E-Star® HiPerForm® Condensing Unit for R-507

Model "OHSE" 5 HP with Digital Capacity Control

INSTALLATION AND OPERATION MANUAL

Part No. 8827714

Effective January 7, 2016
Revised June 26, 2018

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Section 1.0 – Introduction

1.1 GENERAL SPECIFICATIONS

Mueller® E-Star® HiPerForm® "OHSE" condensing units with digital capacity control are engineered to maximize the energy efficiency and cooling capacity of your milk cooling system. Specialized components consist of:

1. A quiet, energy-efficient Copeland® "ZBD" digital scroll refrigeration compressor designed for commercial refrigeration service rather than air conditioning provides improved performance over the entire milk cooling temperature range and controls system capacity from 100% down to 30% for low-load conditions. A 24-volt digital unloader, oil sight glass, oil fill/drain port, and screw electrical terminals are added bonuses that ensure long-term reliability and serviceability.

2. A custom electronic valve control with electric subcooling valve controls the condenser liquid subcooling rather than evaporator superheat.

3. An accumulator heat exchanger with custom subcooling coil maximizes refrigeration capacity while protecting the compressor from liquid refrigerant.

4. A custom tube-and-fin condenser is designed for maximum condensing efficiency. Benefits include integral subcooling loop and tubes constructed from rifled tubing which maximizes the heat transfer to the fins.

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

6. The electrical enclosure is designed for safety, ease of installation, and serviceability.

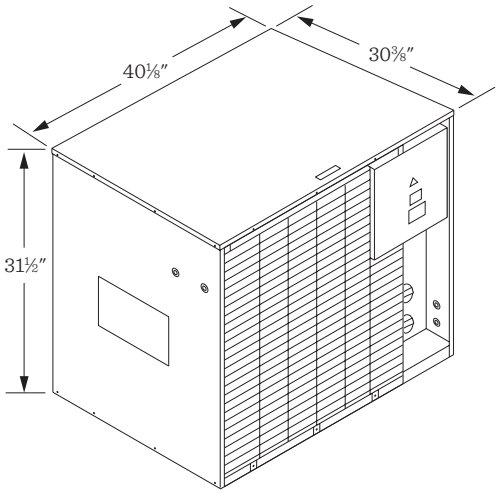
7. A three-piece galvanized steel cover with attached steel grill provides safe operation plus easy service access.

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

TABLE 1: DIMENSIONS AND WEIGHT

	5 HP	
Length	101.92 cm	40⅛ in
Width	77.15 cm	30⅜ in
Height	80.00 cm	31½ in
Approximate Weight	5 HP/176 kg	388 lb

FIGURE 1: DIMENSIONS AND WEIGHT



1.2 TECHNICAL SUPPORT

This manual provides the basic installation and operating information for Mueller E-Star HiPerForm "OHSE" 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:

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

In Europe:
Mueller
Noordgang 14
7141 JP Groenlo
The Netherlands
Telephone: +31 (0) 570 538 310
Facsimile:: +31 (0) 570 538 349
Email: info@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 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. The Clean Air Act 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 and procedures for their 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 condensing unit, consider these items:

- **Environment:** The unit must be located where it is protected from extreme environmental conditions.
- **Condenser Air Flow:** Ensure proper provisions for adequate air flow (5,300 CFM at 1,075 RPM) to the condenser. When installing the condenser facing a wall, the distance to the wall must be a minimum of 45.72 cm (18 in) with non-restricted air flow at the top, left, and right sides. Be especially cautious of installation methods which 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, the condensing unit should not be installed 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.

The condensing unit is 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: R-507 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
10	⅝	⅝	⅞

Paul Mueller Company recommends the shortest pipe run possible.

TABLE 3: R-507 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
10	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
10	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
10	⅝	1⅝	1⅛

2.5 ELECTRICAL CONNECTIONS

Following local and NEC (National Electrical Code) 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.

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

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

WARNING: Mueller 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 PUMP-DOWN INSTALLATIONS

IMPORTANT: Pump-down is not recommended on E-Star HiPerForm "OHSE" condensing units and may cause non-warranted damage to the brazed plate evaporator on chillers due to freezing.

Section 3.0 – Refrigerant Charging

3.1 EPA REFRIGERANT REGULATIONS[1]

The E-Star HiPerForm "OHSE" condensing unit is designed to operate with R-507 refrigerant. R-507 is an HFC binary mixture of 50% R-125 (pentafluoroethane) and 50% R-143a (1,1,1-trifluoroethane). R-507 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.

IMPORTANT: R-404a refrigerant use is not recommended in Mueller condensing units. The high temperature glide characteristics of R-404a can lead to fractionalization of the refrigerant, which is undesirable in a flooded evaporator system such as the Mueller E-Star HiPerForm.

[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 REFRIGERANT CHARGE

Mueller E-Star HiPerForm "OHSE" condensing units require the refrigerant charge shown in Table 6 when installed with a Mueller milk cooler evaporator.

SERVICE NOTE: The refrigeration system must be triple evacuated to 500 microns prior to refrigerant charging.

TABLE 6: RECOMMENDED START-UP REFRIGERANT CHARGE

Recommended Start-Up Charge		
Condensing Unit Size	**Milk Cooler**	**Chiller**
5 HP	15 lbs / 6.8 kg	13 lbs / 5.9 kg

3.3 REFRIGERANT CHARGING

There are several methods used to determine if a conventional system is properly charged: sight glass, compressor amperage, and refrigerant pressures, etc. Due to the unique operating characteristics of E-Star HiPerForm "OHSE" condensing units, the most efficient and reliable method is to weigh in the refrigerant charge, ensuring it matches the manufacturer's recommendations in Section 3.2. Section 3.4 outlines this procedure.

All E-Star HiPerForm "OHSE" digital condensing units ship with the unloader disabled. It is recommended to leave the unloader disabled until system charging is complete. See Section 5.6, "EVC Bit-Switch Configuration."

3.4 WEIGH-IN REFRIGERANT CHARGING

Reference Figure 2, "Refrigerant Piping Schematics," which displays the access port connections described below.

1. With a clean evacuated system, connect the manifold gauges to Access Ports P2 and P6.
2. Connect the center manifold hose to a cylinder of new or reclaimed ARI 700-88 specifications refrigerant.
3. Weigh and record the gross weight of the refrigerant cylinder.

3.4 WEIGH-IN REFRIGERANT CHARGING (CONTINUED)

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

5. Break the refrigeration system's evacuation with liquid refrigerant, charging into the access port at P2, which is located before the accumulator on the suction line.

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 access port P2.

IMPORTANT: Liquid refrigerant must always be charged upstream of the accumulator heat exchanger, access ports P2 or P3, to ensure protection to the compressor against liquid refrigerant slugging.

3.5 CHECKING REFRIGERANT CHARGE, WEIGH-OUT METHOD

To confirm the refrigerant charge on an operating system, the charge should be weighed out. Reference Figure 2, "Refrigerant Piping Schematics," which displays the access port connections described below.

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

2. Purge any air from the manifold gauge hoses.

3. Weigh and record the gross weight of the refrigerant recovery cylinder.

4. Energize the E-Star HiPerForm "OHSE" condensing unit's compressor and open the valve on the recovery cylinder.

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

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

7. Allow the system to operate until the compressor cycles off on the low pressure switch (about 5 psig).

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

9. While monitoring the suction pressure at access port P2, manually operate the compressor by holding the contactor coil in until the suction pressure falls to 0 psig. Do not allow the system to pump into a vacuum.

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

11. Allow the system to set idle for a few minutes and observe the suction pressure at P2. If it rises above 20 psig, reopen the recovery cylinder's liquid valve and repeat the procedure starting at Step 9.

3.5 CHECKING REFRIGERANT CHARGE, WEIGH-OUT METHOD (CONTINUED)

12. Using an approved refrigerant recovery machine, recover the remaining refrigerant from the system until a minimum vacuum level of 0" Hg is achieved.

IMPORTANT: Never energize the compressor while in a vacuum.

13. Weigh the gross weight of the recovery cylinder, subtracting the initial gross weight recorded in Step 3. This will be the weight of refrigerant removed from the system.

3.6 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.

3.7 SAFETY ALERT

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

Liquid refrigerant will cause frostbite.

Dangerous gasses, characterized by a strong acidic odor, will form if refrigerant comes in contact with an open flame or a high-heat source. Immediately vacate the area and ventilate prior to reentry.

Section 4.0 – Operating Features

4.1 REFRIGERANT CYCLE

E-Star HiPerForm "OHSE" condensing units utilize an electronic valve control (EVC) and an electric subcooling valve that control the condenser liquid subcooling rather than the evaporator superheat. The EVC is preset to maintain 15°F (8.3°C) subcooled liquid refrigerant leaving the condenser coil. This effectively keeps the condenser coil drained of excess liquid, utilizing maximum coil surface for condensing purposes.

