EMERSON Climate Technologies

Application Engineering

Copeland brand products

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Application Guidelines for ZF*K5E & ZB*K5E Copeland Scroll™ K5 Compressors for Refrigeration 8-15 HP with CoreSense™ Diagnostics

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Safety Instructions

Copeland Scroll™ compressors with CoreSense™ Diagnostics technology are manufactured according to the latest U.S. and European Safety Standards. Particular emphasis has been placed on the user's safety. Safey icons are explained below and safety instructions applicable to the products in this bulletin are grouped on Page 3. These instructions should be retained throughout the lifetime of the compressor. **You are strongly advised to follow these safety instructions.**

Safety Icon Explanation

⚠ DANGER	DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.
⚠ WARNING	WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.
⚠ CAUTION	CAUTION, used with the safety alert symbol, indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
NOTICE	NOTICE is used to address practices not related to personal injury.
CAUTION	CAUTION, without the safety alert symbol, is used to address practices not related to personal injury.

Instructions Pertaining to Risk of Electrical Shock, Fire, or Injury to Persons

WARNING	**ELECTRICAL SHOCK HAZARD** • Failure to follow these warnings could result in serious personal injury. • Disconnect and lock out power before servicing. • Discharge all capacitors before servicing. • Use compressor with grounded system only. • Molded electrical plug must be used when required. • Refer to original equipment wiring diagrams. • Electrical connections must be made by qualified electrical personnel.
WARNING	**PRESSURIZED SYSTEM HAZARD** • Failure to follow these warnings could result in serious personal injury. • System contains refrigerant and oil under pressure. • Remove refrigerant from both the high and low compressor side before removing compressor. • Use appropriate back up wrenches on rotalock fittings when servicing. • Never install a system and leave it unattended when it has no charge, a holding charge, or with the service valves closed without electrically locking out the system. • Use only approved refrigerants and refrigeration oils. • Personal safety equipment must be used.
WARNING	**BURN HAZARD** • Failure to follow these warnings could result in serious personal injury or property damage. • Do not touch the compressor until it has cooled down. • Ensure that materials and wiring do not touch high temperature areas of the compressor. • Use caution when brazing system components. • Personal safety equipment must be used.
CAUTION	**COMPRESSOR HANDLING** • Failure to follow these warnings could result in personal injury or property damage. • Use the appropriate lifting devices to move compressors. • Personal safety equipment must be used.

Safety Statements

- Refrigerant compressors must be employed only for their intended use.
- Only qualified and authorized HVAC or refrigeration personnel are permitted to install, commission and maintain this equipment.
- Electrical connections must be made by qualified electrical personnel.
- All valid standards and codes for installing, servicing, and maintaining electrical and refrigeration equipment must be observed.

Introduction

The Copeland Scroll™ refrigeration compressor product offering has developed the K5 compressor for the 8 to 15 HP size range. The scope of this bulletin will cover the application parameters unique to the ZB*K5E and ZF*K5E refrigeration scrolls with CoreSense™ technology.

Nomenclature

The Copeland Scroll compressor model numbers include the nominal capacity at the standard 60 Hertz "ARI" rating conditions with R-404A refrigerant.

Example

ZB76K5E-TFD-260

Z = Copeland Scroll

B = Application (B: Medium Temperature, F: Low Temperature)

76K = Nominal Capacity (kBtu/hr)

5 = Model Variation Identifier for the K5 refrigeration scroll

E = Oil Type (POE)

TFD = Motor Version

260 = Build of Materials

Approved Refrigerants

Application	Model Number	HP	Approved Refrigerants
Low Temperature	ZF34K5E	10	R-404A, R-507, R-407A/C, R-22, R-407F
	ZF41K5E	13	
	ZF49K5E	15	
Medium Temperature	ZB58K5E	8	R-404A, R-507, R-407A/C, R-22, R-134a, R-407F
	ZB66K5E	9	
	ZB76K5E	10	
	ZB95K5E	13	
	ZB114K5E	15	

Note! For latest approved refrigerants and lubricants, refer to **Form 93-11**, *Emerson Accepted Refrigerants/ Lubricants,* or contact your Application Engineer.

