E-Star® OESE Condensing Unit

7.5 and 9 HP HFC

INSTALLATION AND OPERATION MANUAL

Part No. 8828748

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E-Star OESE Condensing Unit 7.5 and 9 HP HFC

INSTALLATION AND OPERATION MANUAL

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Section 1.0 – Introduction

1.1 GENERAL SPECIFICATIONS

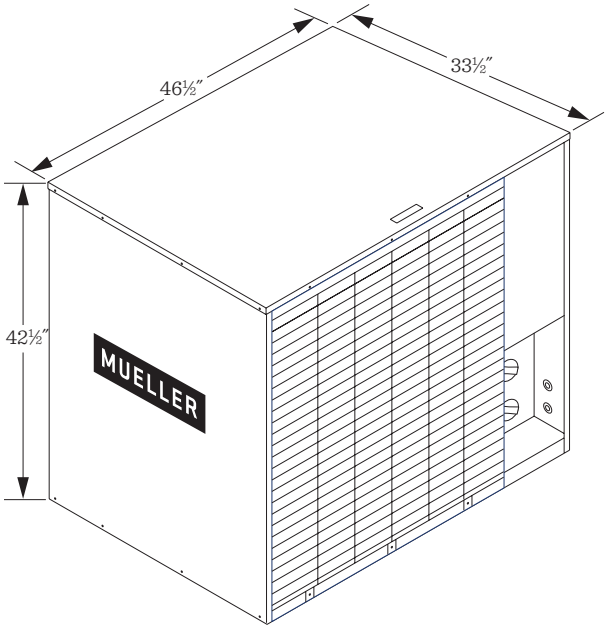
Mueller® E-Star® OESE condensing units are engineered to maximize the energy efficiency and cooling capacity of a milk cooling system. Custom and specialized components consist of the following:

- 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.
- An accumulator heat exchanger with a proprietary subcooling coil maximizes refrigeration capacity while protecting the compressor from liquid refrigerant.
- 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.
- A single, variable speed, high-efficiency fan motor provides maximum condensing efficiency over a wide range of ambient temperatures.
- An electrical enclosure is designed for safety, ease of installation, and serviceability. A resistive heater is included for reliable operation during colder ambient temperatures.
- The three-piece galvanized steel cover with an attached steel grill provides safe operation plus offers easy access for service..
- Rust-resistant brass service valves are located for easy access without removing the cover.

TABLE 1: DIMENSIONS AND WEIGHT

	7.5 and 9 HP	
Width	118.11 cm	46½ in
Depth	85.09 cm	33½ in
Height	107.95 cm	42½ in
Approximate Weight	204 kg	450 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 24 in (61 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 ensure the suction line returning from the evaporator is 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 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 NEC (National Electrical Code) regulations and procedures, connect a fused disconnect power supply of the proper voltage and phase to the E-Star OESE condensing unit's electrical enclosure.

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

Refer to the electrical schematics in Section 8.0 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.

2.6 COMPRESSOR ROTALOCK TORQUE SPECIFICATIONS

During shipment, threaded fittings under tension may stretch and relax. Copeland Corporation recommends inspecting and retorquing the Rotalock fittings on compressors.

The Rotalock fittings need to be checked after installation and the compressor has been in operation, due to the changes in temperature that could reduce the torque from the original setting. The compressor Rotalock torque specifications are as follows:

Discharge Rotalock	1¼ Nut	1,106–1,195 inch pounds or 89–100 foot pounds
Suction Rotalock	1¾ Nut	1,195–1,416 inch pounds or 100–120 foot pounds

2.7 OIL SIGHT GLASS TORQUE SPECIFICATIONS

The scroll compressor's sight glass may be susceptible to leakage due to shipment or a temperature change during operation. However, this fitting has a thread sealer that can crack after curing if re-torque is attempted.

The sight glass should be checked for leaks; if it is not leaking, do not attempt to re-torque. If the sight glass is leaking, the refrigerant must be recovered and the oil removed below the sight glass by utilizing the oil fill/drain port. Remove the sight glass and clean the threads. Apply Loctite anaerobic PST No. 12928/12929 Teflon sealer. Apply sealer sparingly to the threads only; do not apply to the end surface. Reinstall the sight glass and torque to these specifications:

Oil Sight Glass Torque	200 inch pounds or 20 foot pounds

Add new refrigerant oil through fill/drain port to the same level as before sight glass removal.

Section 3.0 – Refrigerant Charging

3.1 EPA REFRIGERANT REGULATIONS[1]

Mueller OESE condensing units are designed to operate with R-507 refrigerant. R-507 refrigerant is specified by 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 or Universal 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: Mueller E-Star 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 recommendation in Table 6. The refrigerant charge should be adjusted for the final operating charge, as described in Section 3.4.

TABLE 6: RECOMMENDED STARTUP REFRIGERANT CHARGE

Condensing Unit Size	Recommended Startup Charge	
	Milk Cooler	Chiller
7.5 HP	25 lbs / 11.34 kg	23 lbs / 10.43 kg
9 HP	25 lbs / 11.34 kg	23 lbs / 10.43 kg

NOTE: R-507 is recommended for use with Mueller E-Star OESE condensing units; however, other refrigerants may be compatible. Contact the Mueller Dairy Farm Equipment Service Department for more information.

IMPORTANT: The compressor is equipped with Rotalock suction and discharge service valves intended for ease of compressor change-out only. At no time during operation should these valves be closed.

3.3 WEIGH-IN REFRIGERANT CHARGING

The following steps will outline the procedure to weigh in the refrigerant startup charge:

1. With a clean and evacuated system, connect the manifold gauges to P2, suction charging access port, and P6, high-side service valve.
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 hose 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 P2, suction charging access port.

3.3 WEIGH-IN REFRIGERANT CHARGING (CONTINUED)

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

7. Monitoring the gross weight of the refrigerant cylinder, weigh in the remaining refrigerant charge in liquid state at P2, suction charging access port (up stream of accumulator).

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

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 refrigerant line length.

1. With the evaporator completely covered with milk/water or with the chilled solution circulating through the chiller, operate the cooler or chiller with the startup refrigerant charge until the product is cooled below 45°F.

2. Check the evaporator superheat and ensure that it is properly adjusted. Milk cooler evaporator superheat should be set at 4–6°F and chiller evaporator superheat should be set at 10–12°F. Refer to Section 5.0 for the 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 P6, high-side service valve, until an occasional bubble of vapor is seen in the sight glass.

4. Slowly add refrigerant at P2, suction charging access port, 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 ports P2 or P3, to ensure the compressor is protected against liquid refrigerant slugging.

3.5 REFRIGERANT TESTING

When removing refrigerant from a system which 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.

3.6 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

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

Refer to Figure 2, "Refrigeration Piping Schematics." 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 (5.5–13.8°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 (1.1–2.75°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.

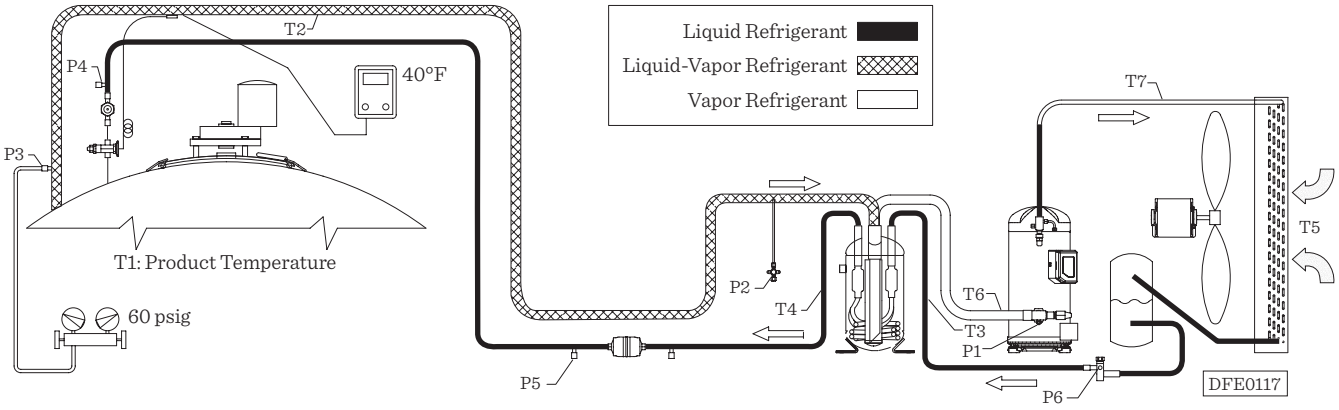
4.2 OIL RETURN

Refrigerant oil returning from the evaporator drops into the accumulator where the oil separates from the refrigerant and settles to the bottom of the accumulator. 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. Reference 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 properly subcooled liquid refrigerant to the TEV, which ensures optimum evaporator efficiency.