Refer to Figure 2, "Refrigeration Piping Schematic." Subcooled liquid refrigerant leaves the condenser coil and flows through the heat exchanger coil in the accumulator, providing 15–30°F (8.3–16.6°C) of additional liquid refrigerant subcooling. This heat exchange also evaporates any liquid refrigerant in the suction accumulator, protecting the compressor against liquid flood-back.

As liquid refrigerant, now subcooled a total of 30–45°F (16.6–24.9°C), passes through the electric subcooling valve, its pressure is reduced to an evaporative pressure. Since the liquid refrigerant was extensively subcooled in the accumulator heat exchanger coil before entering the evaporator, the evaporator will be flooded during operation.

Any liquid refrigerant returned from the flooded evaporator is transformed 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 2–5°F (1.1–2.75°C) prior to entering the compressor's suction intake. The minimal superheat provides protection against liquid refrigerant entering the compressor while providing exceptional refrigerant cooling of the compressor.

The electronic valve control also utilizes a low side pressure transducer installed on the suction line inlet to the accumulator heat exchanger. The 24-volt solenoid valve, located on the discharge of the compressor, will energize for two seconds when the suction pressure drops below 63 psig (23°F saturated suction temperature), causing the compressor to unload. The 24-volt solenoid will then de-energize, causing the compressor to run loaded. The EVC board will repeat the unload cycle as necessary to maintain an operating suction pressure above 63 psig (23°F saturated suction temperature).

4.2 POSITIVE OIL RETURN

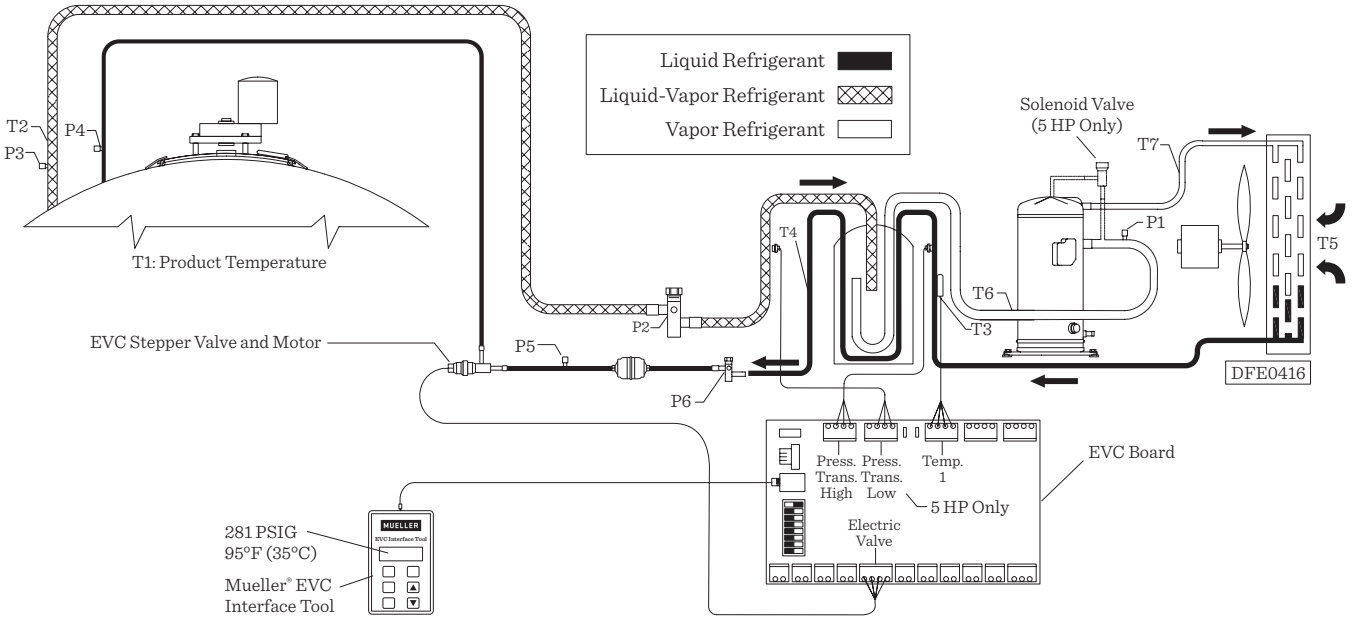
As a direct result of the flooded evaporator, the refrigerant returning from the evaporator is wet with liquid carry-over. This mixture carries oil in suspension much more readily than the dry, superheated suction refrigerant in a conventional refrigeration system. This refrigerant oil mixture drops 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

The flooded evaporator utilizes the entire evaporator surface for cooling without wasting valuable surface area for super heating as in a conventional system.

The EVC and electric subcooling valve control the quantity of liquid refrigerant in the condenser, maintaining lower head pressures while ensuring sufficient refrigerant flow to the evaporator in low-ambient temperatures. In a conventional system, the evaporator operates starved for refrigerant at low-ambient temperatures because the head pressure, without being raised artificially, cannot force sufficient refrigerant through the expansion valve to meet the cooling requirements.

FIGURE 2: REFRIGERANT PIPING SCHEMATIC



Example (R-507):
- P5 is 281 psig.
- Convert P5 pressure to saturation temperature of 110°F (43.3°C).
- Line temperature at T3 is 95°F (35°C).

Results:
- 110°F – 95°F = 15°F subcooling (43.3°C – 35°C = 8.3°C subcooling).

IMPORTANT: When charging the system with liquid refrigerant, always charge upstream of the accumulator heat exchanger, access ports P2 or P3, to ensure protection to the compressor against damage caused by liquid refrigerant slugging.

4.4 MEASURING SUBCOOLING

1. Operate the refrigeration system with the evaporator covered at a product temperature below 45°F (7.2°C).

2. Take an accurate high-side pressure at P5 and convert it to the refrigerant's saturation temperature with a pressure temperature chart (see Section 15).

3. Take an accurate line temperature at T3 and subtract it from the saturation temperature conversion at P5 (Step 2).

This provides the subcooling measurement in the condenser's subcooling loop controlled by the subcooling valve.

Section 5.0 – Subcooling

5.1 ELECTRONIC VALVE CONTROL WITH ELECTRIC SUBCOOLING VALVE

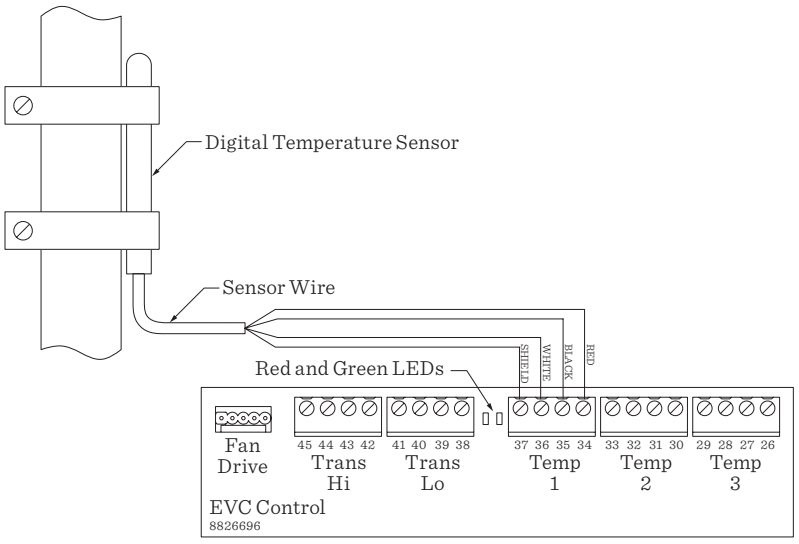
Mueller's electronic valve control (EVC) is factory set to maintain 15°F (8.3°C) of subcooling. The EVC board determines condenser subcooling using two inputs. The pressure transducer senses the liquid line pressure and the digital temperature sensor senses the liquid line temperature. This data is sent to the EVC board, which calculates a subcooling reading. The electric valve is then adjusted to maintain 15°F (8.3°C) of subcooling.

If the liquid refrigerant is subcooled more than 15°F (8.3°C), the EVC will drive the electric valve open, reducing the amount of liquid subcooling in the bottom of the condenser. The EVC drives the electric valve open as the liquid line cools and closed as the liquid line warms in an operation similar to that of a mechanical subcooling valve.

5.2 DIGITAL TEMPERATURE SENSOR

The EVC board's digital temperature sensor is clamped to the liquid line leaving the condenser. The digital temperature sensor should be insulated using cork tape to prevent exposure to ambient temperatures. Connect the digital temperature sensor to the Temp 1 terminals on the EVC board. See Figure 3 for wiring instructions.

