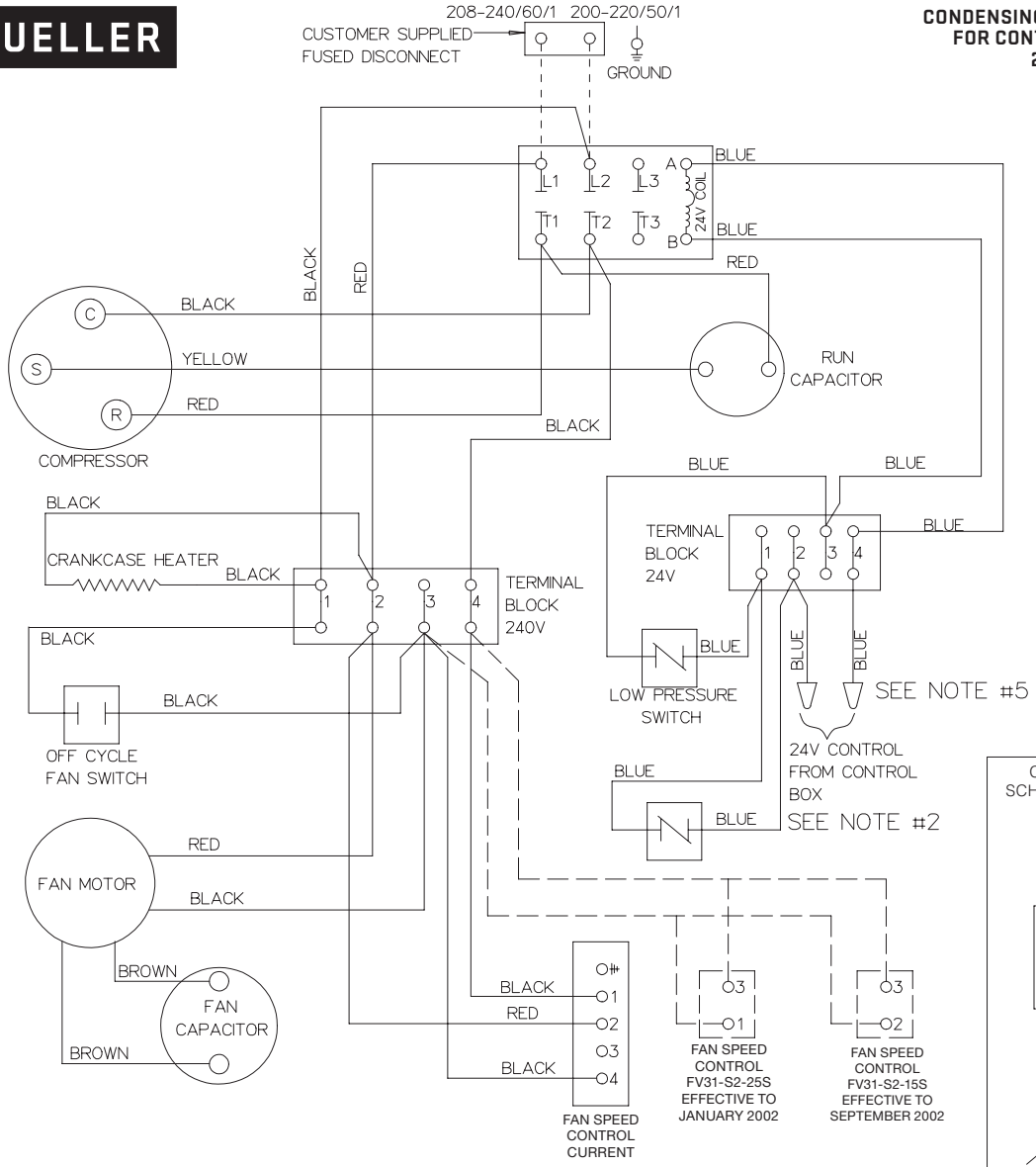
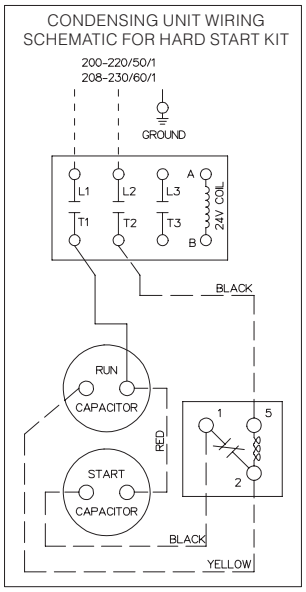
CONDENSING UNIT WIRING SCHEMATIC FOR CONTROL CABINETS UTILIZING 24-VOLT CONTROL OUTPUT





COMPRESSOR	RUN CAPACITOR	START CAPACITOR	START RELAY	(OPTIONAL) HARD START KIT
5HP 8820736 HCFC 8825337 HFC	8820595 80MFD/370V	8820149 270-324MFD 330V	8820596 170-180 PUV 40-115 DOV	8822053
3.5HP 8822549 HCFC 8825340 HFC	8822021 60MFD/370V	8820196 88-106MFD 330V	8820596 170-180 PUV 40-115 DOV	8822055

NOTES:
1. CAUTION: The side of the control circuit employing the safety device shall not be grounded.
2. Minimal 20 VA transformer required for control voltage.
3. Use minimum of 75°C insulated copper wire on field wiring.
4. Fan motor is internally thermal protected.
5. Connect 24-volt control wiring to leads with supplied wire nuts.
6. Field wiring not to come in contact with control box heater.
7. All enforced electrical codes must be followed during installation, service, and/or operation of this equipment.

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7.4 OESE 3.5 AND 5 HP, 200–240/50/3, 208–230/60/3 WIRING SCHEMATIC

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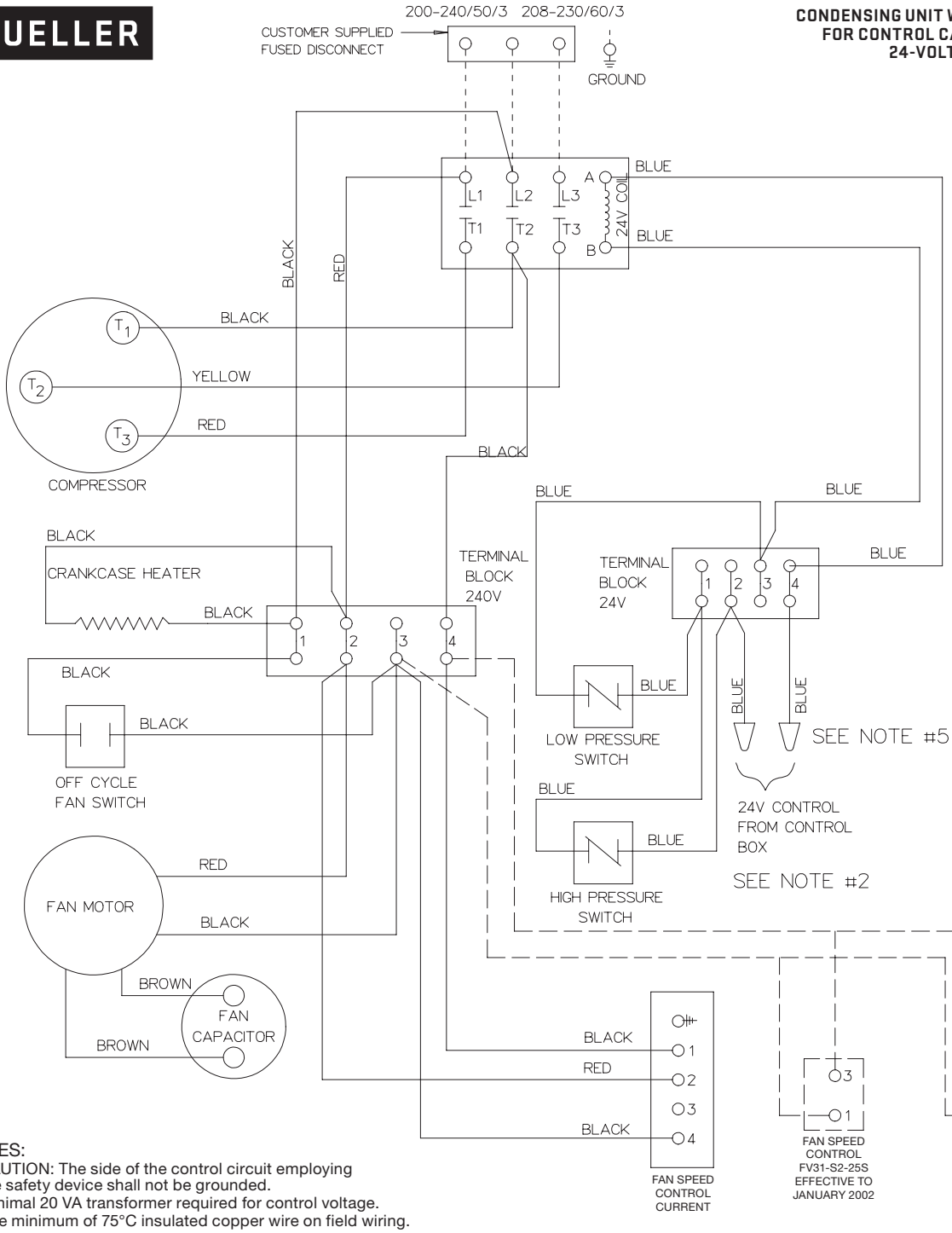
CONDENSING UNIT WIRING SCHEMATIC FOR CONTROL CABINETS UTILIZING 24-VOLT CONTROL OUTPUT



NOTES:
1. CAUTION: The side of the control circuit employing the safety device shall not be grounded.
2. Minimal 20 VA transformer required for control voltage.
3. Use minimum of 75°C insulated copper wire on field wiring.
4. Fan motor is internally thermal protected.
5. Connect 24-volt control wiring to leads with supplied wire nuts.
6. Field wiring not to come in contact with control box heater.
7. All enforced electrical codes must be followed during installation, service, and/or operation of this equipment.