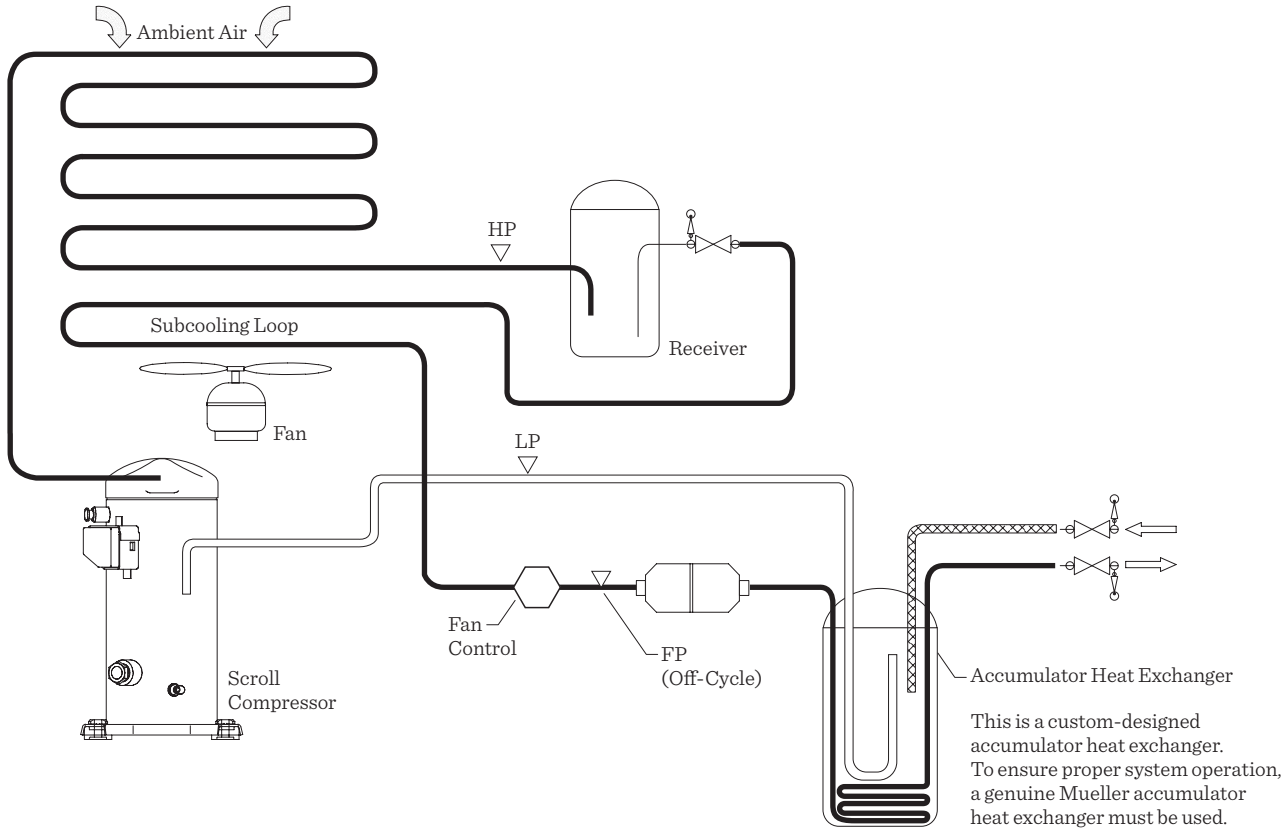
FIGURE 2: REFRIGERANT PIPING SCHEMATICS



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, charging access port 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 condensing unit's TEV must be field adjusted to maintain the milk cooler evaporator's superheat at 4–6°F (2.2–3.3°C) or the chiller evaporator's superheat at 10–12°F (5.6–6.7°C). Proper location and sizing of the thermal expansion valve is critical. Refer to Section 5.2 for the superheat adjustment procedure.

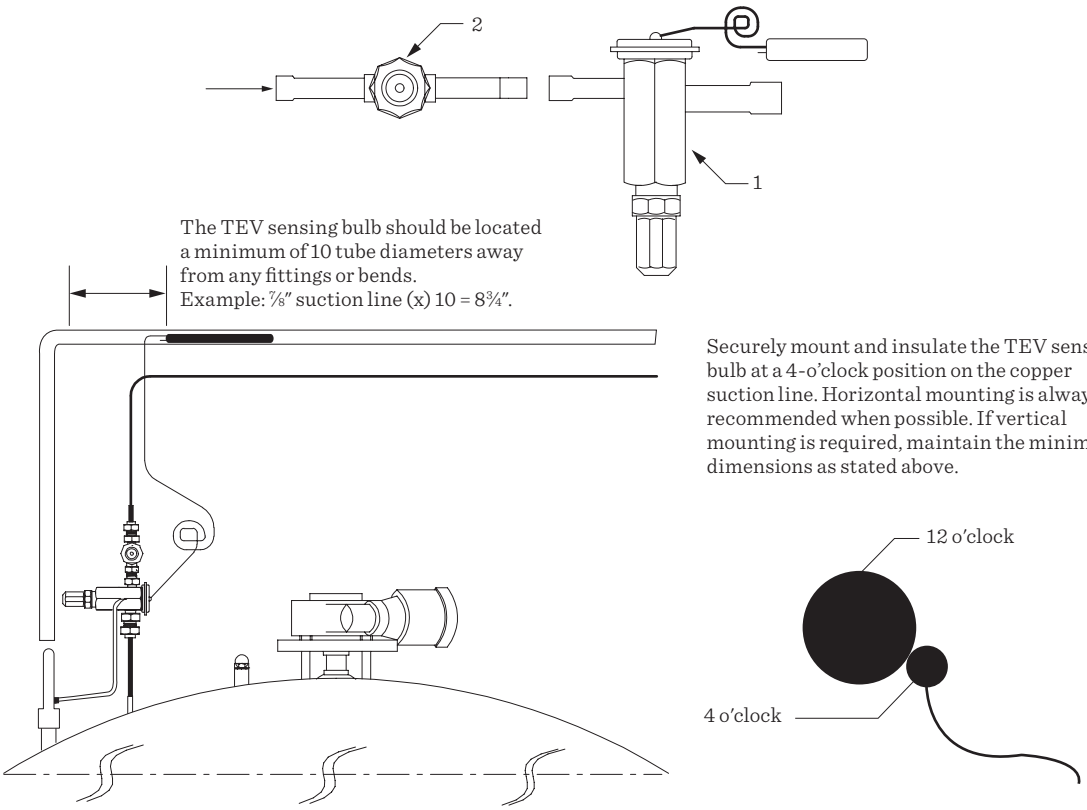
An externally equalized TEV must be used on Mueller milk cooling applications. A sight glass must be installed at the TEV inlet.

See Table 7 for expansion valve selection.

TABLE 7: THERMAL EXPANSION VALVE SELECTION

No.	Description	Specifications	Part No. for Milk Cooler Applications	Part No. for Chiller Applications
1	R-507 TEV (7.5 HP)	½" ODF inlet x ⅞" ODF outlet	8825838	N/A
2	Sight Glass (7.5 HP)	½" ODF inlet x ½" ODF outlet solder	8824494	N/A
3	R-507 TEV (9 HP)	⅝" ODF inlet x ⅞" ODF outlet	8825840	8825850
4	Sight Glass (9 HP)	½" ODF inlet x ½" ODF	9813636	9813636

FIGURE 3: THERMAL EXPANSION VALVE INSTALLATION



5.2 CHECKING AND ADJUSTING SUPERHEAT

Take the following readings with the evaporator completely covered with milk/water or with the chilled 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 access port, due to unknown pressure drop in the refrigerant line between the evaporator and compressor. The technician should also ensure the system is properly charged with refrigerant as described in Section 3.

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

3. Utilizing the appropriate pressure temperature chart, convert the suction pressure reading from step 1 to the saturation temperature. (See Section 17 for the pressure temperature chart.)

4. The superheat 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 of (e.g., 4–6°F for milk coolers, 10–12°F for chillers) at conditions as described above, adjust the TEV.

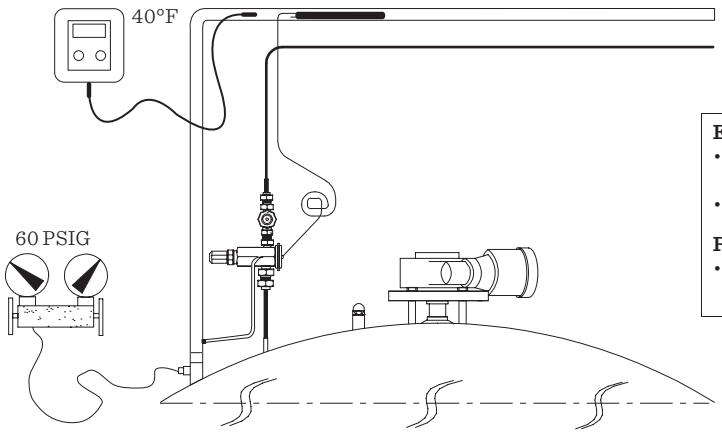
6. If superheat is below the proper range, turn the TEV's adjustment stem clockwise ⅛ to ¼ of a turn. Allow the system to operate for 5 minutes before repeating test.