FIGURE 3: DIGITAL TEMPERATURE SENSOR

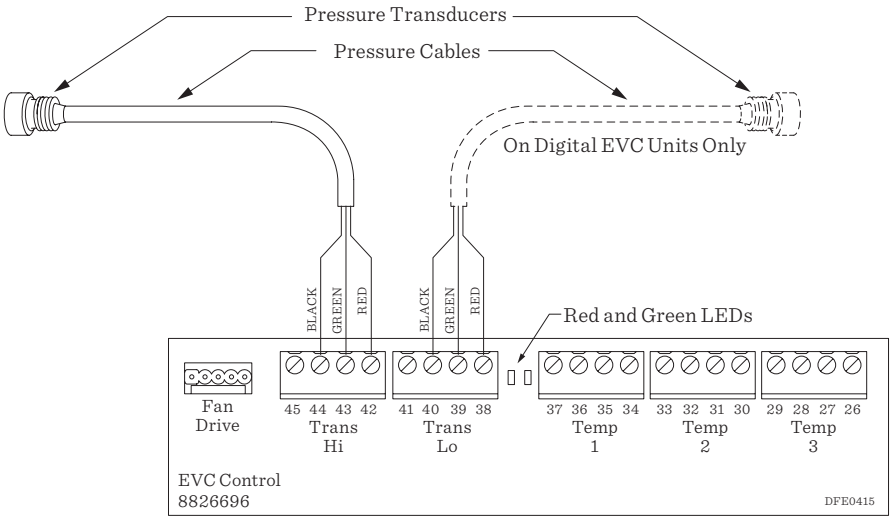


5.3 PRESSURE TRANSDUCER, 0–500 PSI

The high-pressure transducer is attached to the service port on the vertical liquid line at the inlet of the accumulator heat exchanger. The high-pressure transducer senses the liquid line pressure leaving the condenser. The low pressure transducer is attached to an access port on the suction inlet of the accumulator heat exchanger. The low pressure transducer senses the suction line pressure leaving the evaporator. Both transducers operate on a ± 5 VDC signal that is used by the EVC board to maintain subcooling or control compressor capacity.

The high side transducer has an operating range of 0–500 psig; the low side transducer has a range of 0–300 psig. Therefore, these transducers are not interchangeable.

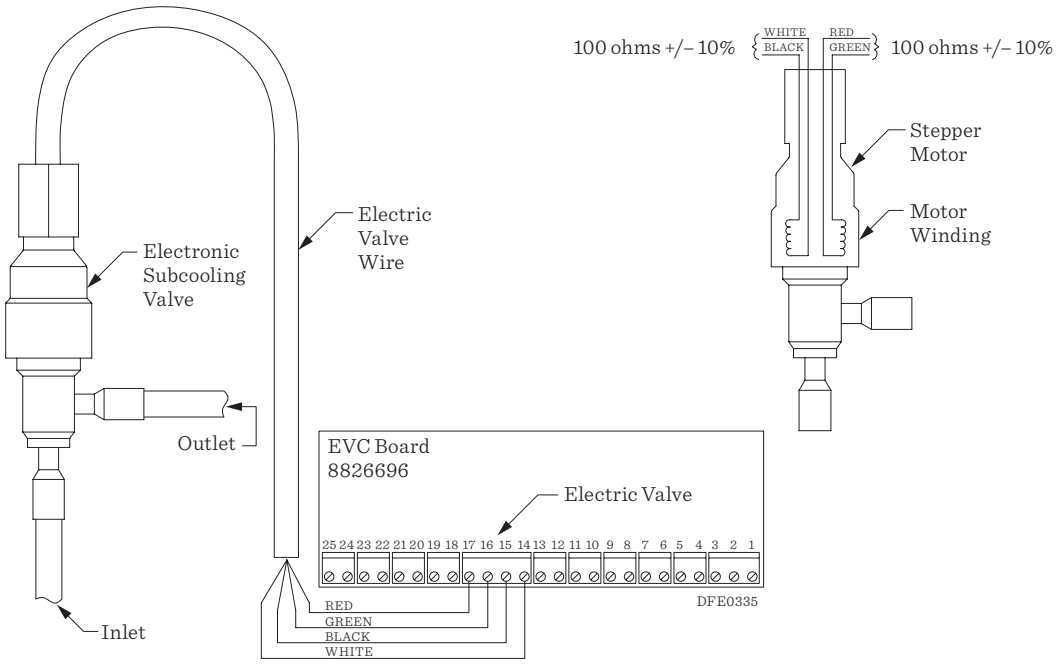
FIGURE 4: PRESSURE TRANSDUCER



5.4 ELECTRIC SUBCOOLING VALVE OPERATION

When a cooling signal is received, the electric valve is held open at a factory programmed start-up position for approximately 10 seconds. After this time, the EVC will adjust the valve accordingly to maintain 15°F (8.3°C) of subcooling with R-507. Once the refrigeration system is de-energized or the cooling signal is lost (the cooling setpoint is reached), the valve moves to a fully closed position (homes), and then returns to the factory programmed start-up position. This setting allows for system equalization during the off cycle.

FIGURE 5: ELECTRIC SUBCOOLING VALVE



5.5 SYSTEM ERROR LIGHT CODES

The EVC board is equipped with diagnostic LEDs which will flash in the event of a system error.

TABLE 6: SYSTEM ERROR LIGHT CODES

Error Code		Possible Cause
Red LED:	1 Flash	Bit-Switch Setting Error (Check Bit-Switch Configuration)
Red LED:	2 Flashes	High-Side Pressure Transducer (Check Transducer Connections)
Red LED:	3 Flashes	Low-Side Pressure Transducer (Check Bit-Switch Configuration)
Red LED:	4 Flashes	Temperature Sensor 1 Error (Check Connection)
Red LED:	5 Flashes	Temperature Sensor 2 Error (Check Connection)
Red LED:	7 Flashes	Electronic Fan Control Error (Check for Open Fuse)
Green LED:	1 Flash	System Off On Anti-Cycle Timer (10 Minutes)
Green LED:	Solid	Normal Operation

5.6 EVC BIT-SWITCH CONFIGURATION

The bit-switch configuration on the EVC board selects the horsepower of the system being controlled, enables digital capacity control, and enables anti-short-cycle protection.

Bit Switches 1–4: Determines the size of the compressor used on the system to be controlled.

Bit Switches 6 and 7: Bit switch 6 is used to enable/disable digital capacity control. Bit switch 7 selects the input (pressure or temperature) used to control the compressor unloader. *Presently, bit switch 7 must remain in the ON position if digital capacity control is enabled.*

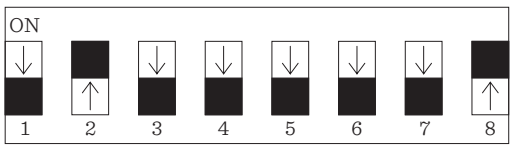
Bit Switch 8: Enables anti-short cycle protection. Bit switch 8 can be turned off when servicing and trouble-shooting, or if another means of cycle protection is present. The anti-short cycle control can be disabled by moving the switch toward the number 8 (downward). The anti-short cycle delay is factory set for 10 minutes.

IMPORTANT: Always confirm that the board is properly configured for the application. All replacement boards are set for a 9 HP condensing unit. Power to the EVC board must be turned off when bit switch settings are changed. Once power is restored, the EVC board will operate with the new settings.

FIGURE 6: EVC BIT-SWITCH CONFIGURATION SETTINGS FOR V3.05 AND LATER

NON-DIGITAL SCROLL COMPRESSOR EVC CONFIGURATION

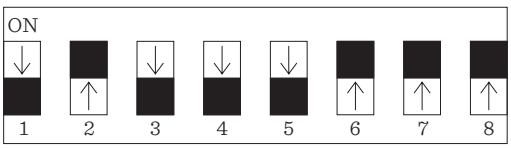
Fan, Minimum Speed, at 170 psig
Fan, Maximum Speed, at 240 psig



5 HP Setting | Configuration (3) Per Handheld

DIGITAL SCROLL COMPRESSOR EVC CONFIGURATION

Fan, Minimum Speed, at 170 psig
Fan, Maximum Speed, at 240 psig



5 HP Setting | Configuration (3) Per Handheld

Section 6.0 – Accumulator Heat Exchanger

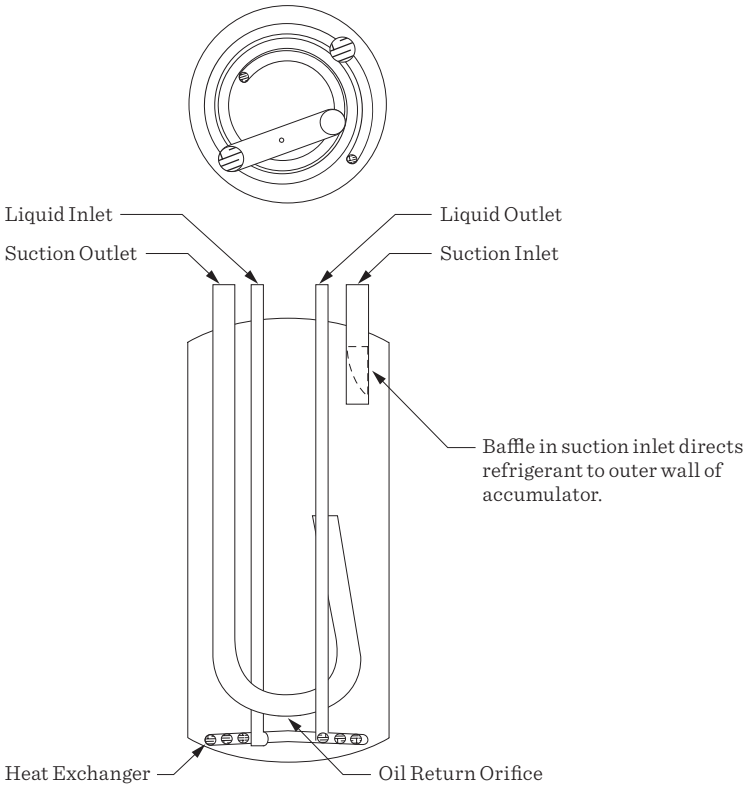
6.1 ACCUMULATOR HEAT EXCHANGER

The accumulator heat exchanger performs several functions on the Mueller E-Star HiPerForm "OHSE" condensing unit:

- **Additional Subcooling:** High pressure liquid refrigerant from the condenser is subcooled 15–30°F (8.3–16.6°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 flooded 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 HiPerForm "OHSE" condensing unit and may cause premature compressor failure. Use genuine Mueller replacement parts only.