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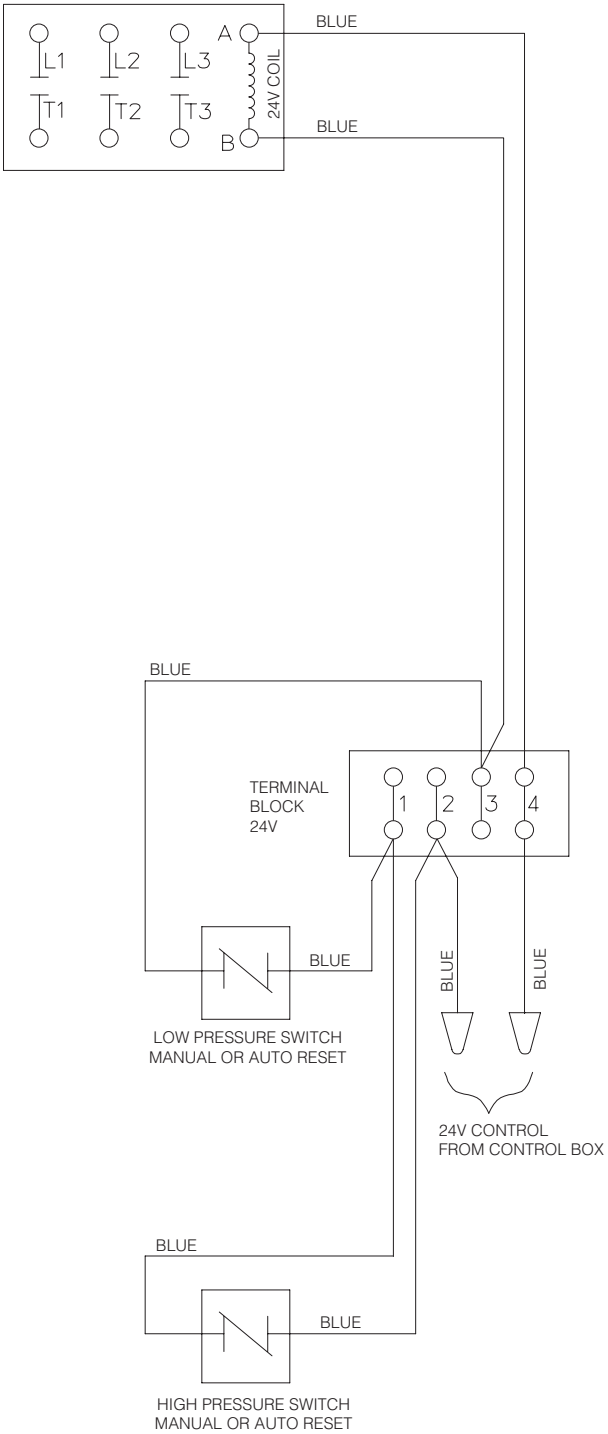
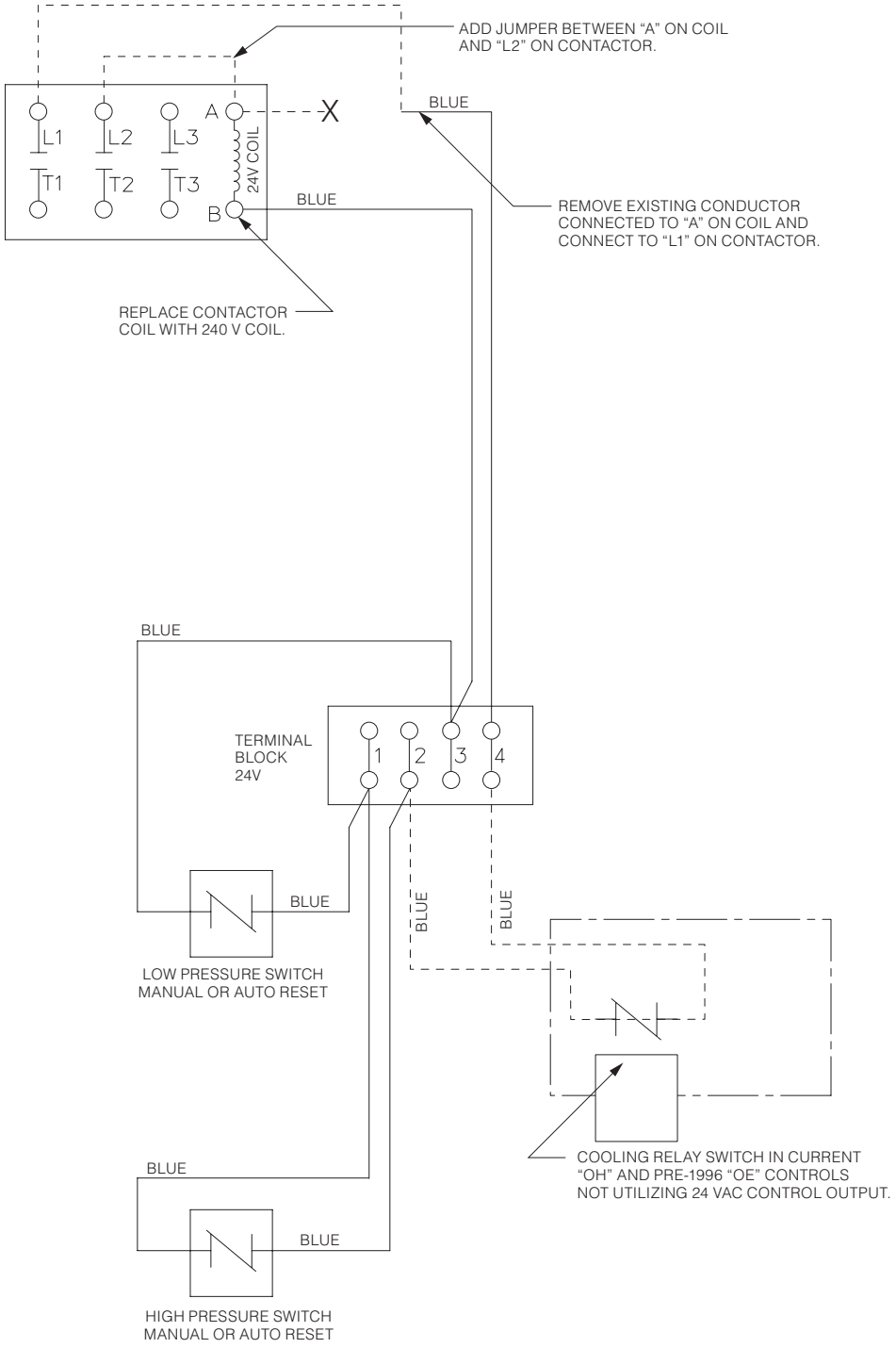
7.5 OESE LOW-VOLTAGE, 24-VAC CONTROL CIRCUIT



7.6 OESE CONTROL CIRCUIT RETROFIT, 24-VAC TO 240-VAC, PRE-1996 CONTROL BOXES



Section 8.0 – Pressure Switches and Fan Control

8.1 LOW-PRESSURE SWITCH WITH AUTOMATIC RESET

The low-pressure switch should be tested during installation to ensure proper operation by following these steps:

IMPORTANT: For brazed-plate chiller applications, ensure the glycol solution temperature is above 50°F (10°C) to prevent damage to the evaporator by freezing.

1. Attach an accurate low-pressure gauge to the suction service valve (P2).
2. Slowly close the service valve (P6) while monitoring the suction pressure on the gauge.
3. The low-pressure switch should open and de-energize the compressor's control circuit at approximately 5 psig (± 2 psig).
4. Slowly open the service valve (P6) and monitor the suction pressure on the gauge.
5. The low-pressure switch should close and energize the compressor's control circuit at approximately 30 psig (± 2 psig).
6. The low-pressure switch should be replaced if it does not operate as indicated above.

8.2 HIGH-PRESSURE SWITCH WITH AUTOMATIC RESET

The high-pressure switch should be tested during installation to ensure proper operation by following these steps:

1. Attach an accurate high-pressure gauge to the high-side service valve (P6).
2. Disconnect the fan motor wires from the high-voltage terminal strip and monitor the high-side pressure on the gauge.
3. The high-pressure switch should open and de-energize the compressor's control circuit at approximately 405 psig (± 5 psig) on R-22 units and 480 psig (± 10 psig) on R-507 units.
4. Reconnect the fan motor wires at the high-voltage terminal strip; monitor the high-side pressure on the gauge.
5. The high-pressure switch should close and energize the compressor's control circuit at approximately 305 psig (± 5 psig) on R-22 units and 350 psig (± 10 psig) on 507 units.
6. The high-pressure switch should be replaced if it does not operate as indicated above.

8.3 RGE ELECTRONIC FAN SPEED CONTROL

E-Star OESE condensing units use an electromagnetic, variable-speed fan control to allow the fan motor to operate at variable speeds at different ambient temperatures.

The RGE fan control must be checked for proper operation upon installation. The RGE has two modes: minimum speed and cutoff. The RGE is intended for operation in the cutoff mode. Cutoff mode is selected by the changeover switch, located inside the encloure. By placing the switch in the cutoff mode when pressure is below the setpoint value, the fan motor will be turned off and remain off until the pressure increases above the setpoint value.

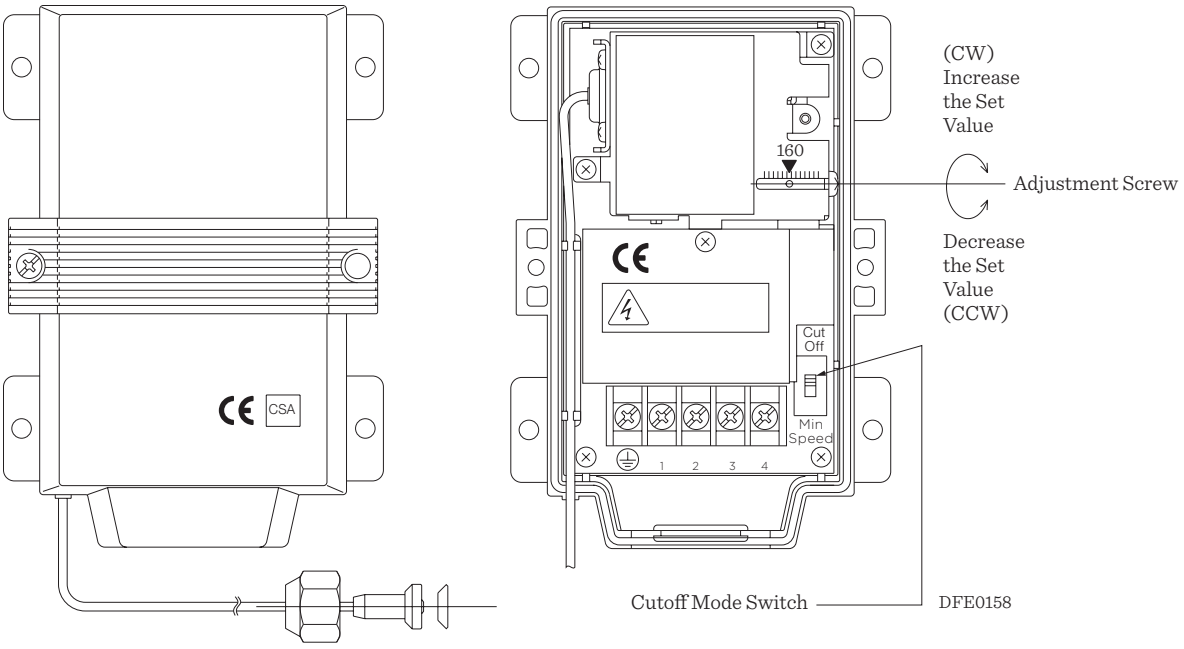
8.4 RGE ELECTRONIC FAN PRESSURE CONTROL SETPOINT ADJUSTMENT

The RGE is factory set for use with R-507 and will energize the fan at minimum speed when the high-side pressure rises above 190–200 psig. The fan motor should operate at full speed (1,075 rpm) when the high-side pressure rises above 230–240 psig. This setting should be verified on initial startup.