Note! The ZB*K5 compressors are each applicable with R-134a, however, Emerson Climate Technologies has released the ZB*K5B series for optimum performance for lower R-134a-like pressures. See following table for specific model numbers.

Optimized R-134a ZB*K5B Compressors

Model	Hertz	Voltage	Capacity	EER
ZB47K5B-TFD	60	460	46,500	7.38
	50	380/420	38,500	7.33
ZB59K5B-TFD	60	460	49,600	7.04
	50	380/420	59,500	7.04
ZB68K5B-TFD	60	460	68,700	7.25
	50	380/420	57,000	7.25

⚠ CAUTION

POE must be handled carefully and the proper protective equipment (gloves, eye protection, etc.) must be used when handling POE lubricant. POE must not come into contact with any surface or material that might be harmed by POE, including without limitation, certain polymers (e.g. PVC/CPVC and polycarbonate).

Operating Envelope

Operating envelopes for the K5 compressors for refrigeration are depicted in **Figures 1A** through **1H** at the end of this bulletin.

Extended ZF*K5E Operating Envelope

Figure 1H presents an extended envelope for the ZF*K5E scroll. While this product is optimized for a low temperature application, in some instances the ZF*K5E, either with vapor injection or no injection at all, can be applied in a medium temperature application. This may be done to use common model numbers in a system or to apply vapor injection for additional cooling capacity.

When applying with vapor injection, it should be noted that the total amount of internal subcooling is limited by the injection pressure at the compressor. In medium temperature operation, this value is typically higher than when a ZFK5 is applied at low temperature and therefore the minimum subcooled liquid temperature allowable exiting the economizer is higher (depending on the refrigerant this may be as high as 75°F). Refer to Emerson's Product Selection Software for estimated values by compressor model.

Note! If applying without vapor injection the injection port should be plugged. The vapor injection fitting is a Rotalock design with a 1" x 14 rotalock thread size, the fitting can be capped using the rotalock to stub tube adaptor kit # 998-0034-18. A ½" copper line can be inserted into the stub end of the adaptor and sealed off. The rotalock adaptor with the supplied Teflon seal will effectively seal the port and will not damage the fitting or the compressor.

ZF*K5E Low Temperature K5 Compressors for Refrigeration

The low temperature models are provided with an injection port that can be used for either liquid or vapor injection.

Liquid Injection

When using the ZF*K5E scrolls for liquid injection operation, a discharge temperature control (DTC) valve must be applied. The purpose of the DTC valve is to eliminate the need for a standard capillary tube. The DTC valve is approved for all refrigerants in this product range. A DTC valve must also be used for ZF**K5E applications with R-407A, R-407C and R-407F (R-407A/C/F) with vapor injection via a special T-fitting adapter. Further details and part numbers related to the DTC valve are listed in **Table 1** at the end of this bulletin.

DTC Valve Specifications

The following components are not required, but they are recommended for liquid injection.

- Sight Glass - A sight glass can be installed before the DTC valve to allow for visual inspection for the presence of liquid refrigerant.
- Filter/Drier - A filter/drier should be installed upstream of the injection circuit to avoid the possibility of the DTC screen blockage due to contaminants.

Figures 2A through **2C** are a representation of typical systems, depicting the location of these components

Installation of DTC Valve

The valve bulb must be installed in the top cap thermal well to adequately control scroll temperatures. The valve should be tightened on the injection fitting to a torque of **216-245 in. lbs. (24.4 - 27.7 Nm)**. A 90° orientation on the valve is recommended, however it will function properly in any orientation. The capillary tube connecting the valve to the bulb should be positioned such that it does not contact the compressor during operation. Do not bend the capillary tube within 1" (25.4mm) of the valve.