FIGURE 7: ACCUMULATOR HEAT EXCHANGER



Section 7.0 – Electrical Schematics

7.1 "OHSE" DIGITAL 5 HP, 460V THREE-PHASE WIRING SCHEMATIC

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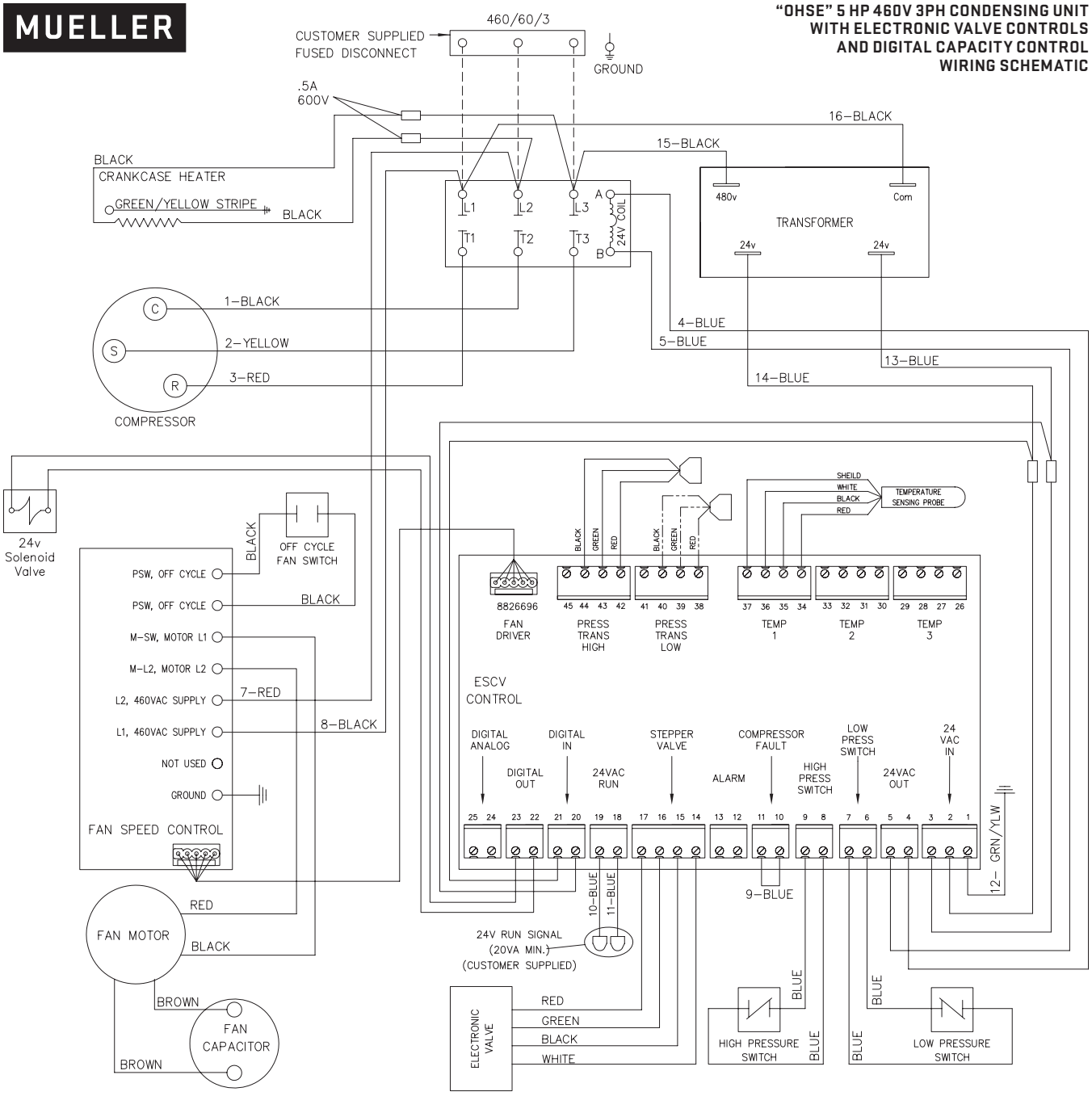
"OHSE" 5 HP 460V 3PH CONDENSING UNIT WITH ELECTRONIC VALVE CONTROLS AND DIGITAL CAPACITY CONTROL WIRING SCHEMATIC



——— FACTORY INSTALLED WIRING

– – – – CUSTOMER FIELD INSTALLED WIRING

WIRING 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 (ITEM #23).
5. ALL ENFORCED ELECTRICAL CODES MUST BE FOLLOWED DURING INSTALLATION, SERVICE, AND/OR OPERATION OF THIS EQUIPMENT.
6. 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 "OHSE" DIGITAL 5 HP, 230V SINGLE-PHASE WIRING SCHEMATIC

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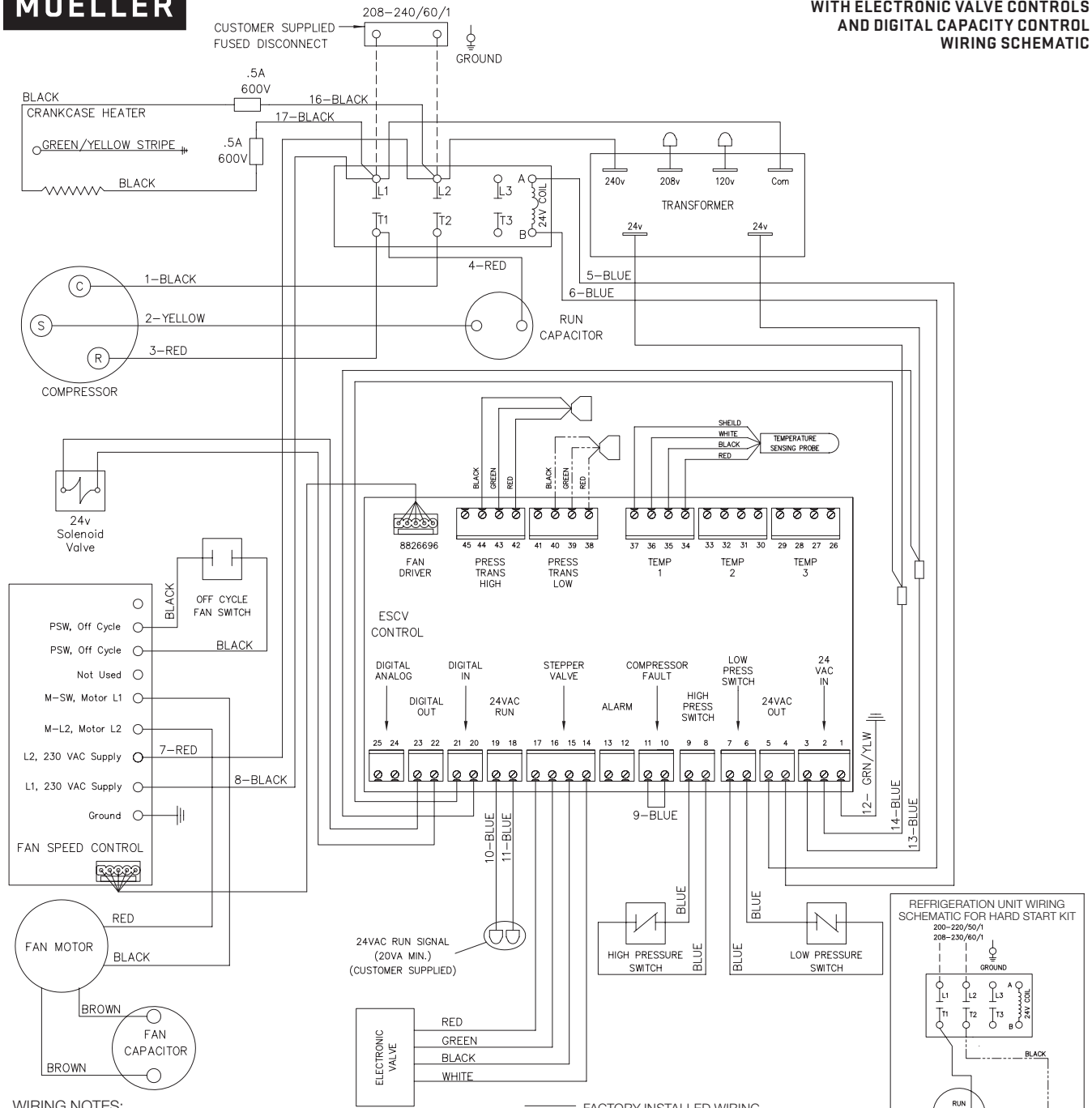
"OHSE" 5 HP 230V 1PH CONDENSING UNIT WITH ELECTRONIC VALVE CONTROLS AND DIGITAL CAPACITY CONTROL WIRING SCHEMATIC



WIRING 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. ALL GROUNDS TERMINATE IN THE CONTROL BOX EXCEPT THE CRANKCASE HEATER, WHICH TERMINATES NEXT TO THE COMPRESSOR ON THE BASE PLATE.