To verify RGE operation, connect the high side of a manifold gauge to the liquid line service valve (P6). Energize the condensing unit and monitor the fan operation in accordance with the high-side pressure. In low-ambient conditions, the condenser may have to be partially blocked to increase head pressure.

To adjust the pressure range, remove the RGE cover and locate the adjustment screw (see Figure 6). To increase the pressure range, turn the adjustment screw clockwise. To lower pressure range, turn the adjustment screw counter clockwise. One turn of the adjustment screw will change the range by approximately 15 psig.

FIGURE 6: RGE ELECTRONIC FAN PRESSURE CONTROL



8.5 OFF-CYCLE FAN PRESSURE SWITCH

The off-cycle fan pressure switch is designed to protect the evaporator and the condensing unit from over pressure during the wash cycle. The off-cycle switch will operate the fan at full speed if high side pressure rises above 270 psig and operate until pressure falls below 220 psig.

8.6 SCHRADER CORE IDENTIFICATION

All pressure switches will be marked with a red tie band indicating a Schrader core is present. If a pressure switch connection does not have a red tie band, the refrigerant will have to be recovered before pressure switch removal.

NOTE: All high-side pressure safety connections will not have a Schrader core due to safety regulation on the system's high side.

Section 9.0 – Equipment Sound Level

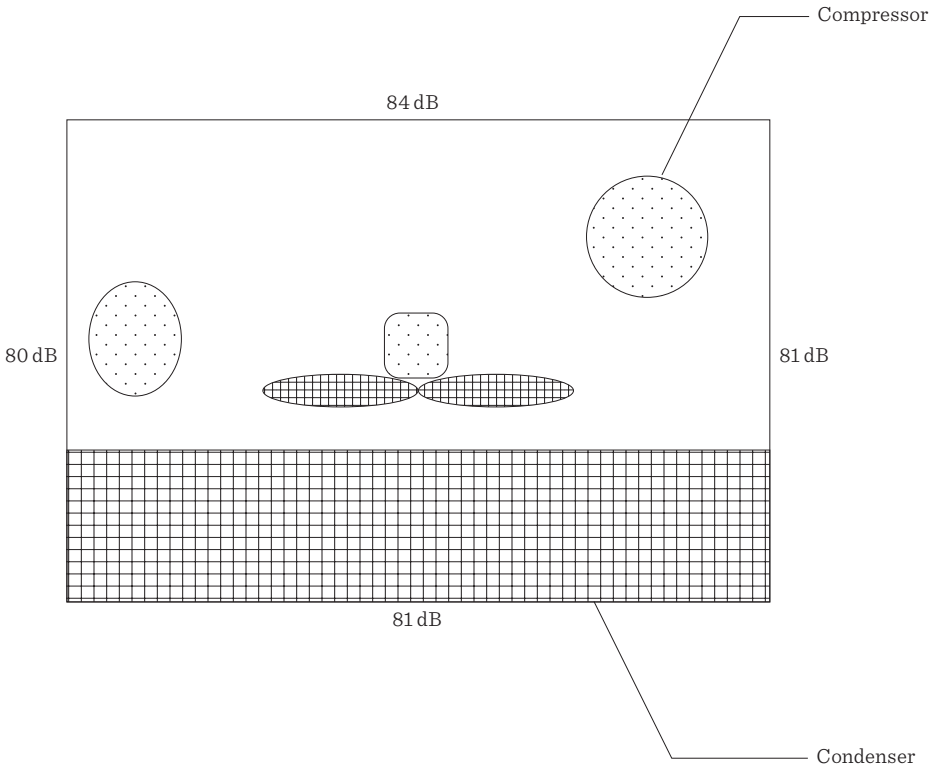
9.1 SOUND TESTING EQUIPMENT

The manufacturer tested sound levels of the E-Star HiPerForm condensing unit under normal operating conditions with the compressor and condenser fan motor operating. Measurements were taken with a sound meter, Model 33-2055, on the "A-weighted" scale.

9.2 SOUND MEASUREMENT

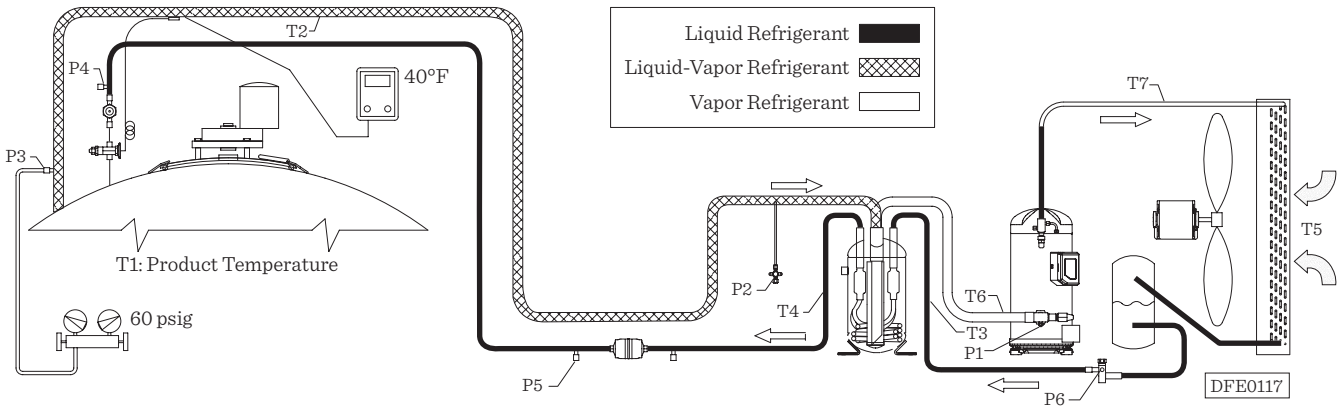
All sound measurements were recorded at a distance of 1 meter (3.28 feet) from the operating equipment. The highest recorded measurement was 84 dB.

FIGURE 7: SOUND MEASUREMENT



Section 10.0 – Maintenance

10.1 E-STAR OESE REFRIGERATION SURVEY



PRESSURE READINGS

P1: Suction Pressure at Compressor Inlet
P2: Suction Pressure at Suction Service Valve
P3: Suction Pressure at Evaporator Outlet
P4: Pressure at Evaporator Inlet
P5: Pressure at Filter Drier Inlet
P6: Pressure at Liquid Line Service Valve
P7: Pressure at Receiver Outlet

TEMPERATURE READINGS

T1: Milk Temperature
T2: Suction Line Temperature at Evaporator Outlet
T3: Line Temperature at Accumulator Inlet
T4: Line Temperature at Accumulator Outlet
T5: Ambient Temperature Entering Condenser
T6: Suction Line Temperature Entering Compressor
T7: Compressor Discharge Temperature

SURVEY DATA TO BE SUPPLIED BY TECHNICIAN

Provide the actual time below. Readings should be taken at five-minute intervals.

															Compressor Amperage		
Time*	**P1**	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	**L1**	**L2**	**L3**

Measured Supply Voltage:	**Condensing Unit Model and Part No.:**	**Serial No.:**

10.2 MAINTENANCE PROCEDURES

Mueller E-Star OESE condensing units require minimal maintenance. The following scheduled maintenance procedures are recommended and should be performed by a knowledgeable service technician on an annual basis:

1. Clean the condenser tubes and fins from accumulated dust or other foreign matter to ensure proper air flow.
2. Check the refrigerant charge described in Section 3.3. If the charge is low, perform a leak test on the complete system and repair.
3. Check for proper superheat as described in Section 5.
4. Check for proper incoming supply voltage.
5. Measure the compressor's amperage draw. Verify it is within 10% of the compressor's technical data chart.
6. Check all electrical connections, ensuring that they are clean and tight.
7. Check the compressor's wrap-around crankcase heater for proper operation.
8. Check for proper operation of the low-, high-, and fan-pressure switches as described in Section 8.
9. Complete a performance survey for each condensing unit, verifying proper cooling capacity. The survey is attached at the end of this manual.

10.3 SAFETY ALERT

All maintenance and service must be performed by trained and knowledgeable service technicians.

Individuals who are not trained and certified in proper refrigeration and electrical procedures should not attempt servicing this equipment.

This equipment starts automatically!

All guards and covers must be in place during operation to prevent mechanical and electrical hazards!

Section 11.0 – Disposal

11.1 GENERAL

If the E-Star OESE condensing unit is removed for resale or disposal, ensure the materials, refrigerant, and oils are handled and/or disposed of according to applicable codes and regulations.

11.2 COMPRESSOR REFRIGERANT OIL

The compressor contains a lubricant consisting of polyolester (POE). Dispose of in accordance with local regulations.

11.3 METAL COMPONENTS

The condensing unit's basic structure consists of steel, tin, aluminum, plastic, and copper, all of which may be separated and recycled.

Section 12.0 – Equipment Markings

12.1 LABEL NO. 8820454, DRY NITROGEN HOLDING CHARGE

IMPORTANT

THIS EQUIPMENT CONTAINS A HOLDING CHARGE OF DRY NITROGEN GAS. SLOWLY RELEASE PRESSURE THROUGH SERVICE PORTS OR SCHRADER VALVES BEFORE REMOVING FITTINGS.