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 5 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.

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

FIGURE 4: CHECKING AND ADJUSTING SUPERHEAT



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.

Section 6.0 – Accumulator Heat Exchanger

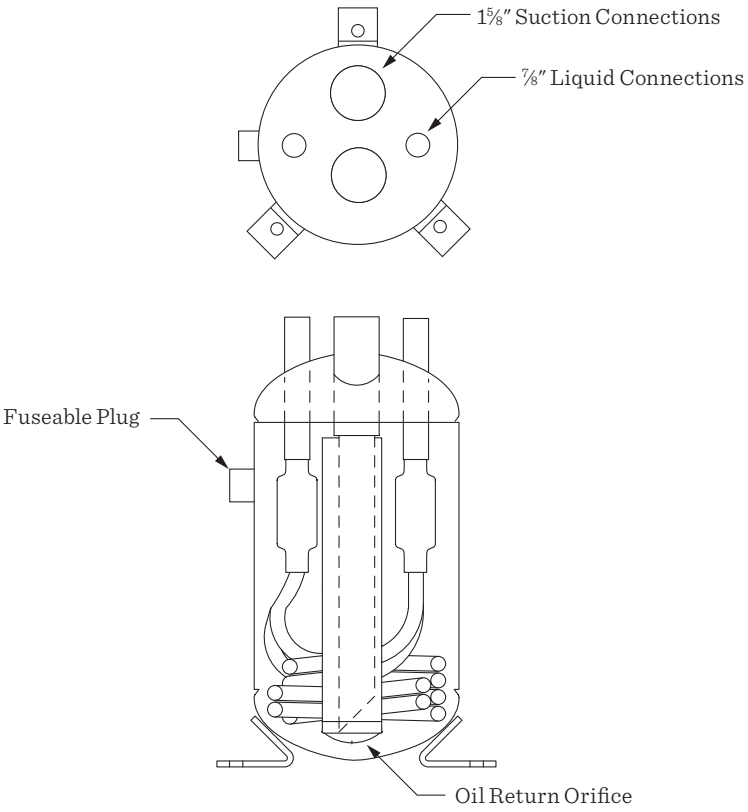
6.1 ACCUMULATOR HEAT EXCHANGER FUNCTIONS

The accumulator heat exchanger performs several functions on the OESE system.

- **Additional Subcooling:** 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 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 custom 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 5: ACCUMULATOR HEAT EXCHANGER



Section 7.0 – Electrical

7.1 E-STAR OESE CONDENSING UNIT ELECTRICAL WIRING

Authorized personnel, in accordance with the National Electrical Code (NEC) and/or local and state codes, must perform all wiring. Refer to Section 16.0 for electrical requirements and Section 8.0 for wiring schematics.

A fused disconnect must be provided of adequate size, voltage, and phase for the incoming power supply to the E-Star OESE condensing unit.

7.2 CORESENSE DIAGNOSTICS™ MODULE FOR 7.5 AND 9 HP COMPRESSORS

A Copeland CoreSense module is installed in the electrical box of all 7.5 and 9 HP K5 Scroll compressors. The CoreSense module can accurately detect the cause of electrical and system related issues by monitoring and analyzing data from K5 compressors via module power, discharge line thermistor, and the current transducer (CT). A flashing LED indicator displays alert, fault, and trip conditions.

IMPORTANT: When servicing or replacing the CoreSense module, it is imperative that bit switch 6 of the compressor operation switch block be turned on; all other switches remain off.

7.3 CORESENSE LED STATUS

CORESENSE MODULE DIAGNOSTICS		
LED Color	**Solid Light**	**Flashing Light**
Green	Normal	Alerts
Yellow	Demand/No Current	Trip (Auto Reset)
Red	—	Lock Out (Manual Reset)

7.4 CORESENSE DIAGNOSTIC FAULT CODE DETAILS

The LEDs will flash a number of times consecutively, pause, and then repeat the process. To identify an alert code number, count the number of consecutive flashes. Detailed descriptions of specific alert codes are shown below.

Fault Code	Color	Code Description	Protection Shutdown	Protection Off Time	Consecutive Detections Until Lockout
1	Red/Yellow	High Discharge Line Temperature	Yes	20 Min.	4
2	Yellow	Excessive Limit Trips	Yes	5 Min.	No Lockout
3	Green	Excessive Demand Cycling	NO	N/A	N/A
4	Red/Yellow	Locked Rotor	Yes	20 Min.	4
5	Green	Demand Present- No Current Present	No	N/A	N/A
6	Red/Yellow	Phase Loss Detected	Yes	20 Min.	10
7	Red	Reversed Phase Detected	Yes	Reset Required	1
8	Green	Welded Contactor	No[1]	—	—
9	Yellow	Low Module Voltage	Yes	5 Min.	No Lockout
10	Green	Module Communications Error	No	—	—
11	Green	Discharge Temperature Sensor Error	No	—	—
12	Green	Current Transducer Error	No	—	—

[1] Code 8 displays for 24 hours after last detection. With Terminal D energized, the M1–M2 relay will open during a protection shutdown. To reset module, cycle module power.

7.5 CORESENSE PROTECTION MODULE CONNECTION WIRING

The CoreSense operates on constant power of 240 volts at terminals L1–L2. When a 120-volt run signal is applied to terminal D, and if there are no protective faults detected within the CoreSense, the M1–M2 control circuit contacts will close. The compressor will run with no external faults present. If the CoreSense detects a problem, the M1–M2 contacts will open, de-energizing the compressor.

7.6 CORESENSE PROTECTION MODULE VOLTAGE TROUBLESHOOTING

1. Verify that all wire connectors are maintaining a good mechanical connection. Replace any connectors that are loose.

2. Measure the voltage across L1–L2 to ensure the proper supply voltage and the demand voltage at terminal D is present.

3. Measure the control voltage (24 VAC) across the M1–M2 contacts:

    a. If the measured voltage is equal to the control voltage, then the M1–M2 contacts are open.

    b. If the measurement is less than one volt and the compressor is not running, then the problem is external to the motor protector module.

IMPORTANT: Do not run a Copeland Scroll compressor in a deep vacuum. Failure to heed this advice can result in arcing of the Fusite pins and permanent damage to the compressor.

IMPORTANT: Scroll compressors (as with any refrigerant compressor) should never be used to evacuate a refrigeration system.

The compressor leads must be routed through the holes in the current transducer (CT) module marked T1, T2, and T3. Only the compressor lead wires should be placed through the CT module.

Directional Dependence of Three-Phase Scroll Compressors: Scroll compressors are directionally dependent and will compress in one rotational direction only. The CoreSense module will provide reverse rotation protection.

7.7 CORESENSE PRODUCT SPECIFICATIONS

Operating Temperature:	–40° to 150°F (–40° to 65°C)
Storage Temperature:	–40° to 175°F (–40° to 80°C)
Power Supply Range:	85–265 VAC, 50–60 Hz
Working Amperage for CT Module:	3–200 A

NOTE: The CoreSense module is not accurate below 3 A. If the current drawn by the compressor during operation falls below 3 A, the module may indicate a fault condition and alarm.

Maximum continuous contactor coil current is 2 A with a maximum in rush current of 20 A.

7.8 COPELAND SCROLL COMPRESSOR FUNCTIONAL CHECK

Copeland Scroll compressors do not have internal suction valves. It is not necessary to perform functional compressor tests to check how the compressor will pull suction pressure. This type of test may damage a scroll compressor. The following diagnostic procedure should be used to evaluate whether a Copeland scroll compressor is functioning properly.

1. Verify proper unit voltage.

2. Normal motor winding continuity and short-to-ground checks can be used to determine proper motor resistance or if an internal short-to-ground has developed.

3. With service gauges connected to the suction and discharge pressure fittings, turn on the compressor. If suction pressure falls below normal levels, the system is either low on charge or there is a flow blockage.

The operational compressor current draw should be compared to published performance curves (see the compressor data sheets) at the operating conditions (e.g., pressures and voltages). Significant deviation (± 15%) from published values may indicate a faulty compressor.