The DTC valve comes with an insulating cap. If this additional height from the cap is an issue, the valve cap could be replaced with high temperature insulation. This should be applied to insulate and protect the valves remote bulb assembly. This will reduce the total height requirement by 0.5" (12.7mm).

Suggested Application Techniques for the DTC Valve

For the most efficient thermal sensing, spread a thin film of thermal grease around the DTC valve bulb before installing into the top cap well. However for proper functioning of the valve this is not required.

- For service purposes, a mechanical ball valve (not provided by Emerson) is also recommended in the liquid and vapor injection line.

For the liquid injection system to be effective, a minmum of 5°F subcooled liquid at the at the DTC inlet is required.

Note! To ensure adequate temperature control, take care to not damage the DTC valve bulb when installing.

Vapor Injection

The ZF*K5E 8-15 HP scrolls can also be applied with vapor injection by implementing an economizer circuit in the system. Economizing is accomplished by utilizing a subcooling circuit similar to that shown in **Figure 3** at the end of this bulletin. This mode of operation increases the refrigeration capacity and in turn the efficiency of the system.

The schematic shows a system configuration for the economizer cycle. A heat exchanger is used to provide subcooling to the refrigerant before it enters the evaporator. This subcooling process provides the increased capacity gain for the system, as described above. During the subcooling process a small amount of refrigerant is evaporated and superheated. This superheated refrigerant is then injected into the mid compression cycle of the scroll compressor and compressed to discharge pressure. This injected vapor also provides cooling at higher compression ratios, similar to liquid injection of standard ZF scroll compressors. The benefits provided will increase as the compression ratio increases, thus, more gains will be made in summer when increased capacity may actually be required.

An example of the additional capacity available when using vapor injection is depicted in the following table.

ARI Low Temperature Ratings
(-25°F/105°F, R-404A)

Model	With EVI*	Without EVI*
ZF34K5E	48,100 Btu/hr	34,200 Btu/hr
ZF41K5E	57,500 Btu/hr	42,200 Btu/hr
ZF49K5E	71,000 Btu/hr	50,500 Btu/hr

* Maximum possible subcooling
* Without EVI is "0" subcooling

Note: For performance of ZF*K5E models with other refrigerants, refer to the Online Product Information at www.emersonclimate.com

Discharge Temperature Control with Vapor Injection

Although using vapor injection offers some inherent compressor cooling, when using the ZF*K5E scrolls with R-407A/C/F and vapor injection additional cooling is required to operate across the whole operating map of the compressor. To provide this extra cooling a t-fitting and DTC valve should be installed onto the compressor's injection port. The t-fitting will meter liquid from the DTC valve into one side of the fitting, while vapor flows in through the otherside. See **Figure 4C** at the end of this bulletin for a example schematic. This is different than the current method used on other Copeland vapor injected scrolls (ZF*KVE models) which use the Copeland Demand Cooling to inject liquid in the vapor line of the compressor based on a discharge line temperature reading.

Note! Just as with liquid injection operation, when using the DTC valve with vapor injection ensure that the thermal bulb is well insulated.

When using vapor injection with R-404A/R-507, the DTC valve and t-fitting are not required. A discharge line thermistor is supplied with the CoreSense diagnostics assembly (more information on CoreSense diagnostics is found later in this bulletin). The thermistor should be placed no more than 6 inches (15.2 cm) from the discharge of the compressor. The thermistor should be well insulated to ensure accurate temperature sensing on the discharge line.

System Configuration

There are two methods of controlling refrigerant flow at the EVI heat exchanger - downstream and upstream extraction.