EVACUATE THE SYSTEM TO 500 MICRONS BEFORE CHARGING WITH REFRIGERANT. DISCARD THIS TAG UPON CHARGING SYSTEM WITH REFRIGERANT AND APPLY A SYSTEM REFRIGERANT SPECIFICATION DECAL.

NOTE: IT IS THE TECHNICIAN'S RESPONSIBILITY TO COMPLY WITH ALL CURRENT REFRIGERANT USAGE REGULATIONS.

(11/94) 8820454

12.2 LABEL NO. 8824716, HFC REFRIGERANT

REFRIGERANT R-507
POE OIL

0305 8824716

12.3 LABEL NO. 8824497, E-STAR DATA TAG

MUELLER E-Star®

MODEL NUMBER	PART NUMBER	SERIAL NUMBER

VOLTAGE	ELECTRICAL HERTZ	PHASE

FAN MOTOR HP / FLA	COMPRESSOR RLA / LRA	DESIGN PRESSURE HIGH SIDE PSIG	DESIGN PRESSURE LOW SIDE PSIG
		475	200

MINIMUM CIRCUIT AMPACITY	MAXIMUM FUSE SIZE	NUMBER OF WIRES

1801 OUTDOOR USE | FOR USE WITH R-507 8824497

12.4 LABEL NO. 8822574, INSPECTION CARD

MUELLER

INSPECTION CARD

Unit Part No.: Unit Part No.:

Component Part No.: Comp. Serial No.:

Initial	Condensing Unit Inspection	
	Add proper amount of oil:	oz.
	Leak test and evacuate	
	Run test unit	
	Dry nitrogen holding charge:	psi
	Manual Part No.:	

Final Inspection: Date:

1806 8822574

12.5 LABEL NO. 8820155, WIRING CONNECTIONS FOR THREE-PHASE SCROLLS

IMPORTANT!

MUELLER

Wiring Connections for Three-Phase Scrolls

Scroll compressors will only compress gas in the clockwise direction when viewed from the top. Since single-phase motors will start and run in only one direction, reverse rotation is not a major consideration. Three-phase motors will start and run in either direction depending on the phase angles of the supplied power. This requires care during installation to ensure the compressor is operating in the proper direction. Verification of proper rotation is done by observing suction and discharge pressures when the compressor is energized. Reverse rotation is indicated by a decrease in discharge pressure and an increase in suction pressure. Reverse rotation has no negative impact on the scroll compressors. However, after several minutes of operation the compressor-line break will de-energize the compressor. In order to correct this, disconnect power and switch any two power leads at the unit contactor. Never switch leads directly at the compressor.

1806 8820155

12.6 LABEL NO. 8820156, BRIEF POWER INTERRUPTIONS ON SCROLL SINGLE-PHASE COMPRESSORS

NOTE!

MUELLER

Brief Power Interruptions on Scroll Single-Phase Compressors

Brief power interruptions of less than one-half second may result in powered reverse rotation of single-phase scroll compressors. This occurs as a result of the high-pressure discharge gas expanding backwards through the scroll at power interruption, causing the scroll to orbit in the reverse direction. When power is reapplied while reverse rotation is occurring, the compressor may continue to run noisily in the reverse direction for several minutes until the compressor's internal protector trips. This has no effect on durability. When the protector resets, the compressor will start and run normally.

1806 8820156

12.7 LABEL NO. 8822225, CE DATA TAG (UK MODELS ONLY)

Year of Construction Année de fabrication Año de fabricación	CE
Model Number Numéro de modèle Número de modelo	
Serial Number Numéro de série Número de serie	
Noise Level Niveau de bruit Nivel de ruido	
Weight Poids Peso	

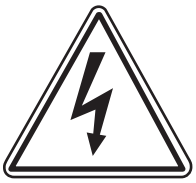
0408 8822225

12.8 LABEL NO. 31193, SCREEN INSIDE (IDENTIFIES SUCTION LINE SCREEN LOCATION)

SCREEN INSIDE • SCREEN INSIDE • SCREEN INSIDE • SCREEN INSIDE

12.9 LABEL NO. 8822232, WARNING SYMBOL: HOT

12.10 LABEL NO. 8820623, WARNING SYMBOL: ELECTRICAL



12.11 LABEL NO. 8822226, WARNING: SCREEN GUARD REMOVAL

⚠ WARNING

Authorized Personnel Only To Remove Screen Guard

6911 8822226

12.12 LABEL NO. 8822141, WARNING: RISK OF ELECTRIC SHOCK, DISCONNECT ALL REMOTE POWER SUPPLIES BEFORE SERVICING

⚠ WARNING

**RISK OF ELECTRIC SHOCK.
CAN CAUSE INJURY OR DEATH.
DISCONNECT ALL REMOTE ELECTRIC
POWER SUPPLIES BEFORE SERVICING.**

⚠ ADVERTISSEMENT

**RISQUE DE DÉCHARGE ÉLECTRIQUE.
PEUT CAUSER DES BLESSURES OU
PROVOQUER LA MORT. DÉBRANCHER
TOUTES LES SOURCES D'ALIMENTATION
À DISTANCE AVANT L'ENTRETIEN.**

⚠ PELIGRO

**RIESGO DE CHOQUE ELÉCTRICO.
PUEDE CAUSAR HERIDA O MUERTE.
DESCONECTAR TODOS LOS
SUMINISTROS DE REMOTO ELÉCTRICO
DE PODER ANTES DE SERVICIO.**

0001 8822141

12.13 LABEL NO. 8820764, WARNING: DISCONNECT POWER BEFORE SCREEN GUARD REMOVAL

12.14 LABEL NO. 8820768, WARNING: PLACE SCREEN GUARD BEFORE UNIT OPERATION

12.15 LABEL NO. 8820769, WARNING: FAN WILL START AUTOMATICALLY

12.16 LABEL NO. 8824383, MUELLER LOGO

MUELLER

12.17 LABEL NO. 8822705, CSA

Section 13.0 – Safety

NOTE: SEE ALL SAFETY, WARNING, AND CAUTION LABELS SHOWN IN SECTION 12.0.

13.1 SAFETY ALERT

Improper handling or service of equipment containing refrigerant and/or powered by electricity can create a health hazard. All installation, service, and/or maintenance must be performed by service technicians who are trained and knowledgeable in proper refrigeration and electrical procedures.

This equipment can start automatically. Use extreme caution when servicing.

All guards and covers must be in place during operation to prevent mechanical and electrical hazards.

13.2 REFRIGERANT HEALTH HAZARDS

Although the toxicity and flammability of HFC refrigerant is low, the possibility of injury or death exists in unusual situations or if it is deliberately misused. These refrigerant vapors are several times heavier than air. Good ventilation must be provided in areas where high concentration of refrigerant vapors might accumulate and displace oxygen.

Most halogenated compounds will decompose at high temperatures, such as those associated with gas flames or electric heaters. The chemicals that result under these circumstances always include hydrofluoric acid.

These dangerous vapors have a sharp, stinging effect on the nose and can be detected by odor at concentrations below its toxic level. These odors serve as a warning that decomposition has occurred. If detected, evacuate the area until ventilation has cleared the area of the decomposed vapors.

Skin or eye contact can result in irritation and frostbite.

13.3 FIRST AID

If refrigerant vapors are inhaled, remove victim to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Avoid stimulants. Do not give adrenaline (epinephrine), as this can complicate possible effects on the heart. Call a physician.

In case of eye contact, flush eyes promptly with cool water for at least 15 minutes. Call a physician.

Soak exposed skin in lukewarm water, not cold or hot. Do not use dressings or ointments. Call a physician.

13.4 PERSONAL PROTECTIVE EQUIPMENT

Technicians handling refrigerants should wear side-shielded safety glasses, impervious (preferably butyl-lined) gloves, and other protective equipment or clothing as required by the situation.

Section 14.0 – Technical Data

14.1 E-STAR OESE ELECTRICAL DATA

Model	Part No.	Description	Voltage	Hz	Phase	Full Load Amps	Locked Rotor Amps	Min. Circuit Ampacity	Max. Fuse Size
OESE-A351-HFC	8825311	3.5 HP, Single-Phase Unit	200–240	50/60	1	–	–	31.4	50
	8825340	Compressor, Scroll, ZB26KCE-PFV	200–220/208–230	50/60	1	23.6	127	–	–
	8823340	Fan Motor, ⅓ HP	200–220/208–230	50/60	1	1.9	–	–	–
OESE-A353-HFC	8825312	3.5 HP, Three-Phase Unit	200–240	50/60	1	–	–	18.4	30
	8825341	Compressor, Scroll, ZB26KCE-TF5	200–220/208–230	50/60	1	13.2	88	–	–
	8823340	Fan Motor, ⅓ HP	200–220/208–230	50/60	1	1.9	–	–	–
OESE-A51-HFC	8825317	5 HP, Single-Phase Unit	200–240	50/60	1	–	–	40	70
	8825337	Compressor, Scroll, ZB38KCE-PFV	200–220/208–230	50/60	1	31.1	175	–	–
	8823340	Fan Motor, ⅓ HP	200–220/208–230	50/60	1	1.9	–	–	–
OESE-A53-HFC	8825318	5 HP, Three-Phase Unit	200–240	50/60	3	–	–	30	50
	8825338	Compressor, Scroll, ZB38KCE-TF5	200–220/208–230	50/60	3	22.1	115	–	–
	8823340	Fan Motor, ⅓ HP	200–220/208–230	50/60	1	1.9	–	–	–
OESE-A534-HFC	8825319	5 HP, Three-Phase Unit	380–420/460	50/60	3	–	–	13.2	20
	8825336	Compressor, Scroll, ZB38KCE-TFD	380–420/460	50/60	3	9.6	63	–	–
	8823340	Fan Motor, ⅓ HP	380–460	50/60	1	1.2	–	–	–

14.2 E-STAR OESE REFRIGERANT DATA

Model	Part No.	Description	Receiver Part No.	R-507 Expansion Valve Part No.	Accumulator Heat Exchanger Part No.	Drier Part No.
OESE-A351-HFC	8825311	3.5 HP, Single-Phase Unit	8820746	8825505	30574	8825333
OESE-A353-HFC	8825312	3.5 HP, Three-Phase Unit	8820746	8825505	30574	8825333
OESE-A51-HFC	8825317	3.5 HP, Three-Phase Unit	8820746	8825505	30574	8825333
OESE-A53-HFC	8825318	5 HP, Single-Phase Unit	8820746	8825503	30574	8825333
OESE-A534-HFC	8825319	5 HP, Three-Phase Unit	8820746	8825503	30574	8825333