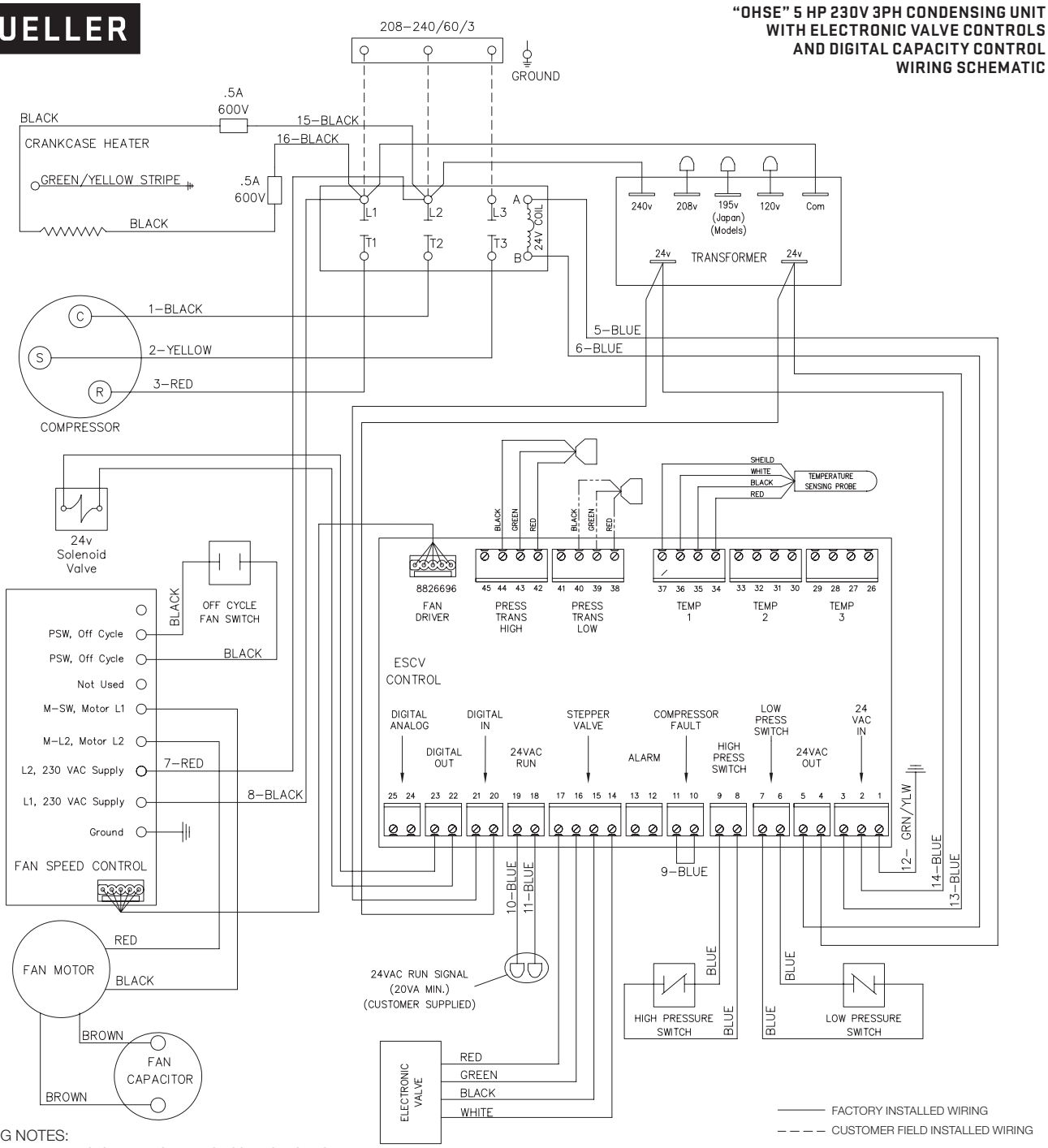
——— FACTORY INSTALLED WIRING
– – – – CUSTOMER FIELD INSTALLED WIRING
—·—·— CUSTOMER FIELD RETROFIT INSTALLED WIRING

DFE_0418

7.3 "OHSE" 3.5 AND 5 HP, 230V, THREE-PHASE WIRING DIAGRAM

MUELLER

"OHSE" 5 HP 230V 3PH CONDENSING UNIT WITH ELECTRONIC VALVE CONTROLS AND DIGITAL CAPACITY CONTROL WIRING SCHEMATIC



WIRING 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. ALL GROUNDS TERMINATE IN THE CONTROL BOX EXCEPT THE CRANKCASE HEATER, WHICH TERMINATES NEXT TO THE COMPRESSOR ON THE BASE PLATE.

DFE_0417

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. This can be accomplished by completing the following steps:

1. Attach an accurate low pressure gauge to P2, the suction service valve.
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. 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. This can be accomplished by completing the following 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 at the high-voltage terminal strip and monitor the high side pressure on the gauge.
5. The high pressure switch should close and energize the compressor's control circuit at approximately 350 psig (± 10 psig) on R-507 units..
6. The high pressure switch should be replaced if it does not operate as indicated above.

8.3 FAN CONTROL DRIVE

E-Star HiPerForm "OHSE" condensing units use an electromagnetic variable speed fan control to allow the fan motor to operate at variable speeds at different ambient temperatures. The Mueller fan control drive (FCD) must be checked for proper operation upon installation.

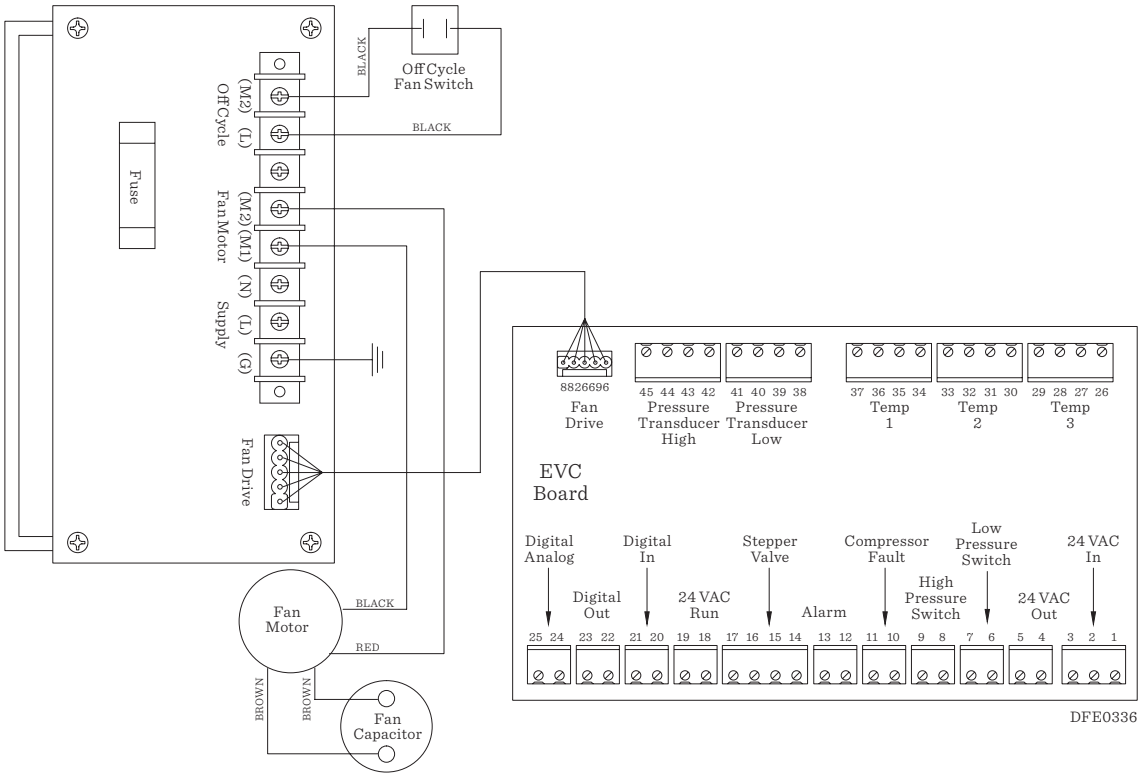
The FCD is factory set to energize the fan at minimum speed when the high side pressure rises above 170 psig. The fan motor should operate at maximum speed when the high side pressure rises above 240 psig. These settings should be verified at start up.