Section 8.0 – Electrical Schematics

8.1 OESE 7.5 AND 9 HP, 200–220/50/3, 208–230/60/3

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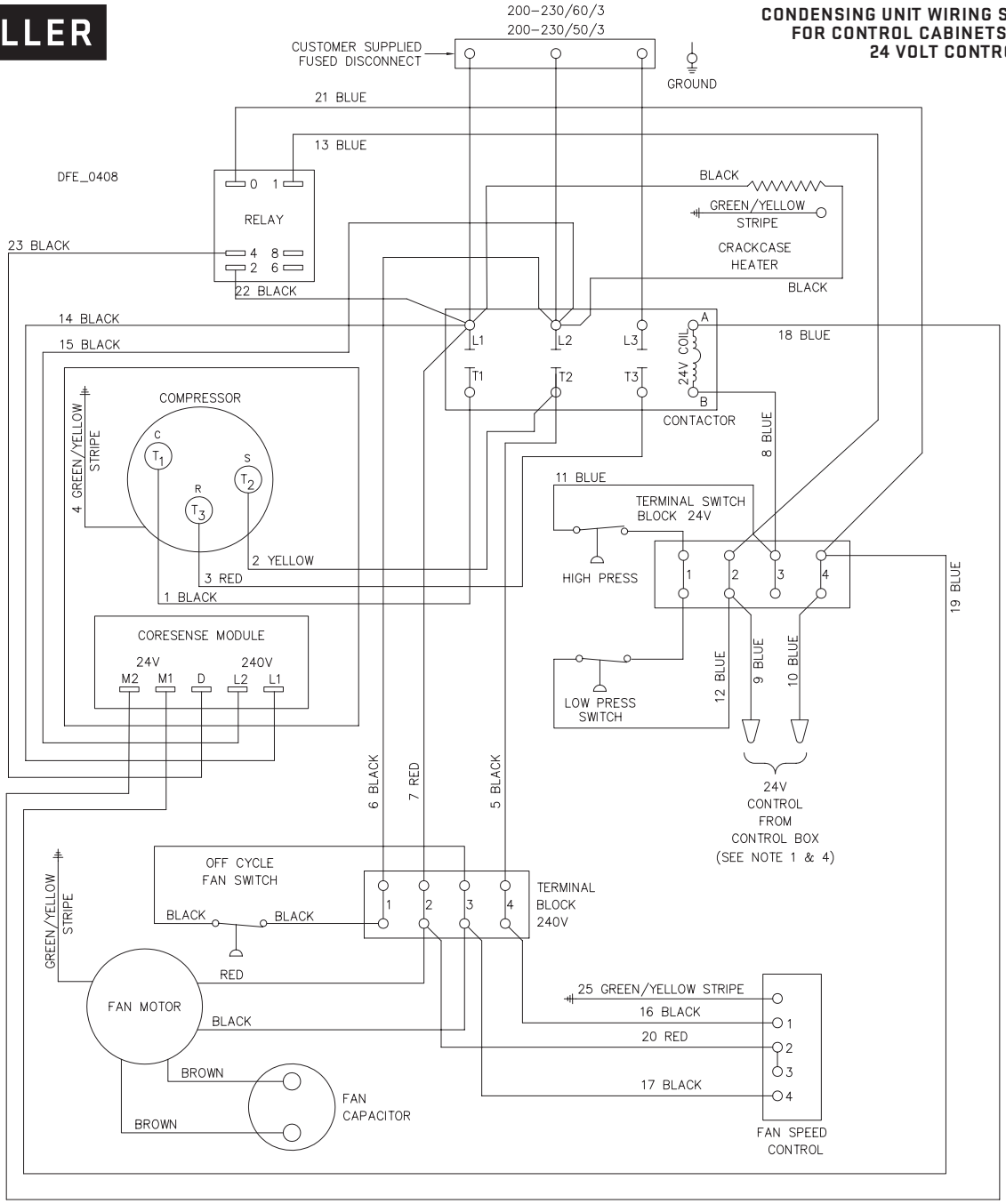
**CONDENSING UNIT WIRING SCHEMATIC
FOR CONTROL CABINETS UTILIZING
24 VOLT CONTROL OUTPUT**



NOTES:
1. Minimal 20 va transformer required for control voltage.
2. Use minimum of 75°c insulated copper wire on field wiring.
3. Fan motor is internally thermal protected.
4. Connect 24 volt control wiring to leads with supplied wire nuts.
5. All enforced electrical codes must be followed during installation, service, and/or operation of this equipment.
6. Fan may start automatically even if the compressor is not running.
7. All grounds terminate in the control box.

—— FACTORY INSTALLED WIRING
– – – CUSTOMER FIELD-INSTALLED WIRING

8.2 OESE 7.5 AND 9 HP, 380/50/3, 460/60/3, 575/60/3

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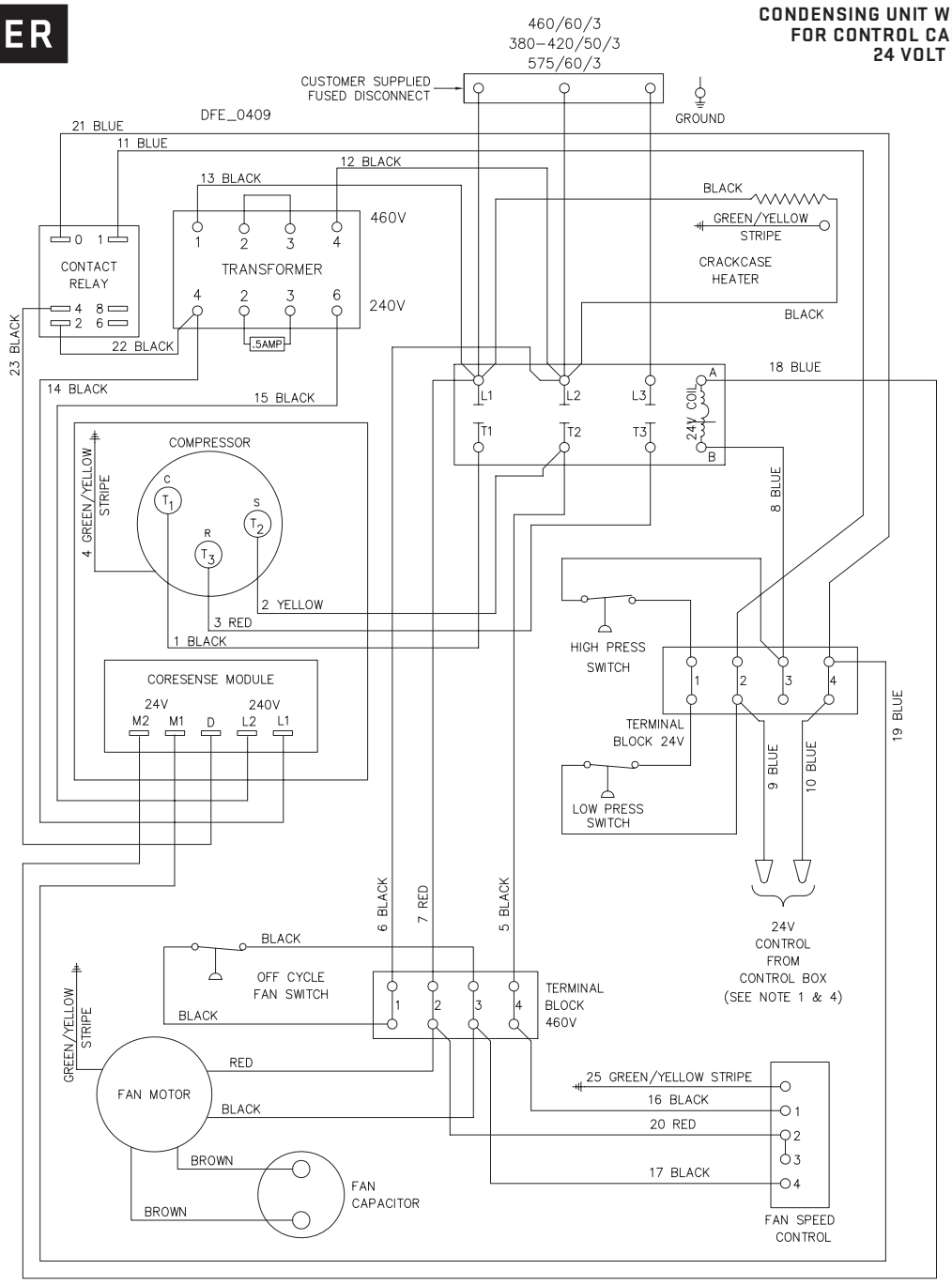
**CONDENSING UNIT WIRING SCHEMATIC
FOR CONTROL CABINETS UTILIZING
24 VOLT CONTROL OUTPUT**



NOTES:
1. Minimal 20 va transformer required for control voltage.
2. Use minimum of 75°c insulated copper wire on field wiring.
3. Fan motor is internally thermal protected.
4. Connect 24 volt control wiring to leads with supplied wire nuts.
5. All enforced electrical codes must be followed during installation, service, and/or operation of this equipment.
6. Fan may start automatically even if the compressor is not running.
7. All grounds terminate in the control box.

—— FACTORY INSTALLED WIRING
– – – CUSTOMER FIELD-INSTALLED WIRING

Section 9.0 – Pressure Switches and Fan Control

9.1 LOW-PRESSURE SWITCH WITH AUTO RESET

The low-pressure switch should be tested during installation to ensure proper operation. (For brazed-plate chiller applications, ensure the glycol solution temperature is above 50°F (10°C) to prevent damage to the evaporator by freezing.) This can be accomplished by completing these steps:

1. Attach an accurate low-pressure gauge to P2, access charging port.
2. Slowly close P6 service valve 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 P6 service valve and monitor the suction pressure on the gauge.
5. When the suction pressure reaches approximately 30 psig (± 2 psig), the pressure switch will reset and the compressor will energize.
6. The low-pressure switch should be replaced if it does not operate as indicated above.