14.3 E-STAR OESE COMPRESSOR OIL CHARGE

Model	Part No.	Description	Oil Charge	Oil Type
OESE-A351-HFC	8825311	3.5 HP, Single-Phase Unit, ZB26KCE	42 oz	Copeland Ultra 22cc or Mobil EAL Arctic 22CC
OESE-A353-HFC	8825312	3.5 HP, Three-Phase Unit, ZB26KCE	42 oz	Copeland Ultra 22cc or Mobil EAL Arctic 22CC
OESE-A51-HFC	8825317	3.5 HP, Three-Phase Unit, ZB38KCE	64 oz	Copeland Ultra 22cc or Mobil EAL Arctic 22CC
OESE-A53-HFC	8825318	5 HP, Single-Phase Unit, ZB38KCE	64 oz	Copeland Ultra 22cc or Mobil EAL Arctic 22CC
OESE-A534-HFC	8825319	5 HP, Three-Phase Unit, ZB38KCE	64 oz	Copeland Ultra 22cc or Mobil EAL Arctic 22CC

Section 15.0 – Compressor Data Charts

15.1 ZB26KCE SINGLE-PHASE, 208/230 V COMPRESSOR DATA CHART

Rating Conditions
65°F Return Gas
0°F Subcooling
95°F Ambient Air Over

MEDIUM TEMPERATURE

Blue Area Restrictions: 20°F Max Superheat

ZB26KCE-PFV
HFC-507
COPELAND SCROLL®
PFV 208/230-1-60

60 Hz Operation

Evaporating Temperature °F (Sat. Dew Pt. Pressure, psig)

Condensing Temperature °F (Sat. Dew Pt. Pressure, psig)		-10.0(25)	0.0(35)	10.0(46)	15.0(52)	20.0(58)	25.0(65)	30.0(73)	35.0(81)	45.0(98)
140.0 (413)	C					20,600	22,800	25,200	27,800	33,600
	P					5,150	5,150	5,150	5,150	5,150
	A					22.6	22.6	22.6	22.5	22.5
	M					563	630	705	788	981
	E					4.0	4.4	4.9	5.4	6.6
	%					54.5	56.9	59.2	61.3	65.1
130.0 (363)	C			19,200	21,400	23,700	26,300	29,000	31,900	38,400
	P			4,570	4,570	4,570	4,570	4,570	4,570	4,550
	A			20.3	20.4	20.4	20.4	20.4	20.4	20.3
	M			456	511	572	639	712	792	979
	E			4.2	4.7	5.2	5.7	6.3	7.0	8.4
	%			53.6	56.0	58.3	60.4	62.4	64.1	66.8
120.0 (319)	C		17,500	21,800	24,200	26,800	29,500	32,600	35,800	42,900
	P		4,030	4,040	4,040	4,050	4,050	4,050	4,040	4,020
	A		18.4	18.5	18.5	18.5	18.5	18.5	18.5	18.4
	M		370	466	521	582	648	720	800	983
	E		4.3	5.4	6.0	6.6	7.3	8.0	8.9	10.7
	%		52.7	57.7	60.0	62.0	63.8	65.4	66.7	68.3
110.0 (279)	C	15,400	19,400	24,100	26,800	29,600	32,700	36,000	39,500	47,400
	P	3,540	3,550	3,570	3,570	3,580	3,580	3,580	3,570	3,550
	A	16.7	16.8	16.8	16.8	16.9	16.9	16.9	16.9	16.8
	M	297	378	475	530	590	657	729	808	990
	E	4.4	5.5	6.8	7.5	8.3	9.1	10.1	11.1	13.3
	%	51.5	56.9	61.5	63.5	65.2	66.6	67.8	68.5	68.8
100.0 (242)	C	16,900	21,300	26,400	29,300	32,400	35,800	39,300	43,200	51,500
	P	3,120	3,140	3,150	3,160	3,160	3,160	3,160	3,160	3,140
	A	15.3	15.4	15.4	15.5	15.5	15.5	15.5	15.5	15.4
	M	302	384	481	537	598	664	737	816	997
	E	5.4	6.8	8.4	9.3	10.3	11.3	12.4	13.7	16.5
	%	55.4	60.5	64.7	66.3	67.6	68.6	69.1	69.2	67.8
80.0 (179)	C	19,600	24,700	30,700	34,100	37,700	41,600	45,800	50,000	60,000
	P	2,420	2,440	2,460	2,460	2,470	2,470	2,470	2,460	2,440
	A	13.1	13.2	13.3	13.3	13.3	13.4	13.4	13.4	13.3
	M	310	392	492	548	610	677	751	830	1,011
	E	8.1	10.1	12.5	13.8	15.3	16.8	18.6	20.4	24.7
	%	61.8	65.8	68.3	68.8	68.8	68.2	66.9	65.0	58.6
70.0 (153)	C	20,900	26,300	32,800	36,400	40,200	44,400	48,900	53,500	
	P	2,130	2,160	2,170	2,180	2,180	2,180	2,180	2,170	
	A	12.3	12.4	12.5	12.5	12.6	12.6	12.6	12.6	
	M	312	396	496	553	615	683	757	837	
	E	9.8	12.2	15.1	16.7	18.5	20.4	22.5	24.7	
	%	63.9	66.9	68.0	67.6	66.6	64.9	62.3	58.9	
50.0 (108)	C	23,400	29,500	36,800	40,800					
	P	1,660	1,680	1,690	1,700					
	A	11.2	11.3	11.4	11.4					
	M	316	401	504	562					
	E	14.1	17.6	21.7	24.1					
	%	64.5	64.3	61.1	58.1					

C: Capacity (Btu/hr), P: Power (Watts), A: Current (Amps), M: Mass Flow (lbs/hr), E: EER (Btu/Watt-hr), %: Isentropic Efficiency (%).
Nominal Performance Values (± 5%) based on 72 hours run-in. Subject to change without notice. Current @ 230 V.

Copeland brand products

Autogenerated Compressor Performance

Printed 1/11/2016
05-184

EMERSON Climate Technologies

15.2 ZB26KCE THREE-PHASE, 208/230 V COMPRESSOR DATA CHART

Rating Conditions
65°F Return Gas
0°F Subcooling
95°F Ambient Air Over

MEDIUM TEMPERATURE

Blue Area Restrictions: 20°F Max Superheat

ZB26KCE-TF5
HFC-507
COPELAND SCROLL®
TF5 208/230-3-60

60 Hz Operation

Evaporating Temperature °F (Sat. Dew Pt. Pressure, psig)

Condensing Temperature °F (Sat. Dew Pt. Pressure, psig)		-10.0(25)	0.0(35)	10.0(46)	15.0(52)	20.0(58)	25.0(65)	30.0(73)	35.0(81)	45.0(98)
140.0 (413)	C					20,500	22,700	25,100	27,700	33,400
	P					4,960	4,960	4,960	4,950	4,930
	A					14.1	14.1	14.1	14.1	14.1
	M					559	627	701	783	975
	E					4.1	4.6	5.1	5.6	6.8
	%					56.3	58.8	61.2	63.4	67.3
130.0 (363)	C			19,100	21,300	23,600	26,100	28,800	31,700	38,100
	P			4,390	4,400	4,400	4,400	4,400	4,390	4,370
	A			12.8	12.8	12.8	12.8	12.8	12.8	12.7
	M			454	508	569	635	707	787	973
	E			4.4	4.8	5.4	5.9	6.6	7.2	8.7
	%			55.4	57.9	60.3	62.5	64.5	66.3	69.1
120.0 (319)	C		17,400	21,600	24,000	26,600	29,400	32,400	35,600	42,700
	P		3,870	3,880	3,890	3,890	3,890	3,890	3,890	3,870
	A		11.5	11.6	11.6	11.6	11.6	11.6	11.6	11.5
	M		368	463	518	578	644	716	795	977
	E		4.5	5.6	6.2	6.8	7.5	8.3	9.2	11.0
	%		54.5	59.7	62.0	64.1	66.0	67.6	68.9	70.6
110.0 (279)	C	15,300	19,300	24,000	26,600	29,500	32,500	35,800	39,300	47,100
	P	3,400	3,420	3,430	3,440	3,440	3,440	3,440	3,440	3,420
	A	10.5	10.5	10.5	10.6	10.6	10.6	10.6	10.6	10.5
	M	295	375	472	527	587	653	725	803	984
	E	4.5	5.6	7.0	7.7	8.6	9.4	10.4	11.4	13.8
	%	53.2	58.8	63.6	65.6	67.4	68.9	70.0	70.8	71.1
100.0 (242)	C	16,800	21,100	26,300	29,100	32,200	35,500	39,100	42,900	51,500
	P	3,000	3,020	3,030	3,040	3,040	3,040	3,040	3,040	3,020
	A	9.6	9.6	9.7	9.7	9.7	9.7	9.7	9.7	9.7
	M	301	382	479	534	594	660	732	811	991
	E	5.6	7.0	8.7	9.6	10.6	11.7	12.9	14.1	17.0
	%	57.3	62.6	66.9	68.5	69.9	70.9	71.4	71.5	70.1
80.0 (179)	C	19,500	24,600	30,500	33,900	37,500	41,300	45,500	49,900	60,000
	P	2,330	2,350	2,360	2,370	2,370	2,370	2,370	2,370	2,340
	A	8.2	8.3	8.3	8.4	8.4	8.4	8.4	8.4	8.4
	M	308	390	489	545	607	673	746	825	1,005
	E	8.4	10.5	12.9	14.3	15.8	17.4	19.2	21.1	25.5
	%	63.9	68.0	70.5	71.1	71.1	70.5	69.2	67.2	60.6
70.0 (153)	C	20,800	26,200	32,600	36,100	40,000	44,100	48,600	53,500	
	P	2,050	2,070	2,090	2,090	2,100	2,100	2,090	2,090	
	A	7.7	7.8	7.8	7.9	7.9	7.9	7.9	7.9	
	M	310	393	493	550	612	679	752	832	
	E	10.1	12.6	15.6	17.3	19.1	21.1	23.2	25.6	
	%	66.0	69.1	70.2	69.9	68.9	67.1	64.4	60.9	
50.0 (108)	C	23,300	29,400	36,600	40,600					
	P	1,600	1,620	1,630	1,630					
	A	7.0	7.1	7.1	7.1					
	M	315	399	501	559					
	E	14.6	18.1	22.4	24.9					
	%	66.6	66.5	63.1	60.1					

C: Capacity (Btu/hr), P: Power (Watts), A: Current (Amps), M: Mass Flow (lbs/hr), E: EER (Btu/Watt-hr), %: Isentropic Efficiency (%).
Nominal Performance Values (± 5%) based on 72 hours run-in. Subject to change without notice. Current @ 230 V.