Downstream Extraction

The downstream extraction is the preferred method employed in the United States. In downstream extraction the TXV is placed between the liquid outlet and vapor inlet of the heat exchanger. The advantage of downstream extraction is that subcooling is ensured because the liquid is further subcooled as it flows through the heat exchanger. Therefore, more subcooled liquid enters the TXV which increases the probability that the valve will not hunt. The disadvantage with this method is that it is not as efficient as the upstream method; however, the difference is too small for practical purposes. See **Figure 4.**

Upstream Extraction

In upstream extraction the TXV is placed between the condenser and the heat exchanger. The TXV regulates the flow of subcooled refrigerant out of the condenser and into the heat exchanger. With this type of configuration there is a potential for flash gas which would cause the valve to hunt. See **Figure 5.**

Heat Exchanger Piping Arrangements

Best subcooling effect is assured if counter flow of gas and liquid is provided as shown (see **Figure 6**). In order to guarantee optimum heat transfer, the plate heat exchanger should be mounted vertically and vapor should exit it at the top.

For more information on applying ZF*K5E scrolls with an economized vapor injection (EVI) circuit refer to **AE4-1327,** *Economized Vapor Injection (EVI) Compressors*.

Accumulator Requirements

Due to the Copeland Scroll compressor's inherent ability to handle liquid refrigerant in flooded start and defrost operation conditions, accumulators may not be required. An accumulator is required on single compressor systems with refrigerant charges over 17 lbs. On systems with defrost schemes or transient operations that allow prolonged, uncontrolled liquid return to the compressor, an accumulator is required unless a suction header of sufficient volume is used to prevent liquid migration to the compressor.

Superheat Requirements

In order to assure that liquid refrigerant does not return to the compressor during the running cycle, attention must be given to maintaining proper superheat at the compressor suction inlet. Emerson recommends a minimum of 20°F (11°C) superheat, measured on the suction line 6 inches (152mm) from the suction valve, to prevent liquid refrigerant floodback.

Another method to determine if liquid refrigerant is returning to the compressor is to accurately measure the temperature difference between the compressor oil crankcase and the suction line. During continuous operation we recommend that this difference be a minimum of 50°F (27°C). This “crankcase differential temperature” requirement supersedes the minimum suction superheat requirement in the last paragraph. To measure oil temperature through the compressor shell, place a thermocouple on the bottom center (not the side) of the compressor shell and insulate from the ambient.

During rapid system changes, such as defrost or ice harvest cycles, this temperature difference may drop

rapidly for a short period of time. When the crankcase temperature difference falls below the recommended 50°F (27°C), our recommendation is the duration should not exceed a maximum (continuous) time period of two minutes and should not go lower than a 25°F (14°C) difference.

Contact your Emerson Climate Technologies representative regarding any exceptions to the above requirements.

Crankcase Heater

Crankcase heaters are required, on outdoor systems, when the system charge exceeds 17 lbs.

Table 2 includes crankcase heaters intended for use only where there is limited access. The heaters are not equipped for use with electrical conduit. Where applicable electrical safety codes require heater lead protection, a crankcase heater terminal box should be used. Recommended crankcase heater terminal cover and box numbers are also listed in **Table 2** If there are any questions concerning the application, contact Application Engineering.

Pressure Controls

Both high and low pressure controls are required. The minimum and maximum pressure setpoints are shown in **Table 4** at the end of this bulletin.

IPR Valve

There is **no** internal pressure relief valve in these larger horsepower scrolls. Therefore a high pressure control located prior to any shut-off valves is **mandatory**. There is an access port located on the compressor discharge rotalock fitting to accommodate this control.

Motor Protection

Motor protection in the K5 compressor for refrigeration is either by internal line break (ILB) or solid state protection with positive temperature coefficient (PTC) sensors. The type of motor protection is based on the compressor motor version. An "F" in the second character indicates line break while a "W" indicates PTC protection. For example, a ZF34K5E-TFC has ILB and a ZB95K5E-TWC uses PTC sensors.

PTC Motor Protection

There are four PTC (Positive Temperature Coefficient) internal thermistors connected in series that react with avalanching resistance in the event of high temperatures. The thermistors are used to sense motor temperatures. The thermistor circuit is connected to the protector module terminals S1 and S2.