8.3 FAN CONTROL DRIVE (CONTINUED)

To verify FCD operation, connect the high side of a manifold gauge to the liquid line service valve (P6). Energize the condensing unit and monitor 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.

When the system receives the cooling signal, the fan motor will start at maximum speed and run for about eight seconds. This de-ice mode is designed to ensure that the fan motor starts in the correct clockwise rotation.

FIGURE 8: FAN CONTROL DRIVE



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 a system's high side.

Section 9.0 – Equipment Sound Level

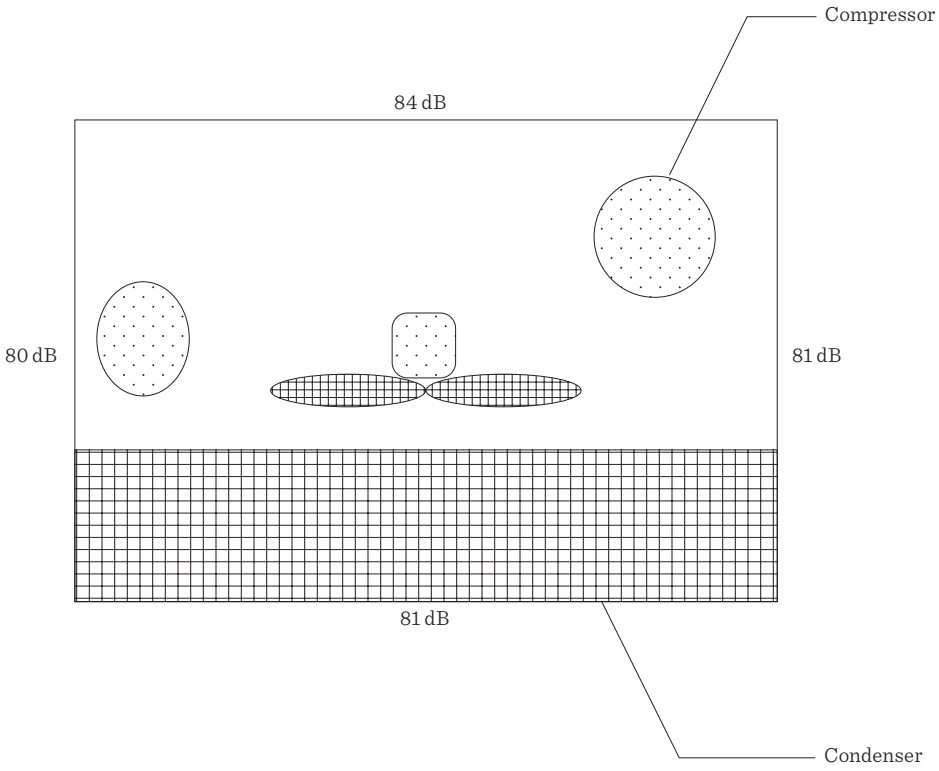
9.1 SOUND TESTING EQUIPMENT

The manufacturer tested sound levels of the E-Star HiPerForm "OHSE" 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

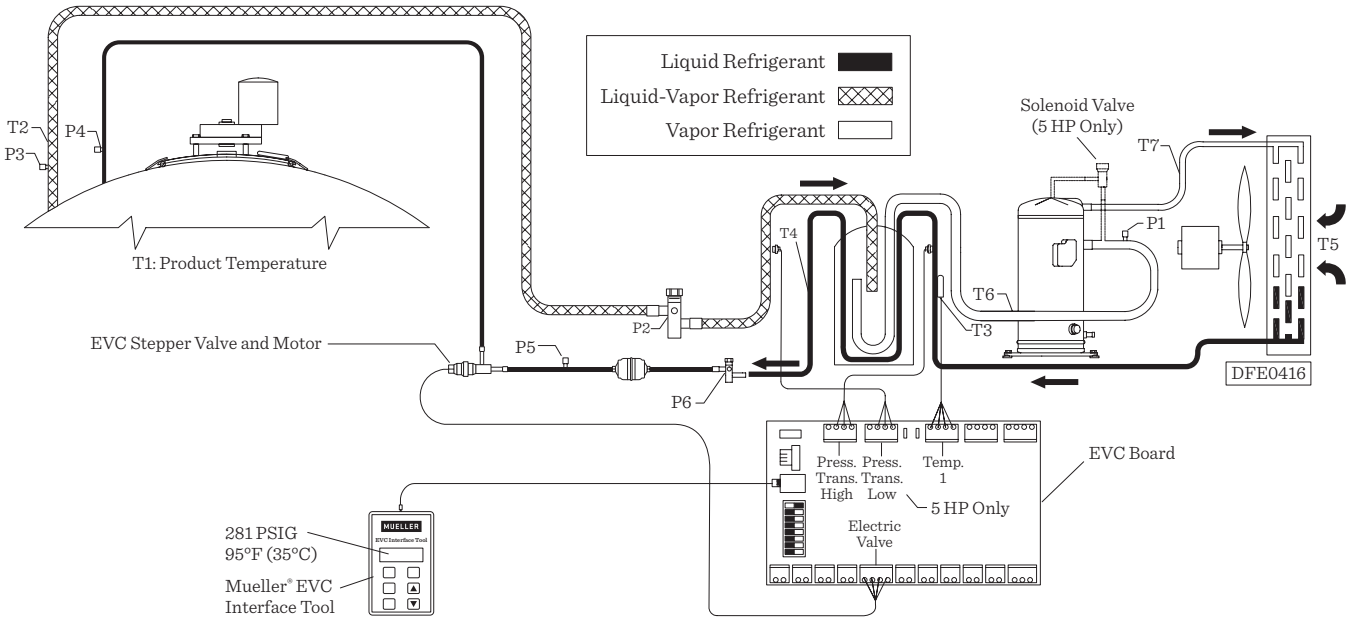
All sound measurements were recorded at a distance of 1 meter (3.28 feet) from the operating equipment. The highest recorded measurement was 84 dB.

FIGURE 9: SOUND MEASUREMENT



Section 10.0 – Maintenance

10.1 "OHSE" REFRIGERATION SURVEY



PRESSURE READINGS

P1: Suction Pressure at Compressor Inlet
P2: Suction Pressure at Accumulator Inlet
P3: Suction Pressure at Evaporator Outlet
P4: Pressure at Evaporator Inlet
P5: Pressure at Subcooling Valve Inlet
P6: Pressure at Liquid Line Service Valve

TEMPERATURE READINGS

T1: Milk Temperature
T2: Suction Line Temperature at Evaporator Outlet
T3: Line Temperature at Subcooling Valve Bulb
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**	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	**L1**	**L2**	**L3**

Measured Supply Voltage:	**"OHSE" Model and Part No.:**	**Serial No.:**

10.2 MAINTENANCE PROCEDURES

The "OHSE" unit requires minimal maintenance. The following scheduled maintenance procedures are recommended to 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 by the weigh-out method described in Section 3.5. If the charge is low, perform a leak test on the complete system and repair.
3. Check for proper subcooling 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 8.
9. Complete a performance survey for each condensing unit verifying proper cooling capacity (see Section 10.1).

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 HiPerForm "OHSE" 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 POE (polyolester). 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, WARNING: HFC REFRIGERANT

REFRIGERANT R-507
POE OIL

0305 8824716

12.3 LABEL NO. 8824497, 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.:

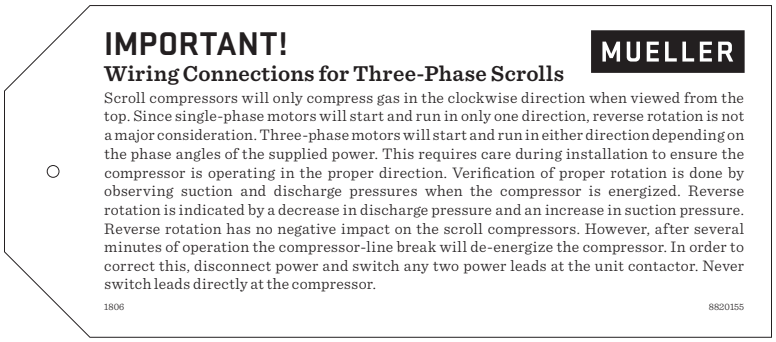
Component Part No.: Comp. Serial No.:

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!