Copeland brand products

Autogenerated Compressor Performance

Printed 1/10/2016
04-1338

EMERSON Climate Technologies

15.3 ZB38KCE SINGLE-PHASE, 208/230 V COMPRESSOR DATA CHART

Rating Conditions
65°F Return Gas
0°F Subcooling
95°F Ambient Air Over

MEDIUM TEMPERATURE

Blue Area Restrictions: 20°F Max Superheat

ZB38KCE-PFV
HFC-507
COPELAND SCROLL®
PFV 208/230-1-60

60 Hz Operation

Evaporating Temperature °F (Sat. Dew Pt. Pressure, psig)

Condensing Temperature °F (Sat. Dew Pt. Pressure, psig)

		-10.0(25)	0.0(35)	10.0(46)	15.0(52)	20.0(58)	25.0(65)	30.0(73)	35.0(81)	45.0(98)
140.0 (413)	C					28,600	31,900	35,500	39,300	47,800
	P					6,900	6,950	7,000	7,000	7,100
	A					32.4	32.5	32.7	32.8	33.2
	M					783	882	992	1,113	1,395
	E					4.1	4.6	5.1	5.6	6.7
	%					56.6	59.1	61.5	63.6	66.9
130.0 (363)	C			26,600	29,800	33,300	37,000	41,100	45,400	55,000
	P			6,150	6,200	6,200	6,250	6,250	6,300	6,400
	A			29.1	29.2	29.3	29.5	29.6	29.8	30.2
	M			630	711	802	901	1,009	1,128	1,399
	E			4.3	4.8	5.4	5.9	6.5	7.2	8.6
	%			54.9	57.6	60.1	62.4	64.4	66.1	67.9
120.0 (319)	C		23,800	30,200	33,900	37,800	42,000	46,500	51,000	61,500
	P		5,450	5,500	5,550	5,550	5,600	5,650	5,650	5,800
	A		26.1	26.4	26.5	26.6	26.8	26.9	27.1	27.5
	M		504	648	731	822	921	1,028	1,145	1,410
	E		4.4	5.5	6.1	6.8	7.5	8.2	9.0	10.7
	%		53.0	58.7	61.3	63.6	65.5	67.0	68.0	68.2
110.0 (279)	C	20,700	26,700	33,900	37,900	42,200	46,800	51,500	57,000	68,000
	P	4,840	4,900	4,950	4,970	5,000	5,050	5,050	5,100	5,250
	A	23.6	23.8	24.1	24.2	24.3	24.4	24.6	24.7	25.3
	M	398	520	666	750	841	939	1,045	1,160	1,419
	E	4.3	5.5	6.8	7.6	8.4	9.3	10.2	11.1	13.0
	%	50.5	56.7	62.3	64.5	66.4	67.8	68.6	68.7	67.0
100.0 (242)	C	22,900	29,600	37,400	41,800	46,400	51,500	56,500	62,000	74,000
	P	4,340	4,390	4,440	4,460	4,490	4,530	4,570	4,630	4,770
	A	21.6	21.8	22.0	22.1	22.2	22.4	22.5	22.8	23.4
	M	411	534	682	765	856	953	1,058	1,171	1,423
	E	5.3	6.7	8.4	9.4	10.3	11.3	12.4	13.4	15.5
	%	54.0	60.2	65.1	66.9	68.1	68.7	68.6	67.7	63.6
80.0 (179)	C	27,500	35,100	43,900	48,700	54,000	59,500	65,000	71,000	84,000
	P	3,490	3,530	3,590	3,620	3,670	3,720	3,790	3,870	4,090
	A	18.4	18.5	18.7	18.8	19.0	19.2	19.5	19.8	20.7
	M	433	557	703	785	872	966	1,067	1,175	1,414
	E	7.9	9.9	12.2	13.4	14.7	15.9	17.2	18.3	20.5
	%	60.0	64.6	66.9	66.9	66.1	64.4	61.9	58.4	48.8
70.0 (153)	C	29,600	37,600	46,700	51,500	57,000	62,500	68,500	75,000	
	P	3,130	3,180	3,250	3,290	3,350	3,420	3,510	3,610	
	A	17.1	17.2	17.4	17.6	17.8	18.1	18.4	18.8	
	M	442	564	707	787	873	964	1,063	1,167	
	E	9.5	11.8	14.4	15.7	17.0	18.3	19.6	20.8	
	%	61.6	64.6	64.8	63.6	61.4	58.4	54.3	49.4	
50.0 (108)	C	33,400	41,700	51,000	56,500					
	P	2,560	2,630	2,740	2,820					
	A	15.1	15.3	15.7	16.0					
	M	451	566	702	777					
	E	13.0	15.8	18.7	20.0					
	%	59.7	58.0	52.6	48.4					

C: Capacity (Btu/hr), P: Power (Watts), A: Current (Amps), M: Mass Flow (lbs/hr), E: EER (Btu/Watt-hr), %: Isentropic Efficiency (%).
Nominal Performance Values (± 5%) based on 72 hours run-in. Subject to change without notice. Current @ 230 V.

Copeland brand products

Autogenerated Compressor Performance

Printed 1/11/2016
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EMERSON Climate Technologies

14.4 ZB38KCE THREE-PHASE, 208/230 V COMPRESSOR DATA CHART

Rating Conditions
65°F Return Gas
0°F Subcooling
95°F Ambient Air Over

MEDIUM TEMPERATURE

Blue Area Restrictions: 20°F Max Superheat

ZB38KCE-TF5
HFC-507
COPELAND SCROLL®
TF5 200/230-3-60

60 Hz Operation

Evaporating Temperature °F (Sat. Dew Pt. Pressure, psig)

Condensing Temperature °F (Sat. Dew Pt. Pressure, psig)		-10.0(25)	0.0(35)	10.0(46)	15.0(52)	20.0(58)	25.0(65)	30.0(73)	35.0(81)	45.0(98)
140.0 (413)	C					29,300	32,500	35,900	39,600	47,900
	P					7,000	7,000	7,000	6,950	6,950
	A					20.6	20.6	20.6	20.6	20.5
	M					801	897	1,004	1,121	1,396
	E					4.2	4.7	5.1	5.7	6.9
	%					57.3	59.9	62.3	64.5	68.5
130.0 (363)	C			27,400	30,500	33,800	37,400	41,200	45,400	54,500
	P			6,200	6,200	6,200	6,200	6,200	6,200	6,150
	A			18.6	18.6	18.6	18.6	18.6	18.6	18.5
	M			649	728	814	909	1,013	1,127	1,393
	E			4.4	4.9	5.5	6.0	6.7	7.3	8.9
	%			56.4	58.9	61.3	63.6	65.6	67.4	70.3
120.0 (319)	C		24,800	31,000	34,400	38,100	42,000	46,300	51,000	61,000
	P		5,450	5,450	5,450	5,450	5,450	5,450	5,450	5,450
	A		16.8	16.8	16.9	16.9	16.9	16.9	16.9	16.8
	M		526	663	742	828	922	1,025	1,138	1,399
	E		4.6	5.7	6.3	7.0	7.7	8.5	9.3	11.2
	%		55.5	60.7	63.1	65.2	67.1	68.8	70.1	71.8
110.0 (279)	C	21,900	27,600	34,300	38,100	42,200	46,500	51,000	56,500	67,500
	P	4,780	4,810	4,830	4,830	4,840	4,840	4,840	4,830	4,810
	A	15.2	15.3	15.4	15.4	15.4	15.4	15.4	15.4	15.3
	M	422	538	675	754	840	934	1,037	1,150	1,408
	E	4.6	5.7	7.1	7.9	8.7	9.6	10.6	11.6	14.0
	%	54.1	59.8	64.7	66.8	68.6	70.1	71.3	72.1	72.4
100.0 (242)	C	24,000	30,300	37,600	41,700	46,100	51,000	56,000	61,500	73,500
	P	4,220	4,240	4,260	4,270	4,280	4,280	4,280	4,270	4,250
	A	14.0	14.0	14.1	14.1	14.1	14.1	14.1	14.1	14.1
	M	430	546	685	764	851	945	1,049	1,161	1,418
	E	5.7	7.1	8.8	9.8	10.8	11.9	13.1	14.4	17.3
	%	58.3	63.7	68.0	69.8	71.1	72.1	72.7	72.8	71.3
80.0 (179)	C	28,000	35,200	43,700	48,500	53,500	59,000	65,000	71,500	85,500
	P	3,270	3,300	3,330	3,330	3,340	3,340	3,340	3,330	3,300
	A	12.0	12.1	12.1	12.2	12.2	12.2	12.2	12.2	12.2
	M	441	558	700	780	868	964	1,068	1,181	1,439
	E	8.5	10.6	13.1	14.5	16.1	17.7	19.5	21.5	25.9
	%	65.0	69.2	71.8	72.3	72.3	71.7	70.4	68.3	61.7
70.0 (153)	C	29,800	37,500	46,600	51,500	57,000	63,000	69,500	76,500	
	P	2,890	2,920	2,940	2,950	2,950	2,950	2,940	2,940	
	A	11.3	11.3	11.4	11.4	11.5	11.5	11.5	11.5	
	M	444	563	706	787	876	972	1,077	1,191	
	E	10.3	12.9	15.9	17.6	19.4	21.4	23.6	26.0	
	%	67.2	70.4	71.5	71.1	70.1	68.2	65.6	61.9	
50.0 (108)	C	33,300	42,000	52,500	58,000					
	P	2,250	2,280	2,290	2,300					
	A	10.2	10.3	10.4	10.4					
	M	450	571	717	800					
	E	14.8	18.5	22.8	25.3					
	%	67.8	67.6	64.2	61.1					

C: Capacity (Btu/hr), P: Power (Watts), A: Current (Amps), M: Mass Flow (lbs/hr), E: EER (Btu/Watt-hr), %: Isentropic Efficiency (%).
Nominal Performance Values (± 5%) based on 72 hours run-in. Subject to change without notice. Current @ 230 V.