When any thermistor reaches a limiting value, the module interrupts the control circuit and shuts off the compressor. After the thermistor has cooled sufficiently, it will reset. However, the module has a 30 minute time delay before reset after a thermistor trip.

Programmable Logic Controller Requirements

If the INT69 (071-0660-00) module is applied in conjunction with a Programmable Logic Controller, it is important that a minimum load is carried through the M1-M2 control circuit contacts.

The minimum required current through the module relay contacts needs to be greater than 100 milliamps but not to exceed 5 amps. If this minimum current is not maintained, this has a detrimental effect upon the long-term contact resistance of the relay and may result in false compressor trips.

PLC operated control circuits may not always provide this minimum current. In these cases modifications to the PLC control circuit are required. Consult your Application Engineering Department for details.

Kriwan INT69 Module and Sensor Functional Check

Module specifications are listed in **Table 3** at the end of this bulletin. Refer to **Figure 2** for wiring schematic. The following field troubleshooting procedure can be used to evaluate the solid state control circuit:

Motor Protector Module Voltage Supply Troubleshooting

- Verify that all wire connectors are maintaining a good mechanical connection. Replace any connectors that are loose.
- Measure the voltage across T1-T2 to ensure proper supply voltage.
- Determine the control voltage by using a voltmeter and then measure the voltage across the M1-M2 contacts:
  a) If the measured voltage is equal to the control volts then the M1-M2 contacts are open.
  b) If the measurement is less than 1 volt and the compressor is not running, then the problem is external to the motor protector module.
  c) If the voltage is greater than 1 volt but less than the control voltage, the motor protector module is faulty and should be replaced.

Sensor Troubleshooting

- Remove the leads from S1-S2, and then by using an Ohmmeter to measure the resistance of the incoming leads.

CAUTION

Use an Ohmmeter with a maximum of 9 VDC for checking – do not attempt to check continuity through the sensors with any other type of instrument. Any external voltage or current may cause damage requiring compressor replacement.

a) During normal operation, this resistance value should read less than 4500 ohms ±20%.

b) If the M1-M2 contacts are open, the measured S1-S2 value is above 2750 ohms ±20% and the compressor has been tripped less then 30 minutes then the module is functioning properly.

- If the S1-S2 wire leads read less than 2750 ohms ±20% and the M1-M2 contacts are open, reset the module by removing the power to T1-T2 for a minimum of 5 seconds.
- Replace all wire leads and use a voltmeter to verify the M1-M2 contacts are closed.
- If the M1-M2 contacts remain open and S1-S2 are less than 2500 ohms, remove leads from the M1-M2 contacts and jumper together, using a 100 ohm resistor.

CAUTION

Compressor should start at this time. HOWEVER DO NOT LEAVE JUMPER IN PLACE FOR NORMAL SYSTEM OPERATIONS. THE JUMPER IS USED FOR DIAGNOSTIC PURPOSES ONLY.

- Go to Compressor Supply Voltage Troubleshooting.

Compressor Voltage Supply Troubleshooting

- Remove phase sensing leads from the module from L1/L2/L3.
- Use a voltmeter to measure the incoming 3 phase voltage on L1/L2/L3. **WARNING: L1/L2/L3 could be at a potential up to 600VAC.**
- Ensure proper voltage on each phase.
- Remove power to the module for a minimum of 5 seconds to reset and replace all wire leads. Re-energize the module. If the M1-M2 contacts are open with proper voltage to T1-T2, L1/L2/L3 and proper resistance to S1-S2 then the module is faulty and should be replaced.

Oil Management for Rack Applications

Copeland K5 refrigeration scrolls may be used on multiple compressor parallel rack applications. This requires the use of an oil management system to maintain proper oil level in each compressor crankcase. The sight glass connection supplied can accommodate the mounting of the oil control devices.