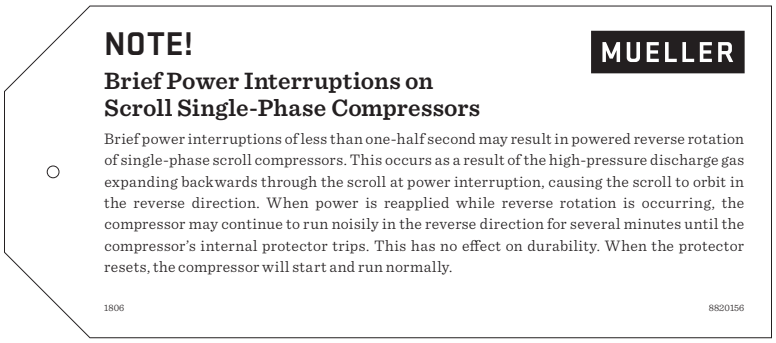
MUELLER

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!

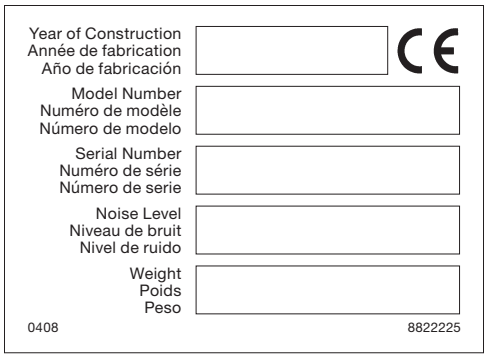
MUELLER

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)

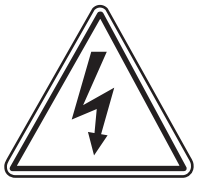


12.8 LABEL NO. 31193, IDENTIFIES SUCTION LINE SCREEN LOCATION

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 (UK MODELS ONLY)

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

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. 8802896, CSA LR67608

C US
0104
8802896

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 refrigerants is low, the possibility of injury or death exists in unusual situations or if they are 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 exclude 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 include hydrogen chloride and hydrogen fluoride.

These dangerous vapors have a sharp, stinging effect on the nose and can be detected by odor at concentrations below their 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 dressing 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 "OHSE" ELECTRICAL DATA

Model	Part No.	Description	Voltage	Hz	PH	Full Load Amps	Locked Rotor Amps	Rated Load Amps	Min. Circuit Ampacity	Max. Fuse Size
OHSE-A51ED	8827484	5 HP, 1 Phase Unit, R-507	208–230	60	1				45	80
	8827485	Compressor, Scroll, ZBD38KCE-PFV	208–230	60	1		148	34.3		
	8823340	Fan Motor, ⅓ HP	200–230	60	1	1.9				
OHSE-A53ED	8827406	5 HP, 3 Phase Unit, R-507	200–230	50/60	3				32	60
	8827410	Compressor, Scroll, ZBD38KCE-TF5	200–208–230	50/60	3		137	23.7		
	8823340	Fan Motor, ⅓ HP	200–208–230	50/60	1	1.9				
OHSE-A53JED	8827483	5 HP, 3 Phase Unit, R-507	195–230	50/60	3				32	60
	8827410	Compressor, Scroll, ZBD38KCE-TF5	195–230	50/60	3		137	23.7		
	8823340	Fan Motor, ⅓ HP	200–208–230	50/60	1	1.9				
OHSE-A534ED	8827407	5 HP, 3 Phase Unit, R-507	380–420/460	50/60	3				15.5	30
	8827411	Compressor, Scroll, ZBD38KCE-TFD	380–420/460	50/60	3		63	9.6		
	8825021	Fan Motor, ⅓ HP	380–420/460	50/60	1	1.2				

14.2 "OHSE" REFRIGERANT DATA

Model	Part No.	Description	Refrigerant Type	Refrigerant Charge	
				Milk Tank	Chiller
OHSE-A5***ED	88274**	5 HP, 1- and 3-Phase Units	R-507	15 lbs / 6.8 kg	13 lbs / 5.9 kg

14.3 "OHSE" COMPRESSOR OIL CHARGE (R-507 APPLICATIONS)

Model	Part No.	Description	Oil Charge	Oil Type
OHSE-A5***ED	88274**	5 HP, 1- and 3-Phase Units, R-507	60 oz	Copeland Ultra 32-3MAF

Section 15.0 – Compressor Data Charts

15.1 ZBD38KCE-PFV SINGLE-PHASE COMPRESSOR DATA CHART

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

MEDIUM TEMPERATURE

Bold Area Restrictions: 20°F Max Superheat

ZBD38KCE-PFV
HFC-507
COPELAND SCROLL®
PFV 208/230-1-60

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

Evaporating 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					**785**	**880**	**990**	1,110	1,390
	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**	**710**	**800**	900	1,010	1,130	1,400
	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		**505**	**650**	730	820	920	1,030	1,150	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**	665	750	840	940	1,050	1,160	1,420
	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**	535	680	765	855	955	1,060	1,170	1,420
	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	555	705	785	870	965	1,070	1,170	1,410
	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	565	705	785	875	965	1,060	1,170	
	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	565	700	775					
	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 (1%)
Nominal Performance Values (±5%) based on 72 hours run-in. Subject to change without notice. Current @ 230 V.

Printed 10/14/2015
Autogenerated Compressor Performance
14-521

15.2 ZBD38KCE-TF5 3-PHASE, 230V COMPRESSOR DATA CHART

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

MEDIUM TEMPERATURE

Bold Area Restrictions: 20°F Max Superheat

ZBD38KCE-TF5
HFC-507
COPELAND SCROLL®
TF5 208/230-3-60

60 Hz Operation

Condensing Temperature °F (Sat. Dew Pt. Pressure, psig)		Evaporating 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					**29,600**	**32,600**	**35,800**	39,300	47,100
	P					**6,350**	**6,450**	**6,550**	6,650	6,850
	A					**18.1**	**18.3**	**18.5**	18.8	19.2
	M					**810**	**900**	**1,000**	1,110	1,370
	E					**4.7**	**5.0**	**5.4**	5.9	6.9
	%					**63.6**	**64.8**	**65.9**	66.8	68.4
130.0 (363)	C			**28,100**	**31,100**	**34,300**	37,700	41,500	45,500	54,500
	P			**5,550**	**5,650**	**5,750**	5,850	5,950	6,050	6,200
	A			**16.3**	**16.5**	**16.7**	17.0	17.2	17.4	17.7
	M			**665**	**740**	**825**	920	1,020	1,130	1,390
	E			**5.1**	**5.5**	**6.0**	6.4	7.0	7.5	8.8
	%			**64.6**	**65.8**	**66.8**	67.7	68.4	69.0	69.6
120.0 (319)	C		**25,500**	**31,500**	34,900	38,500	42,400	46,600	51,000	61,000
	P		**4,790**	**5,000**	5,150	5,250	5,300	5,400	5,500	5,600
	A		**14.7**	**15.2**	15.4	15.6	15.8	16.0	16.1	16.4
	M		**540**	**675**	755	835	930	1,030	1,140	1,400
	E		**5.3**	**6.3**	6.8	7.4	8.0	8.6	9.3	10.9
	%		**64.8**	**67.3**	68.3	69.1	69.7	70.0	70.2	69.7
110.0 (279)	C	**22,400**	**28,000**	34,600	38,300	42,400	46,700	51,500	56,500	67,500
	P	**4,130**	**4,350**	4,560	4,650	4,750	4,830	4,910	4,980	5,100
	A	**13.3**	**13.8**	14.2	14.4	14.6	14.7	14.9	15.0	15.3
	M	**431**	**545**	680	760	845	940	1,040	1,150	1,410
	E	**5.4**	**6.4**	7.6	8.2	8.9	9.7	10.5	11.3	13.3
	%	**64.0**	**67.0**	69.1	69.8	70.3	70.5	70.4	70.1	68.5
100.0 (242)	C	**24,200**	30,300	37,500	41,600	46,000	50,500	56,000	61,500	73,500
	P	**3,750**	3,950	4,140	4,230	4,310	4,390	4,450	4,510	4,600
	A	**12.6**	13.0	13.4	13.5	13.7	13.8	14.0	14.1	14.3
	M	**433**	545	685	765	850	945	1,050	1,160	1,420
	E	**6.5**	7.7	9.1	9.8	10.7	11.6	12.5	13.6	16.0
	%	**66.0**	68.5	70.0	70.3	70.4	70.2	69.7	68.8	65.8
80.0 (179)	C	28,100	35,000	43,300	48,000	53,000	58,500	64,500	71,000	85,000
	P	3,110	3,270	3,410	3,480	3,540	3,590	3,630	3,660	3,690
	A	11.5	11.8	12.0	12.1	12.2	12.3	12.4	12.5	12.5
	M	442	555	695	775	860	955	1,060	1,170	1,430
	E	9.0	10.7	12.7	13.8	15.0	16.3	17.8	19.4	23.0
	%	68.7	69.6	69.3	68.6	67.6	66.1	64.1	61.6	54.7
70.0 (153)	C	30,300	37,600	46,400	51,500	57,000	62,500	69,000	75,500	
	P	2,830	2,970	3,090	3,140	3,180	3,220	3,250	3,260	
	A	11.2	11.3	11.5	11.6	11.7	11.7	11.8	11.8	
	M	452	565	700	780	870	965	1,070	1,180	
	E	10.7	12.7	15.0	16.4	17.8	19.5	21.2	23.2	
	%	69.8	69.4	67.7	66.3	64.4	62.0	58.9	55.2	
50.0 (108)	C	36,200	44,000	53,500	59,000					
	P	2,320	2,400	2,460	2,480					
	A	10.6	10.7	10.7	10.7					
	M	489	600	735	815					
	E	15.6	18.4	21.8	23.8					
	%	71.5	67.3	61.4	57.6					