9.2 HIGH-PRESSURE SWITCH WITH AUTO RESET

The high-pressure switch should be tested during installation to ensure proper operation. This can be accomplished by completing these steps:

1. Attach an accurate high-pressure gauge to P6, high-side service valve.
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 480 psig (± 10 psig) on R-507 units.
4. Reconnect the fan motor wires and monitor the high-side pressure on the gauge.
5. The pressure switch will reset and the compressor will energize when the high-side pressure reaches approximately 450 psig on R-507 units.
6. The high-pressure switch should be replaced if it does not operate as indicated above.

9.3 RGE ELECTRONIC FAN PRESSURE CONTROL

The Mueller E-Star OESE condensing unit uses 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.

9.3 RGE ELECTRONIC FAN PRESSURE CONTROL (CONTINUED)

The RGE has two modes, minimum speed and cut-off (230 V models only). The RGE is intended to be operated in the cut-off mode. This mode is selected by the changeover switch, located inside the enclosure. By placing the switch in the cut-off 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.

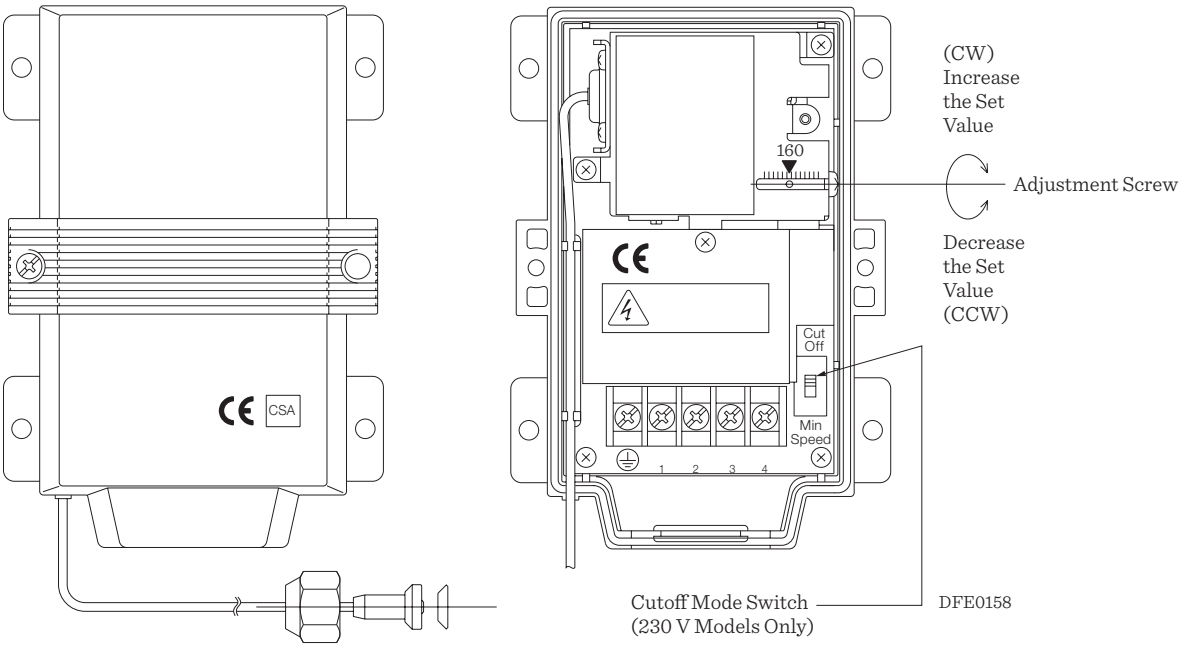
9.4 RGE ELECTRONIC FAN PRESSURE CONTROL SETPOINT ADJUSTMENT

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 high-side pressure.

To adjust the pressure range, remove the RGE cover and locate the adjustment screw (see Figure 5). To increase the pressure range, turn the adjustment screw clockwise. To lower pressure range, turn the adjustment screw counterclockwise. One turn of the adjustment screw will change the range by approximately 15 psig.

FIGURE 6: RGE ELECTRONIC FAN PRESSURE CONTROL



9.5 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.

9.6 SCHRADER CORE IDENTIFICATION

All pressure switches will be marked with a red tie band to indicate if a Schrader core is present. If a pressure switch connection does not have a red tie band, the refrigerant will require recovery before the pressure switch can be removed.

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

Section 10.0 – Equipment Sound Level

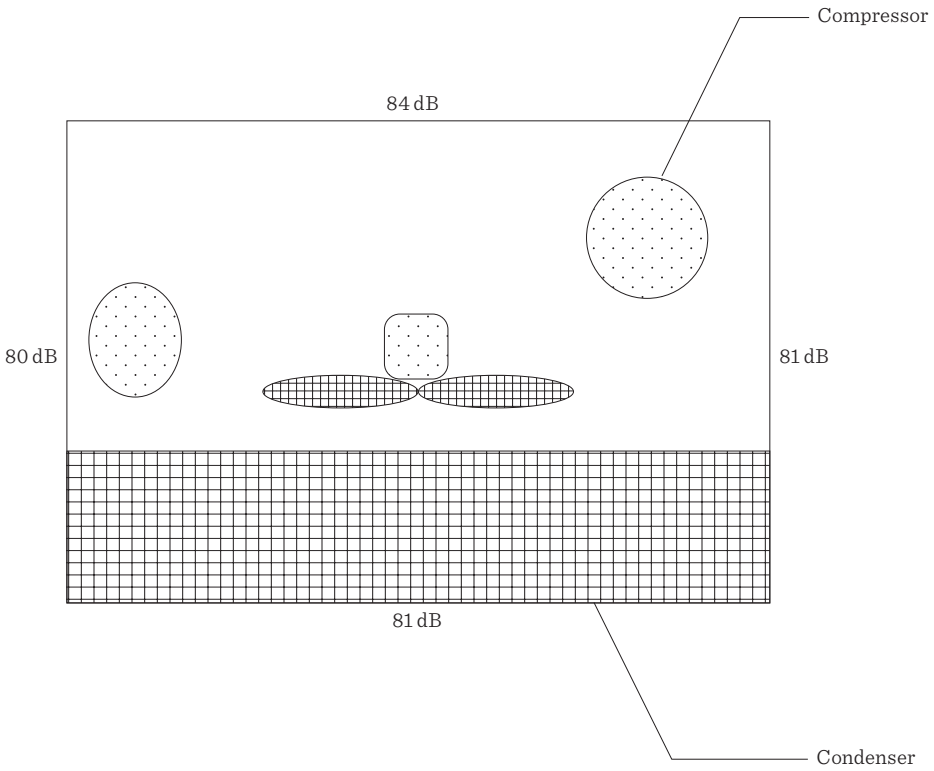
10.1 SOUND TESTING EQUIPMENT

The manufacturer tested sound levels of the Mueller E-Star OESE 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.

10.2 SOUND MEASUREMENT

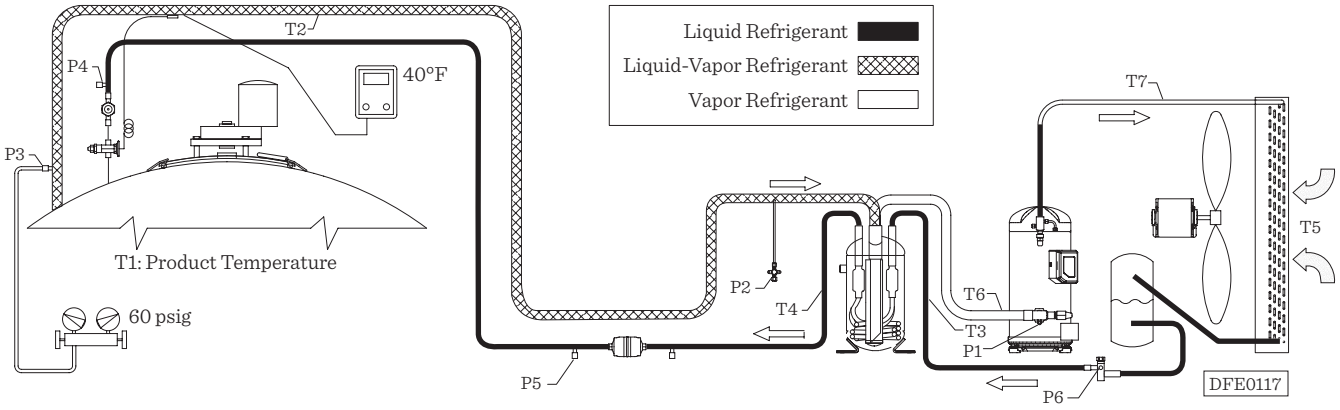
All sound measurements were recorded at a distance of 1 meter (3.28 feet) from the operating equipment. The highest recorded measurement was 84 dB.