Unlike semi-hermetic compressors, scrolls do not have an oil pump with accompanying oil pressure safety controls. Therefore, an external oil level control is required.

The OMB Oil Level Management Control combines the functions of level control and timed compressor shut-off should the level not come back to normal within a set period of time. This device has been found to provide excellent performance in field tests on scroll compressors and is recommended for parallel system applications. Refer to **Table 5** for Oil Monitoring accessory part numbers.

Immediately after system start-up the oil reservoir level will fluctuate until equilibrium is reached. It is advisable to monitor the oil level during this time to assure sufficient oil is available. This will prevent unnecessary trips of the oil control system. Additional information on oil management in Copeland Scroll compressors can be found in Application Engineering bulletin **AE17-1320.**

Discharge Mufflers

Gas flow through scroll compressors is continuous with relatively low pulsation. External mufflers applied to piston compressors may not be required on Copeland Scroll compressors. Due to system variability individual tests should be conducted by the system manufacturer to verify acceptable levels of sound and vibration.

Compressor Mounting

Compressor mounting must be selected based on application. Consideration must be given to sound reduction and tubing reliability. Some tubing geometry or “shock loops” may be required to reduce vibration transferred from the compressor to external tubing. Mounting kit part numbers are listed in **Table 4** at the end of this bulletin.

Mounting for Rack Systems – Specially designed steel spacers and rubber isolator pads are available for Copeland Scroll 8 -15 HP rack applications. This mounting arrangement limits the compressors motion thereby minimizing potential problems of excessive tubing stress. Sufficient isolation is provided to prevent vibration from being transmitted to the mounting structure. This mounting arrangement is recommended for multiple compressor rack installations. See **Figure 7A** for a detail of this mounting system.

Condensing Units – For 8 -15 HP Copeland Scroll condensing unit applications, standard mounts (55-65 durometer) are recommended. The mounting system for K5 refrigeration scroll condensing units is depicted in **Figure 7B**.

Tubing Considerations – Proper tube design must be taken into consideration when designing the tubing connecting the scroll to the remaining system. The tubing should provide enough "flexibility" to allow normal starting and stopping of the compressor without exerting excessive stress on the tube joints. In addition, it is desirable to design tubing with a natural frequency away from the normal running frequency of the compressor. Failure to do this can result in tube resonance and unacceptable tubing life. **Figure 2** is an example of an acceptable tubing configuration.

CAUTION

These examples are intended only as guidelines to depict the need for flexibility in tube designs. In order to properly determine if a design is appropriate for a given application, samples should be tested and evaluated for stress under various conditions of use including voltage, frequency, and load fluctuations, and shipping vibration. The guidelines above may be helpful; however, testing should be performed for each system designed.

Connection Fittings, Service Valves, and Adapters

The fitting sizes for 8 through 15 HP scrolls are shown in **Table 5**.

Deep Vacuum Operation

⚠WARNING

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.

A low pressure control is required for protection against deep vacuum operation. See *Pressure Control* section for proper set points. (**Table 6**)

Scroll compressors (as with any refrigerant compressor) should never be used to evacuate a refrigeration or air conditioning system. See **AE-1105** for proper system evacuation procedures.

Unbrazing System Components

⚠WARNING

If the refrigerant charge is removed from a scroll unit by bleeding the high side only, it is sometimes possible for the scrolls to seal, preventing pressure equalization through the compressor. This may leave the low side shell and suction line tubing pressurized. If a brazing torch is then applied to the low side, the pressurized refrigerant and oil mixture could ignite as it escapes and contacts the brazing flame. It is important to check both the high and low sides with manifold gauges before unbrazing or in the case of assembly line repair, remove refrigerant from both the high and low sides. Instructions should be provided in appropriate product literature and assembly (line repair) areas.