C: Capacity (Btu/hr), P: Power (Watts), A: Current (Amps), M: Mass Flow (lbs/hr), E: EER (Btu/Watt-hr), %: Isentropic Efficiency (1%)
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 10/14/2015
12-540

EMERSON Climate Technologies

15.3 ZBD38KCE-TFD 3-PHASE, 460V COMPRESSOR DATA CHART

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

MEDIUM TEMPERATURE

Bold Area Restrictions: 20°F Max Superheat

ZBD38KCE-TFD
HFC-507
COPELAND SCROLL®
TFD 460-3-60

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

Evaporating 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					**29,600**	**32,600**	**35,800**	39,300	47,100
	p					**6,350**	**6,450**	**6,550**	6,650	6,850
	A					**9.0**	**9.2**	**9.3**	9.4	9.6
	M					**810**	**900**	**1,000**	1,110	1,370
	E					**4.7**	**5.0**	**5.4**	5.9	6.9
	%					**63.6**	**64.8**	**65.9**	66.8	68.4
130.0 (363)	C			**28,100**	**31,100**	**34,300**	37,700	41,500	45,500	54,500
	p			**5,550**	**5,650**	**5,750**	5,850	5,950	6,050	6,200
	A			**8.1**	**8.3**	**8.4**	8.5	8.6	8.7	8.9
	M			**665**	**740**	**825**	920	1,020	1,130	1,390
	E			**5.1**	**5.5**	**6.0**	6.4	7.0	7.5	8.8
	%			**64.6**	**65.8**	**66.8**	67.7	68.4	69.0	69.6
120.0 (319)	C		**25,500**	**31,500**	34,900	38,500	42,400	46,600	51,000	61,000
	p		**4,790**	**5,000**	5,150	5,250	5,300	5,400	5,500	5,600
	A		**7.3**	**7.6**	7.7	7.8	7.9	8.0	8.1	8.2
	M		**540**	**675**	755	835	930	1,030	1,140	1,400
	E		**5.3**	**6.3**	6.8	7.4	8.0	8.6	9.3	10.9
	%		**64.8**	**67.3**	68.3	69.1	69.7	70.0	70.2	69.7
110.0 (279)	C	**22,400**	**28,000**	34,600	38,300	42,400	46,700	51,500	56,500	67,500
	p	**4,130**	**4,350**	4,560	4,650	4,750	4,830	4,910	4,980	5,100
	A	**6.7**	**6.9**	7.1	7.2	7.3	7.4	7.5	7.5	7.6
	M	**431**	**545**	680	760	845	940	1,040	1,150	1,410
	E	**5.4**	**6.4**	7.6	8.2	8.9	9.7	10.5	11.3	13.3
	%	**64.0**	**67.0**	69.1	69.8	70.3	70.5	70.4	70.1	68.5
100.0 (242)	C	**24,200**	30,300	37,500	41,600	46,000	50,500	56,000	61,500	73,500
	p	**3,750**	3,950	4,140	4,230	4,310	4,390	4,450	4,510	4,600
	A	**6.3**	6.5	6.7	6.8	6.8	6.9	7.0	7.0	7.1
	M	**433**	545	685	765	850	945	1,050	1,160	1,420
	E	**6.5**	7.7	9.1	9.8	10.7	11.6	12.5	13.6	16.0
	%	**66.0**	68.5	70.0	70.3	70.4	70.2	69.7	68.8	65.8
80.0 (179)	C	28,100	35,000	43,300	48,000	53,000	58,500	64,500	71,000	85,000
	p	3,110	3,270	3,410	3,480	3,540	3,590	3,630	3,660	3,690
	A	5.8	5.9	6.0	6.1	6.1	6.2	6.2	6.2	6.3
	M	442	555	695	775	860	955	1,060	1,170	1,430
	E	9.0	10.7	12.7	13.8	15.0	16.3	17.8	19.4	23.0
	%	68.7	69.6	69.3	68.6	67.6	66.1	64.1	61.6	54.7
70.0 (153)	C	30,300	37,600	46,400	51,500	57,000	62,500	69,000	75,500	
	p	2,830	2,970	3,090	3,140	3,180	3,220	3,250	3,260	
	A	5.6	5.7	5.8	5.8	5.8	5.9	5.9	5.9	
	M	452	565	700	780	870	965	1,070	1,180	
	E	10.7	12.7	15.0	16.4	17.8	19.5	21.2	23.2	
	%	69.8	69.4	67.7	66.3	64.4	62.0	58.9	55.2	
50.0 (108)	C	36,200	44,000	53,500	59,000					
	p	2,320	2,400	2,460	2,480					
	A	5.3	5.3	5.4	5.4					
	M	489	600	735	815					
	E	15.6	18.4	21.8	23.8					
	%	71.5	67.3	61.4	57.6					

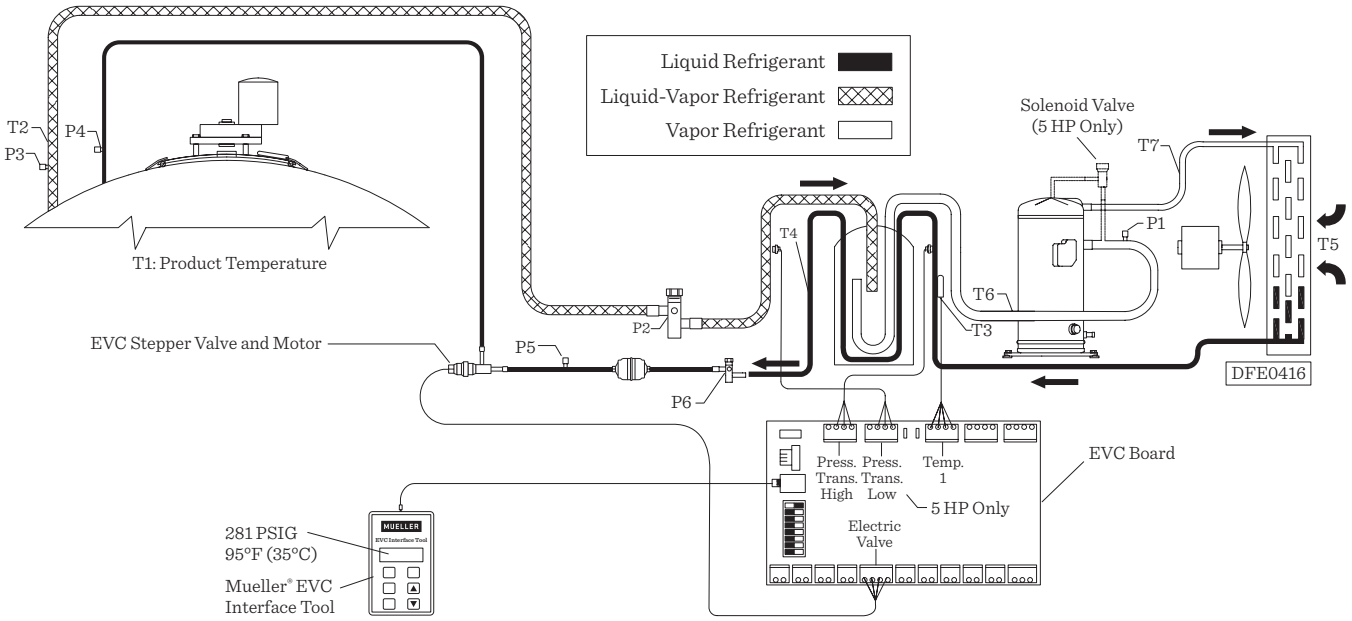
C: Capacity (Btu/hr), P: Power (Watts), A: Current (Amps), M: Mass Flow (lbs/hr), E: EER (Btu/Watt-hr), %: Isentropic Efficiency (1%)
Nominal Performance Values (±5%) based on 72 hours run-in. Subject to change without notice. Current @ 230 V.

Printed 10/14/2015
14-540

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

"OHSE" Installation Survey



PRESSURE READINGS

P1: Suction Pressure at Compressor Inlet
P2: Suction Pressure at Accumulator Inlet
P3: Suction Pressure at Evaporator Outlet
P4: Pressure at Evaporator Inlet
P5: Pressure at Subcooling Valve Inlet
P6: Pressure at Liquid Line Service Valve

TEMPERATURE READINGS

T1: Milk Temperature
T2: Suction Line Temperature at Evaporator Outlet
T3: Line Temperature at Subcooling Valve Bulb
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**	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	**L1**	**L2**	**L3**

Measured Supply Voltage:	**"OHSE" Model and Part No.:**	**Serial No.:**

PAUL
MUELLER
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