FIGURE 7: SOUND MEASUREMENT



Section 11.0 – Maintenance

11.1 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 After Liquid Line Filter Drier
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.:**					

11.2 MAINTENANCE PROCEDURES

The E-Star OESE condensing unit requires 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 amperage draw of the compressor and verify that 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 9.
9. Complete a performance survey for each condensing unit verifying proper cooling capacity. Please refer to Section 11.1.

11.3 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 12.0 – Disposal

12.1 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.

12.2 COMPRESSOR REFRIGERANT OIL

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

12.3 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 13.0 – Equipment Markings

13.1 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

13.2 LABEL NO. 8824716, HFC REFRIGERANT

REFRIGERANT R-507
POE OIL

0305 8824716

13.3 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

13.4 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

13.5 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

13.6 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

13.7 LABEL NO. 8822232, WARNING SYMBOL: HOT

6911 8822232

13.8 LABEL NO. 8820623, WARNING SYMBOL: ELECTRICAL

13.9 LABEL NO. 8822226, WARNING: SCREEN GUARD REMOVAL

⚠ WARNING

Authorized Personnel Only To Remove Screen Guard

6911 8822226

13.10 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

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

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

⚠ WARNING

SCREEN GUARD MUST BE IN PLACE
BEFORE OPERATING THE UNIT.

⚠ ADVERTISSEMENT

L'ÉCRAN DE PROTECTION DOIT
ÊTRE EN PLACE AVANT DE FAIRE
FONCTIONNER L'APPAREIL.

⚠ PELIGRO

LA TELA DE PROTECCION DEBE DE
ESTAR SITUADA ANTES DE OPERAR
LA UNIDAD.

8906 8820768

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

13.14 LABEL NO. 8824383, MUELLER LOGO

MUELLER

13.15 LABEL NO. 8822705, CSA

Section 14.0 – Safety

NOTE: SEE ALL SAFETY, WARNING, AND CAUTION LABELS DISPLAYED IN SECTION 13.0.

14.1 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.

14.2 REFRIGERANT HEALTH HAZARDS

Although the toxicity and flammability of HFC refrigerants 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.

14.3 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.

14.4 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 for the situation.

Section 15.0 – Technical Data

15.1 E-STAR OESE ELECTRICAL DATA

Model	Part No.	Description	Voltage	Hz	Phase	Full Load Amps	Locked Rotor Amps	Rated Load Amps	Min. Circuit Amps	Max. Fuse Size
OESE-A753-HFC	8827001	7.5 HP, Three-Phase Unit, R-507	200–230	50/60	3	–	–	–	46.8	80
	8827021	Compressor, Scroll, ZB58K5E-TFC	200–230	50/60	3	–	195	35.4	–	–
	8824390	Fan Motor, ½ HP	200–208–230	50/60	1	2.5	–	–	–	–
OESE-A754-HFC	8827002	7.5 HP, Three-Phase Unit, R-507	380–460	50/60	3	–	–	–	20.7	35
	8827022	Compressor, Scroll, ZB58K5E-TFD	380–460	50/60	3	–	95	15.4	–	–
	8824825	Fan Motor, ½ HP	380–460	50/60	1	1.4	–	–	–	–
OESE-A93-HFC	8827003	9 HP, Three-Phase Unit, R-507	200–240	50/60	3	–	–	–	53	90
	8827023	Compressor, Scroll, ZB66K5E-TFC	200–240	50/60	3	–	225	40.3	–	–
	8824390	Fan Motor, ½ HP	200–208–230	50/60	1	2.5	–	–	–	–
OESE-A94-HFC	8827004	9 HP, Three-Phase Unit, R-507	380–460	50/60	3	–	–	–	23.3	40
	8827024	Compressor, Scroll, ZB66K5E-TFD	380–460	50/60	3	–	114	17.5	–	–
	8824825	Fan Motor, ½ HP	380–460	50/60	1	1.4	–	–	–	–

15.2 E-STAR OESE REFRIGERANT DATA

Model	Part No.	Description	Refrigerant Type	Recommended Startup Refrigerant Charge	
				Milk Tank	Chiller
OESE-A753-HFC	8827001	7.5 HP, Three-Phase Unit	R-507	25 lbs / 11.3 kg	23 lbs / 10.4 kg
OESE-A754-HFC	8827002	7.5 HP, Three-Phase Unit	R-507	25 lbs / 11.3 kg	23 lbs / 10.4 kg
OESE-A93-HFC	8827003	9 HP, Three-Phase Unit	R-507	25 lbs / 11.3 kg	23 lbs / 10.4 kg
OESE-A94-HFC	8827004	9 HP, Three-Phase Unit	R-507	25 lbs / 11.3 kg	23 lbs / 10.4 kg

15.3 E-STAR OESE EXPANSION VALVE SELECTION

Model	Part No.	Description	Expansion Valve Part No.	
			Milk Tank	Chiller
OESE-A753-HFC	8827001	7.5 HP, Three-Phase Unit, ZB58K5E, R-507	8825838	N/A
OESE-A754-HFC	8827002	7.5 HP, Three-Phase Unit, ZB58K5E, R-507	8825838	N/A
OESE-A93-HFC	8827003	9 HP, Three-Phase Unit, ZB66K5E, R-507	8825840	8825850
OESE-A94-HFC	8827004	9 HP, Three-Phase Unit, ZB66K5E, R-507	8825840	8825850

Section 16.0 – Compressor Data Charts

16.1 ZB58K5E-TFC 3-PHASE, 7.5 HP, 208–230 V COMPRESSOR DATA CHART

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

MEDIUM TEMPERATURE

ZB58K5E-TFC
HFC-507
COPELAND SCROLL®
TFC 208/230-3-60

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

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

		-10.0 (25)	-5.0 (30)	5.0 (40)	10.0 (46)	20.0 (58)	25.0 (65)	30.0 (73)	40.0 (89)	45.0 (98)
140.0 (413)	C				34,300	44,700	50,200	55,900	68,500	75,500
	P				10,750	10,750	10,800	10,800	10,850	10,850
	A				31.4	31.6	31.6	31.7	31.8	31.8
	M				921	1,222	1,386	1,563	1,968	2,204
	E				3.2	4.2	4.7	5.2	6.4	7.0
	%				48.9	56.7	59.9	62.6	67.3	69.2
130.0 (363)	C			36,200	41,500	52,400	58,300	64,600	78,400	86,200
	P			9,520	9,530	9,580	9,610	9,640	9,680	9,690
	A			28.5	28.6	28.8	28.9	28.9	29.0	29.0
	M			853	983	1,264	1,418	1,586	1,974	2,200
	E			3.8	4.4	5.5	6.1	6.7	8.1	8.9
	%			51.3	55.3	61.5	63.9	65.9	69.2	70.5
115.0 (298)	C	29,300	34,500	45,100	50,600	62,600	69,200	76,300	92,200	101,500
	P	7,870	7,880	7,940	7,980	8,070	8,120	8,150	8,190	8,180
	A	24.9	24.9	25.0	25.1	25.3	25.4	25.5	25.6	25.6
	M	587	695	918	1,038	1,302	1,450	1,612	1,989	2,210
	E	3.7	4.4	5.7	6.4	7.8	8.6	9.4	11.3	12.4
	%	47.3	52.3	59.9	62.6	66.6	68.1	69.2	70.8	71.2
105.0 (260)	C	34,000	39,200	50,100	55,900	68,700	75,800	83,500	101,000	111,000
	P	6,920	6,960	7,060	7,120	7,220	7,270	7,300	7,310	7,290
	A	22.9	22.9	23.0	23.1	23.4	23.5	23.6	23.7	23.7
	M	630	730	942	1,057	1,315	1,462	1,624	2,000	2,220
	E	4.9	5.7	7.1	7.9	9.5	10.5	11.5	13.8	15.2
	%	54.0	58.0	63.8	65.8	68.5	69.4	70.0	70.4	70.2
90.0 (209)	C	39,800	45,100	56,500	62,800	76,900	84,900	93,600	113,500	124,500
	P	5,750	5,820	5,960	6,030	6,140	6,170	6,180	6,140	6,070
	A	20.5	20.6	20.7	20.9	21.1	21.2	21.3	21.4	21.3
	M	666	757	958	1,070	1,325	1,473	1,635	2,015	2,237
	E	6.9	7.8	9.5	10.4	12.6	13.8	15.2	18.5	20.6
	%	61.1	63.7	67.0	68.0	68.8	68.8	68.5	66.9	65.6
80.0 (179)	C	42,900	48,300	60,300	66,900	82,100	90,700	100,000	121,500	134,000
	P	5,110	5,190	5,350	5,410	5,500	5,520	5,510	5,420	5,320
	A	19.3	19.3	19.5	19.6	19.9	20.0	20.1	20.1	20.0
	M	677	765	961	1,072	1,329	1,478	1,642	2,027	2,252
	E	8.4	9.3	11.3	12.4	14.9	16.5	18.2	22.5	25.2
	%	64.0	65.6	67.3	67.6	67.2	66.5	65.5	62.3	59.9
65.0 (141)	C	47,000	52,700	65,500	72,800	89,600	99,300	110,000		
	P	4,320	4,400	4,550	4,600	4,640	4,630	4,580		
	A	17.9	17.9	18.1	18.2	18.4	18.5	18.6		
	M	683	768	961	1,073	1,334	1,487	1,655		
	E	10.9	12.0	14.4	15.8	19.3	21.5	24.0		
	%	65.3	65.6	65.0	64.2	61.6	59.7	57.3		
55.0 (118)	C	49,500	55,300	68,800	76,600	94,700				
	P	3,870	3,950	4,080	4,110	4,100				
	A	17.1	17.2	17.4	17.5	17.7				
	M	684	767	962	1,075	1,340				
	E	12.8	14.0	16.9	18.7	23.1				
	%	64.4	63.8	61.6	60.0	55.5				
40.0 (89)	C	53,000	59,300	74,000						
	P	3,260	3,330	3,390						
	A	16.3	16.3	16.5						
	M	685	768	965						
	E	16.3	17.9	21.8						
	%	60.3	58.3	53.3						