Copeland brand products

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EMERSON Climate Technologies

14.5 ZB38KCE THREE-PHASE, 460 V COMPRESSOR DATA SHEET

Rating Conditions
65°F Return Gas
0°F Subcooling
95°F Ambient Air Over

MEDIUM TEMPERATURE

Blue Area Restrictions: 20°F Max Superheat

ZB38KCE-TFD
HFC-507
COPELAND SCROLL®
TFD 460-3-60

60 Hz Operation

Evaporating Temperature °F (Sat. Dew Pt. Pressure, psig)

Condensing Temperature °F (Sat. Dew Pt. Pressure, psig)		-10.0(25)	0.0(35)	10.0(46)	15.0(52)	20.0(58)	25.0(65)	30.0(73)	35.0(81)	45.0(98)
140.0 (413)	C					29,300	32,500	35,900	39,600	47,900
	P					7,000	7,000	7,000	6,950	6,950
	A					10.3	10.3	10.3	10.3	10.3
	M					801	897	1,004	1,121	1,396
	E					4.2	4.7	5.1	5.7	6.9
	%					57.3	59.9	62.3	64.5	68.5
130.0 (363)	C			27,400	30,500	33,800	37,400	41,200	45,400	54,500
	P			6,200	6,200	6,200	6,200	6,200	6,200	6,150
	A			9.3	9.3	9.3	9.3	9.3	9.3	9.3
	M			649	728	814	909	1,013	1,127	1,393
	E			4.4	4.9	5.5	6.0	6.7	7.3	8.9
	%			56.4	58.9	61.3	63.6	65.6	67.4	70.3
120.0 (319)	C		24,800	31,000	34,400	38,100	42,000	46,300	51,000	61,000
	P		5,450	5,450	5,450	5,450	5,450	5,450	5,450	5,450
	A		8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4
	M		526	663	742	828	922	1,025	1,138	1,399
	E		4.6	5.7	6.3	7.0	7.7	8.5	9.3	11.2
	%		55.5	60.7	63.1	65.2	67.1	68.8	70.1	71.8
110.0 (279)	C	21,900	27,600	34,300	38,100	42,200	46,500	51,000	56,500	67,500
	P	4,780	4,810	4,830	4,830	4,840	4,840	4,840	4,830	4,810
	A	7.6	7.6	7.7	7.7	7.7	7.7	7.7	7.7	7.7
	M	422	538	675	754	840	934	1,037	1,150	1,408
	E	4.6	5.7	7.1	7.9	8.7	9.6	10.6	11.6	14.0
	%	54.1	59.8	64.7	66.8	68.6	70.1	71.3	72.1	72.4
100.0 (242)	C	24,000	30,300	37,600	41,700	46,100	51,000	56,000	61,500	73,500
	P	4,220	4,240	4,260	4,270	4,280	4,280	4,280	4,270	4,250
	A	7.0	7.0	7.0	7.1	7.1	7.1	7.1	7.1	7.0
	M	430	546	685	764	851	945	1,049	1,161	1,418
	E	5.7	7.1	8.8	9.8	10.8	11.9	13.1	14.4	17.3
	%	58.3	63.7	68.0	69.8	71.1	72.1	72.7	72.8	71.3
80.0 (179)	C	28,000	35,200	43,700	48,500	53,500	59,000	65,000	71,500	85,500
	P	3,270	3,300	3,330	3,330	3,340	3,340	3,340	3,330	3,300
	A	6.0	6.0	6.1	6.1	6.1	6.1	6.1	6.1	6.1
	M	441	558	700	780	868	964	1,068	1,181	1,439
	E	8.5	10.6	13.1	14.5	16.1	17.7	19.5	21.5	25.9
	%	65.0	69.2	71.8	72.3	72.3	71.7	70.4	68.3	61.7
70.0 (153)	C	29,800	37,500	46,600	51,500	57,000	63,000	69,500	76,500	
	P	2,890	2,920	2,940	2,950	2,950	2,950	2,940	2,940	
	A	5.6	5.7	5.7	5.7	5.7	5.7	5.7	5.7	
	M	444	563	706	787	876	972	1,077	1,191	
	E	10.3	12.9	15.9	17.6	19.4	21.4	23.6	26.0	
	%	67.2	70.4	71.5	71.1	70.1	68.2	65.6	61.9	
50.0 (108)	C	33,300	42,000	52,500	58,000					
	P	2,250	2,280	2,290	2,300					
	A	5.1	5.1	5.2	5.2					
	M	450	571	717	800					
	E	14.8	18.5	22.8	25.3					
	%	67.8	67.6	64.2	61.1					

C: Capacity (Btu/hr), P: Power (Watts), A: Current (Amps), M: Mass Flow (lbs/hr), E: EER (Btu/Watt-hr), %: Isentropic Efficiency (%).
Nominal Performance Values (± 5%) based on 72 hours run-in. Subject to change without notice. Current @ 460 V.

Copeland brand products

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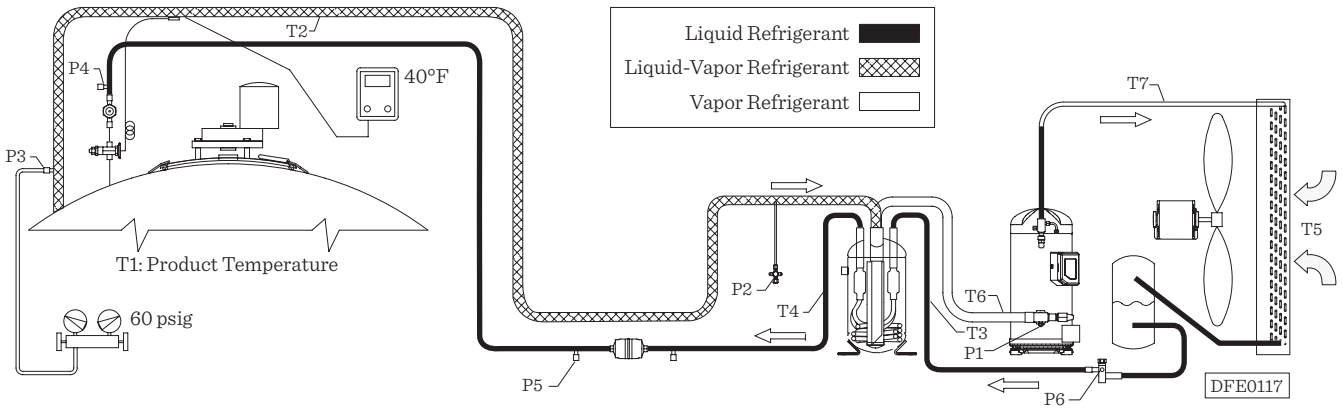
EMERSON Climate Technologies