C: Capacity (Btu/hr), P: Power (Watts), A: Current (Amps), M: Mass Flow (lb/hr), E: EER (Btu/Wh), %: 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 5/7/2018
11-88 2051

EMERSON Climate Technologies

16.2 ZB58K5E-TFD 3-PHASE, 7.5 HP, 460 V COMPRESSOR DATA CHART

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

MEDIUM TEMPERATURE

ZB58K5E-TFD
HFC-507
COPELAND SCROLL®
TFD 460-3-60

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

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

		-10.0 (25)	-5.0 (30)	5.0 (40)	10.0 (46)	20.0 (58)	25.0 (65)	30.0 (73)	40.0 (89)	45.0 (98)
140.0 (413)	C				34,300	44,700	50,200	55,900	68,500	75,500
	P				10,750	10,750	10,800	10,800	10,850	10,850
	A				15.7	15.8	15.8	15.9	15.9	15.9
	M				921	1,222	1,386	1,563	1,968	2,204
	E				3.2	4.2	4.7	5.2	6.4	7.0
	%				48.9	56.7	59.9	62.6	67.3	69.2
130.0 (363)	C			36,200	41,500	52,400	58,300	64,600	78,400	86,200
	P			9,520	9,530	9,580	9,610	9,640	9,680	9,690
	A			14.3	14.3	14.4	14.4	14.5	14.5	14.5
	M			853	983	1,264	1,418	1,586	1,974	2,200
	E			3.8	4.4	5.5	6.1	6.7	8.1	8.9
	%			51.3	55.3	61.5	63.9	65.9	69.2	70.5
115.0 (298)	C	29,300	34,500	45,100	50,600	62,600	69,200	76,300	92,200	101,500
	P	7,870	7,880	7,940	7,980	8,070	8,120	8,150	8,190	8,180
	A	12.5	12.4	12.5	12.5	12.7	12.7	12.8	12.8	12.8
	M	587	695	918	1,038	1,302	1,450	1,612	1,989	2,210
	E	3.7	4.4	5.7	6.4	7.8	8.6	9.4	11.3	12.4
	%	47.3	52.3	59.9	62.6	66.6	68.1	69.2	70.8	71.2
105.0 (260)	C	34,000	39,200	50,100	55,900	68,700	75,800	83,500	101,000	111,000
	P	6,920	6,960	7,060	7,120	7,220	7,270	7,300	7,310	7,290
	A	11.5	11.5	11.5	11.6	11.7	11.8	11.8	11.9	11.8
	M	630	730	942	1,057	1,315	1,462	1,624	2,000	2,220
	E	4.9	5.7	7.1	7.9	9.5	10.5	11.5	13.8	15.2
	%	54.0	58.0	63.8	65.8	68.5	69.4	70.0	70.4	70.2
90.0 (209)	C	39,800	45,100	56,500	62,800	76,900	84,900	93,600	113,500	124,500
	P	5,750	5,820	5,960	6,030	6,140	6,170	6,180	6,140	6,070
	A	10.3	10.3	10.4	10.4	10.6	10.6	10.7	10.7	10.7
	M	666	757	958	1,070	1,325	1,473	1,635	2,015	2,237
	E	6.9	7.8	9.5	10.4	12.6	13.8	15.2	18.5	20.6
	%	61.1	63.7	67.0	68.0	68.8	68.8	68.5	66.9	65.6
80.0 (179)	C	42,900	48,300	60,300	66,900	82,100	90,700	100,000	121,500	134,000
	P	5,110	5,190	5,350	5,410	5,500	5,520	5,510	5,420	5,320
	A	9.7	9.7	9.8	9.8	10.0	10.0	10.0	10.1	10.0
	M	677	765	961	1,072	1,329	1,478	1,642	2,027	2,252
	E	8.4	9.3	11.3	12.4	14.9	16.5	18.2	22.5	25.2
	%	64.0	65.6	67.3	67.6	67.2	66.5	65.5	62.3	59.9
65.0 (141)	C	47,000	52,700	65,500	72,800	89,600	99,300	110,000		
	P	4,320	4,400	4,550	4,600	4,640	4,630	4,580		
	A	8.9	9.0	9.1	9.1	9.2	9.3	9.3		
	M	683	768	961	1,073	1,334	1,487	1,655		
	E	10.9	12.0	14.4	15.8	19.3	21.5	24.0		
	%	65.3	65.6	65.0	64.2	61.6	59.7	57.3		
55.0 (118)	C	49,500	55,300	68,800	76,600	94,700				
	P	3,870	3,950	4,080	4,110	4,100				
	A	8.6	8.6	8.7	8.8	8.8				
	M	684	767	962	1,075	1,340				
	E	12.8	14.0	16.9	18.7	23.1				
	%	64.4	63.8	61.6	60.0	55.5				
40.0 (89)	C	53,000	59,300	74,000						
	P	3,260	3,330	3,390						
	A	8.2	8.2	8.3						
	M	685	768	965						
	E	16.3	17.9	21.8						
	%	60.3	58.3	53.3						

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

Copeland brand products

Autogenerated Compressor Performance
Printed 5/7/2018
11-88 2051

EMERSON Climate Technologies

16.3 ZB66K5E-TFC 3-PHASE, 9 HP, 208–230 V COMPRESSOR DATA CHART

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

MEDIUM TEMPERATURE

ZB66K5E-TFC
HFC-507
COPELAND SCROLL®
TFC 208/230-3-60

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

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

		-10.0 (25)	-5.0 (30)	5.0 (40)	10.0 (46)	20.0 (58)	25.0 (65)	30.0 (73)	40.0 (89)	45.0 (98)
140.0 (413)	C				42,300	52,000	57,300	63,000	75,800	82,900
	P				11,800	11,850	11,900	11,900	11,950	12,000
	A				34.5	34.7	34.8	34.9	35.0	35.0
	M				1,135	1,421	1,583	1,761	2,176	2,419
	E				3.6	4.4	4.8	5.3	6.4	6.9
	%				55.0	59.9	62.0	64.0	67.2	68.5
130.0 (363)	C			43,600	48,600	59,600	65,700	72,200	86,900	95,100
	P			10,450	10,500	10,600	10,650	10,700	10,800	10,850
	A			31.3	31.5	31.7	31.9	32.0	32.2	32.2
	M			1,027	1,153	1,437	1,598	1,775	2,186	2,426
	E			4.2	4.6	5.6	6.2	6.8	8.1	8.8
	%			56.3	58.8	63.1	64.9	66.4	68.8	69.6
115.0 (298)	C	36,300	41,100	51,800	57,600	70,600	77,800	85,600	103,000	113,000
	P	8,520	8,630	8,820	8,900	9,030	9,090	9,140	9,230	9,280
	A	27.1	27.2	27.4	27.6	28.0	28.1	28.3	28.6	28.6
	M	728	830	1,055	1,181	1,466	1,630	1,809	2,223	2,464
	E	4.3	4.8	5.9	6.5	7.8	8.6	9.4	11.2	12.2
	%	54.1	57.0	61.9	63.9	67.1	68.3	69.3	70.1	70.0
105.0 (260)	C	40,100	45,400	56,900	63,200	77,500	85,500	94,200	113,500	124,500
	P	7,550	7,680	7,890	7,980	8,130	8,190	8,240	8,330	8,360
	A	24.9	25.0	25.3	25.5	25.9	26.1	26.2	26.5	26.6
	M	745	845	1,069	1,196	1,485	1,650	1,831	2,251	2,493
	E	5.3	5.9	7.2	7.9	9.6	10.5	11.5	13.7	14.9
	%	58.4	60.8	64.8	66.4	68.8	69.5	69.9	69.6	68.7
90.0 (209)	C	45,500	51,200	64,000	71,300	87,500	96,700	106,500	129,000	141,500
	P	6,340	6,480	6,720	6,810	6,960	7,010	7,050	7,100	7,120
	A	22.2	22.3	22.7	22.9	23.3	23.5	23.7	24.0	24.1
	M	761	860	1,085	1,214	1,508	1,677	1,862	2,290	2,535
	E	7.2	7.9	9.6	10.5	12.6	13.8	15.1	18.2	19.9
	%	63.4	65.0	67.4	68.3	69.1	69.0	68.4	65.7	63.5
80.0 (179)	C	48,800	54,800	68,600	76,300	94,000	104,000	114,500	139,000	152,500
	P	5,660	5,810	6,040	6,130	6,260	6,300	6,330	6,350	6,340
	A	20.8	20.9	21.2	21.4	21.8	22.1	22.2	22.6	22.7
	M	769	867	1,093	1,223	1,521	1,693	1,881	2,314	2,562
	E	8.6	9.5	11.4	12.5	15.0	16.5	18.1	21.9	24.0
	%	65.6	66.5	67.8	68.0	67.6	66.7	65.3	60.6	57.1
65.0 (141)	C	53,400	59,900	75,000	83,700	103,500	114,500	126,500		
	P	4,790	4,930	5,140	5,220	5,300	5,320	5,310		
	A	19.1	19.2	19.5	19.7	20.1	20.2	20.4		
	M	775	873	1,102	1,234	1,538	1,714	1,906		
	E	11.2	12.2	14.6	16.1	19.5	21.5	23.8		
	%	66.8	66.7	65.9	65.1	62.2	59.8	56.8		
55.0 (118)	C	56,200	63,100	79,200	88,400	109,500				
	P	4,270	4,400	4,590	4,650	4,690				
	A	18.2	18.3	18.5	18.7	19.0				
	M	777	876	1,106	1,239	1,548				
	E	13.2	14.4	17.3	19.0	23.3				
	%	66.2	65.3	62.9	61.1	56.1				
40.0 (89)	C	60,300	67,700	85,200						
	P	3,550	3,650	3,780						
	A	17.1	17.1	17.3						
	M	779	878	1,111						
	E	17.0	18.6	22.6						
	%	63.0	60.7	55.1						

C: Capacity (Btu/hr), P: Power (Watts), A: Current (Amps), M: Mass Flow (lb/hr), E: EER (Btu/Wh), %: 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
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EMERSON Climate Technologies

16.4 ZB66K5E-TFD 3-PHASE, 9 HP, 460 V COMPRESSOR DATA CHART

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

MEDIUM TEMPERATURE

ZB66K5E-TFD
HFC-507
COPELAND SCROLL®
TFD 460-3-60

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

Condensing Temperature °F (Sat. Dew Pt. Pressure, psig)		-10.0 (25)	-5.0 (30)	5.0 (40)	10.0 (46)	20.0 (58)	25.0 (65)	30.0 (73)	40.0 (89)	45.0 (98)
140.0 (413)	C				42,300	52,000	57,300	63,000	75,800	82,900
	P				11,800	11,850	11,900	11,900	11,950	12,000
	A				17.3	17.4	17.4	17.5	17.5	17.5
	M				1,135	1,421	1,583	1,761	2,176	2,419
	E				3.6	4.4	4.8	5.3	6.4	6.9
	%				55.0	59.9	62.0	64.0	67.2	68.5
130.0 (363)	C			43,600	48,600	59,600	65,700	72,200	86,900	95,100
	P			10,450	10,500	10,600	10,650	10,700	10,800	10,850
	A			15.7	15.7	15.9	15.9	16.0	16.1	16.1
	M			1,027	1,153	1,437	1,598	1,775	2,186	2,426
	E			4.2	4.6	5.6	6.2	6.8	8.1	8.8
	%			56.3	58.8	63.1	64.9	66.4	68.8	69.6
115.0 (298)	C	36,300	41,100	51,800	57,600	70,600	77,800	85,600	103,000	113,000
	P	8,520	8,630	8,820	8,900	9,030	9,090	9,140	9,230	9,280
	A	13.5	13.6	13.7	13.8	14.0	14.1	14.2	14.3	14.3
	M	728	830	1,055	1,181	1,466	1,630	1,809	2,223	2,464
	E	4.3	4.8	5.9	6.5	7.8	8.6	9.4	11.2	12.2
	%	54.1	57.0	61.9	63.9	67.1	68.3	69.3	70.1	70.0
105.0 (260)	C	40,100	45,400	56,900	63,200	77,500	85,500	94,200	113,500	124,500
	P	7,550	7,680	7,890	7,980	8,130	8,190	8,240	8,330	8,360
	A	12.4	12.5	12.7	12.7	12.9	13.0	13.1	13.3	13.3
	M	745	845	1,069	1,196	1,485	1,650	1,831	2,251	2,493
	E	5.3	5.9	7.2	7.9	9.6	10.5	11.5	13.7	14.9
	%	58.4	60.8	64.8	66.4	68.8	69.5	69.9	69.6	68.7
90.0 (209)	C	45,500	51,200	64,000	71,300	87,500	96,700	106,500	129,000	141,500
	P	6,340	6,480	6,720	6,810	6,960	7,010	7,050	7,100	7,120
	A	11.1	11.2	11.3	11.4	11.6	11.8	11.8	12.0	12.1
	M	761	860	1,085	1,214	1,508	1,677	1,862	2,290	2,535
	E	7.2	7.9	9.6	10.5	12.6	13.8	15.1	18.2	19.9
	%	63.4	65.0	67.4	68.3	69.1	69.0	68.4	65.7	63.5
80.0 (179)	C	48,800	54,800	68,600	76,300	94,000	104,000	114,500	139,000	152,500
	P	5,660	5,810	6,040	6,130	6,260	6,300	6,330	6,350	6,340
	A	10.4	10.5	10.6	10.7	10.9	11.0	11.1	11.3	11.3
	M	769	867	1,093	1,223	1,521	1,693	1,881	2,314	2,562
	E	8.6	9.5	11.4	12.5	15.0	16.5	18.1	21.9	24.0
	%	65.6	66.5	67.8	68.0	67.6	66.7	65.3	60.6	57.1
65.0 (141)	C	53,400	59,900	75,000	83,700	103,500	114,500	126,500		
	P	4,790	4,930	5,140	5,220	5,300	5,320	5,310		
	A	9.5	9.6	9.8	9.8	10.0	10.1	10.2		
	M	775	873	1,102	1,234	1,538	1,714	1,906		
	E	11.2	12.2	14.6	16.1	19.5	21.5	23.8		
	%	66.8	66.7	65.9	65.1	62.2	59.8	56.8		
55.0 (118)	C	56,200	63,100	79,200	88,400	109,500				
	P	4,270	4,400	4,590	4,650	4,690				
	A	9.1	9.1	9.3	9.4	9.5				
	M	777	876	1,106	1,239	1,548				
	E	13.2	14.4	17.3	19.0	23.3				
	%	66.2	65.3	62.9	61.1	56.1				
40.0 (89)	C	60,300	67,700	85,200						
	P	3,550	3,650	3,780						
	A	8.5	8.6	8.7						
	M	779	878	1,111						
	E	17.0	18.6	22.6						
	%	63.0	60.7	55.1						

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

Copeland brand products

Autogenerated Compressor Performance
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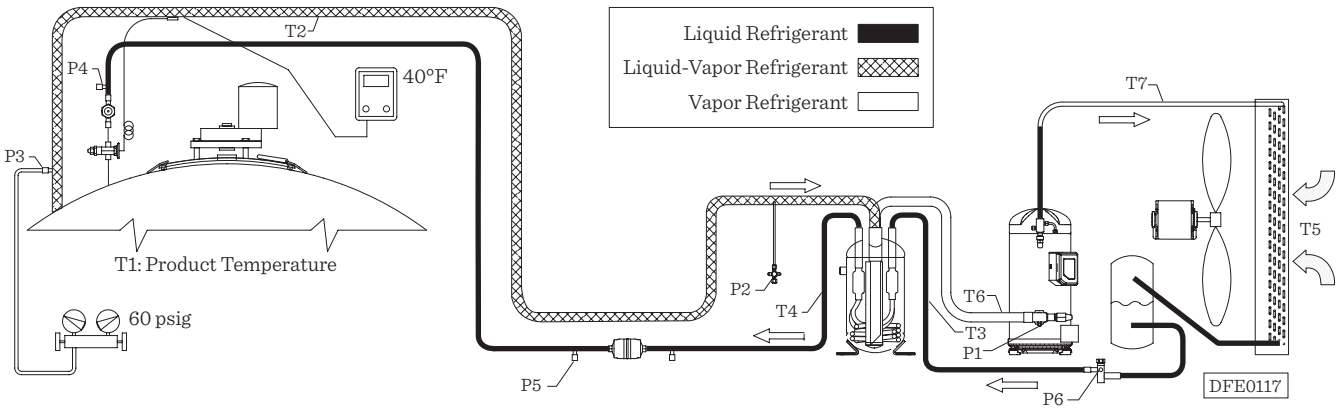
EMERSON Climate Technologies

Section 17.0 – 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 After Liquid Line Filter Drier
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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COMPANY

1600 West Phelps Street | Springfield, Missouri 65802, U.S.A.
DFE Service: 1-800-756-5991 | DFETechService@paulmueller.com
1-800-MUELLER | WWW.PAULMUELLER.COM