Section 16.0 – R-507 Pressure Temperature Chart

psig	°C	°F	psig	°C	°F	psig	°C	°F	psig	°C	°F	psig	°C	°F	psig	°C	°F	psig	°C	°F
0	-46.73	-52.11	71	-1.93	28.52	142	18.50	65.29	213	32.72	90.89	284	43.84	110.90	355	52.95	127.30	426	60.73	141.30
1	-45.37	-49.66	72	-1.57	29.17	143	18.72	65.70	214	32.89	91.20	285	43.95	111.10	356	53.06	127.50	427	60.84	141.50
2	-44.08	-47.34	73	-1.21	29.82	144	18.96	66.12	215	33.06	91.51	286	44.11	111.40	357	53.17	127.70	428	60.95	141.70
3	-42.85	-45.12	74	-0.85	30.47	145	19.18	66.53	216	33.24	91.82	287	44.23	111.60	358	53.28	127.90	429	61.06	141.90
4	-41.67	-43.00	75	-0.49	31.11	146	19.41	66.94	217	33.41	92.13	288	44.39	111.90	359	53.45	128.20	430	61.17	142.10
5	-40.54	-40.96	76	-0.14	31.74	147	19.64	67.35	218	33.58	92.44	289	44.50	112.10	360	53.56	128.40	431	61.28	142.30
6	-39.45	-39.00	77	0.21	32.37	148	19.87	67.76	219	33.75	92.75	290	44.67	112.40	361	53.67	128.60	432	61.34	142.40
7	-38.40	-37.11	78	0.55	32.99	149	20.10	68.17	220	33.92	93.06	291	44.78	112.60	362	53.78	128.80	433	61.45	142.60
8	-37.39	-35.29	79	0.89	33.61	150	20.32	68.57	221	34.09	93.36	292	44.95	112.90	363	53.89	129.00	434	61.56	142.80
9	-36.41	-33.53	80	1.23	34.22	151	20.54	68.97	222	34.26	93.67	293	45.06	113.10	364	54.00	129.20	435	61.67	143.00
10	-35.46	-31.82	81	1.57	34.83	152	20.76	69.37	223	34.43	93.97	294	45.23	113.40	365	54.12	129.40	436	61.78	143.20
11	-34.54	-30.17	82	1.91	35.44	153	20.99	69.77	224	34.60	94.28	295	45.34	113.60	366	54.23	129.60	437	61.84	143.30
12	-33.65	-28.56	83	2.24	36.04	154	21.21	70.17	225	34.77	94.58	296	45.45	113.80	367	54.34	129.80	438	61.95	143.50
13	-32.78	-27.00	84	2.57	36.63	155	21.42	70.56	226	34.94	94.88	297	45.61	114.10	368	54.45	130.00	439	62.06	143.70
14	-31.94	-25.48	85	2.90	37.22	156	21.64	70.95	227	35.10	95.18	298	45.73	114.30	369	54.56	130.20	440	62.17	143.90
15	-31.11	-24.00	86	3.23	37.81	157	21.86	71.34	228	35.27	95.48	299	45.89	114.60	370	54.73	130.50	441	62.28	144.10
16	-30.31	-22.56	87	3.55	38.39	158	22.07	71.73	229	35.44	95.78	300	46.00	114.80	371	54.84	130.70	442	62.34	144.20
17	-29.53	-21.15	88	3.87	38.97	159	22.29	72.12	230	35.60	96.07	301	46.17	115.10	372	54.95	130.90	443	62.45	144.40
18	-28.77	-19.78	89	4.19	39.54	160	22.51	72.51	231	35.76	96.37	302	46.28	115.30	373	55.06	131.10	444	62.56	144.60
19	-28.02	-18.44	90	4.51	40.11	161	22.72	72.89	232	35.93	96.67	303	46.39	115.50	374	55.17	131.30	445	62.67	144.80
20	-27.30	-17.13	91	4.82	40.67	162	22.93	73.27	233	36.09	96.96	304	46.56	115.80	375	55.28	131.50	446	62.78	145.00
21	-26.58	-15.84	92	5.13	41.24	163	23.15	73.66	234	36.25	97.25	305	46.67	116.00	376	55.39	131.70	447	62.84	145.10
22	-25.89	-14.59	93	5.44	41.79	164	23.35	74.03	235	36.42	97.55	306	46.84	116.30	377	55.50	131.90	448	62.95	145.30
23	-25.20	-13.36	94	5.75	42.35	165	23.56	74.41	236	36.58	97.84	307	46.95	116.50	378	55.62	132.10	449	63.06	145.50
24	-24.53	-12.15	95	6.06	42.90	166	23.77	74.79	237	36.74	98.13	308	47.06	116.70	379	55.73	132.30	450	63.17	145.70
25	-23.87	-10.97	96	6.36	43.44	167	23.98	75.16	238	36.90	98.42	309	47.23	117.00	380	55.84	132.50	451	63.23	145.80
26	-23.22	-9.80	97	6.66	43.98	168	24.19	75.54	239	37.06	98.71	310	47.34	117.20	381	55.95	132.70	452	63.34	146.00
27	-22.59	-8.66	98	6.96	44.52	169	24.40	75.91	240	37.22	98.99	311	47.50	117.50	382	56.06	132.90	453	63.45	146.20
28	-21.97	-7.55	99	7.26	45.06	170	24.60	76.28	241	37.38	99.28	312	47.61	117.70	383	56.17	133.10	454	63.56	146.40
29	-21.36	-6.45	100	7.55	45.59	171	24.81	76.65	242	37.54	99.57	313	47.73	117.90	384	56.28	133.30	455	63.62	146.50
30	-20.76	-5.37	101	7.85	46.12	172	25.01	77.01	243	37.70	99.85	314	47.89	118.20	385	56.39	133.50	456	63.73	146.70
31	-20.17	-4.30	102	8.13	46.64	173	25.21	77.38	244	37.84	100.10	315	48.00	118.40	386	56.50	133.70	457	63.84	146.90
32	-19.59	-3.26	103	8.42	47.16	174	25.41	77.74	245	38.00	100.40	316	48.11	118.60	387	56.62	133.90	458	63.95	147.10
33	-19.02	-2.23	104	8.71	47.68	175	25.61	78.10	246	38.17	100.70	317	48.28	118.90	388	56.73	134.10	459	64.01	147.20
34	-18.45	-1.21	105	9.00	48.19	176	25.81	78.46	247	38.34	101.00	318	48.39	119.10	389	56.84	134.30	460	64.12	147.40
35	-17.90	-0.22	106	9.28	48.70	177	26.01	78.82	248	38.50	101.30	319	48.50	119.30	390	56.95	134.50	461	64.23	147.60
36	-17.35	0.77	107	9.56	49.21	178	26.21	79.18	249	38.61	101.50	320	48.67	119.60	391	57.06	134.70	462	64.28	147.70
37	-16.81	1.74	108	9.85	49.72	179	26.41	79.54	250	38.78	101.80	321	48.78	119.80	392	57.17	134.90	463	64.39	147.90
38	-16.28	2.69	109	10.12	50.22	180	26.61	79.89	251	38.95	102.10	322	48.89	120.00	393	57.28	135.10	464	64.51	148.10
39	-15.76	3.63	110	10.40	50.72	181	26.81	80.25	252	39.11	102.40	323	49.00	120.20	394	57.39	135.30	465	64.62	148.30
40	-15.25	4.56	111	10.67	51.21	182	27.00	80.60	253	39.28	102.70	324	49.17	120.50	395	57.50	135.50	466	64.67	148.40
41	-14.74	5.47	112	10.95	51.71	183	27.20	80.95	254	39.39	102.90	325	49.28	120.70	396	57.62	135.70	467	64.78	148.60
42	-14.23	6.38	113	11.22	52.20	184	27.39	81.30	255	39.56	103.20	326	49.39	120.90	397	57.73	135.90	468	64.89	148.80
43	-13.74	7.27	114	11.49	52.68	185	27.59	81.65	256	39.73	103.50	327	49.56	121.20	398	57.84	136.10	469	64.95	148.90
44	-13.25	8.15	115	11.76	53.17	186	27.77	81.99	257	39.89	103.80	328	49.67	121.40	399	57.89	136.20	470	65.06	149.10
45	-12.77	9.02	116	12.03	53.65	187	27.97	82.34	258	40.00	104.00	329	49.78	121.60	400	58.00	136.40	471	65.17	149.30
46	-12.30	9.87	117	12.30	54.13	188	28.16	82.68	259	40.17	104.30	330	49.89	121.80	401	58.12	136.60	472	65.23	149.40
47	-11.82	10.72	118	12.56	54.60	189	28.35	83.03	260	40.34	104.60	331	50.06	122.10	402	58.23	136.80	473	65.34	149.60
48	-11.36	11.56	119	12.82	55.08	190	28.54	83.37	261	40.45	104.80	332	50.17	122.30	403	58.34	137.00	474	65.45	149.80
49	-10.90	12.38	120	13.08	55.55	191	28.73	83.71	262	40.61	105.10	333	50.28	122.50	404	58.45	137.20	475	65.56	150.00
50	-10.45	13.20	121	13.34	56.01	192	28.92	84.05	263	40.78	105.40	334	50.39	122.70	405	58.56	137.40	476	65.62	150.10
51	-10.00	14.01	122	13.60	56.48	193	29.10	84.38	264	40.89	105.60	335	50.56	123.00	406	58.67	137.60	477	65.73	150.30
52	-9.55	14.81	123	13.86	56.94	194	29.29	84.72	265	41.06	105.90	336	50.67	123.20	407	58.78	137.80	478	65.84	150.50
53	-9.11	15.60	124	14.11	57.40	195	29.48	85.06	266	41.23	106.20	337	50.78	123.40	408	58.89	138.00	479	65.89	150.60
54	-8.68	16.38	125	14.37	57.86	196	29.66	85.39	267	41.34	106.40	338	50.89	123.60	409	59.00	138.20	480	66.01	150.80
55	-8.25	17.15	126	14.62	58.32	197	29.85	85.72	268	41.50	106.70	339	51.00	123.80	410	59.12	138.40	481	66.12	151.00
56	-7.82	17.92	127	14.87	58.77	198	30.03	86.05	269	41.67	107.00	340	51.17	124.10	411	59.17	138.50	482	66.17	151.10
57	-7.41	18.67	128	15.12	59.22	199	30.21	86.38	270	41.78	107.20	341	51.28	124.30	412	59.28	138.70	483	66.28	151.30
58	-6.99	19.42	129	15.37	59.67	200	30.40	86.71	271	41.95	107.50	342	51.39	124.50	413	59.39	138.90	484	66.39	151.50
59	-6.58	20.16	130	15.62	60.11	201	30.58	87.04	272	42.11	107.80	343	51.50	124.70	414	59.50	139.10	485	66.45	151.60
60	-6.17	20.90	131	15.87	60.56	202	30.76	87.37	273	42.23	108.00	344	51.62	124.90	415	59.62	139.30	486	66.56	151.80
61	-5.77	21.62	132	16.11	61.00	203	30.94	87.69	274	42.39	108.30	345	51.78	125.20	416	59.73	139.50	487	66.67	152.00
62	-5.37	22.34	133	16.36	61.44	204	31.12	88.02	275	42.50	108.50	346	51.89	125.40	417	59.84	139.70	488	66.73	152.10
63	-4.97	23.05	134	16.60	61.87	205	31.30	88.34	276	42.67	108.80	347	52.00	125.60	418	59.95	139.90	489	66.84	152.30
64	-4.58	23.76	135	16.84	62.31	206	31.48	88.66	277	42.84	109.10	348	52.12	125.80	419	60.00	140.00	490	66.89	152.40
65	-4.19	24.46	136	17.08	62.74	207	31.66	88.99	278	42.95	109.30	349	52.23	126.00	420	60.12	140.20	491	67.01	152.60
66	-3.81	25.15	137	17.32	63.17	208	31.84	89.31	279	43.11	109.60	350	52.34	126.20	421	60.23	140.40	492	67.12	152.80
67	-3.43	25.83	138	17.56	63.60	209	32.01	89.62	280	43.23	109.80	351	52.50	126.50	422	60.34	140.60	493	67.17	152.90
68	-3.05	26.51	139	17.79	64.02	210	32.19	89.94	281	43.39	110.10	352	52.62	126.70	423	60.45	140.80	494	67.28	153.10
69	-2.67	27.19	140	18.02	64.44	211	32.37	90.26	282	43.50	110.30	353	52.73	126.90	424	60.56	141.00	495	67.39	153.30
70	-2.31	27.85	141	18.26	64.87	212	32.54	90.57	283	43.67	110.60	354	52.84	127.10	425	60.67	141.20	496	67.45	153.40

Section 17.0 – E-Star OESE Installation Survey



PRESSURE READINGS

P1: Suction Pressure at Compressor Inlet
P2: Suction Pressure at Suction Service Valve
P3: Suction Pressure at Evaporator Outlet
P4: Pressure at Evaporator Inlet
P5: Pressure at Filter Drier Inlet
P6: Pressure at Liquid Line Service Valve
P7: Pressure at Receiver Outlet

TEMPERATURE READINGS

T1: Milk Temperature
T2: Suction Line Temperature at Evaporator Outlet
T3: Line Temperature at Accumulator Inlet
T4: Line Temperature at Accumulator Outlet
T5: Ambient Temperature Entering Condenser
T6: Suction Line Temperature Entering Compressor
T7: Compressor Discharge Temperature

SURVEY DATA TO BE SUPPLIED BY TECHNICIAN

Provide the actual time below. Readings should be taken at five-minute intervals.

															Compressor Amperage		
Time*	**P1**	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	**L1**	**L2**	**L3**

Measured Supply Voltage:	**Condensing Unit Model and Part No.:**	**Serial No.:**

PAUL
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