High Potential (Hipot) Testing

Many of the Copeland brand compressors are configured with the motor below the compressor. As a result, when liquid refrigerant is within the compressor shell the motor can be immersed in liquid refrigerant to a greater extent than with compressors with the motor mounted above the compressor. When Copeland brand compressors are Hipot tested and liquid refrigerant is in the shell, they can show higher levels of leakage current than compressors with the motor on top because of the higher electrical conductivity of liquid refrigerant than refrigerant vapor and oil. This phenomenon can occur with any compressor when the motor is immersed in refrigerant. The level of current leakage does not present any safety issue. To lower the current leakage reading, the system should be operated for a brief period of time to redistribute the refrigerant to a more normal configuration and the system Hipot tested again. See bulletin **AE4-1294** for Megohm testing recommendations. Under no circumstances should the Hipot or Megohm test be performed while the compressor is under a vacuum.

Note: The solid state electronic module components and internal sensors are delicate and can be damaged by exposure to high voltage. Under no circumstances should a high potential test be made at the sensor terminals or sensor leads connected to the module. Damage to the sensors or module may result.

Three Phase Scroll Compressors – Directional Dependence

Scroll compressors are directional dependent; i.e. they will compress in one rotational direction only. Three phase scrolls will rotate in either direction depending on power phasing. Since there is a 50/50 chance of connected power being "backwards", contractors should be warned of this. Appropriate instructions or notices should be provided by the OEM.

Verification of proper rotation can be made by observing that the suction pressure drops and the discharge pressure rises when the compressor is energized.

No time delay is required on three phase models to prevent reverse rotation due to brief power interruptions. The CoreSense module will provide reverse rotation protection.

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.
4. If the suction pressure does not drop and the discharge pressure does not rise, reverse any two of the compressor power leads and reapply power to verify the compressor was not wired to run in the reverse direction.

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

CoreSense Diagnostics™ Module for Refrigeration Compressors

The CoreSense Diagnostics module (see **Figure 12**) for Copeland Scroll refrigeration compressors (referred to as “the CoreSense module” in this document) is a breakthrough innovation for troubleshooting refrigeration system faults. The CoreSense module is installed in the electrical box of all 8-15 HP K5 refrigeration scroll compressors. By monitoring and analyzing data from the Copeland brand compressors via module power, discharge line thermistor, and the current transducer (referred to as “CT” in this document), the CoreSense module can accurately detect the cause of electrical and system related issues. A flashing LED indicator communicates the alert code and guides the service technician more quickly and accurately to the root cause of a problem.

The CoreSense module can provide both compressor protection and lockout capability. Compressor protection means that the CoreSense module will trip the compressor when any of the following severe alert conditions (Codes 1, 2, 4, 6, 7 or 9) are detected. A trip condition is when the protector on a compressor opens and stops current flow into the compressor motor. As a result, the compressor shuts down. A trip condition will reset after short cycle time and when trip condition is not present.

If lockout is enabled and a preset number of alarm events happen, the CoreSense module will not allow the compressor to start (Codes 1, 4, 6 or 7) until the situation is corrected and the module is manually reset. The module can be reset by cycling power to the module.

CoreSense Module LED Overview

The CoreSense module, under abnormal detected conditions, has the ability to shut down the compressor if the compressor contactor coil is wired through the M1-M2 relay.

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 in **Table 7**.

The CoreSense module will continue to display the alert code until the condition returns to normal or if module power is cycled to the device.

Yellow LED:

FLASHING: Alerts of an abnormal system condition via Alert Codes

SOLID: Demand is present but no current is detected. All protective shutdowns will auto reset in their allotted time

Red LED:

FLASHING: Indicates the CoreSense module is locked out on the flashing Alert Code. Manual power cycle reset is required to restart the compressor

Green LED:

FLASHING: Alert Codes that do NOT have a protective shutdown associated with them.

Some troubleshooting tips for the CoreSense module are listed in **Table 8** at the end of this document.

Product Specifications

Operating Temp: -40° to 150°F (-40° to 65°C)
Storage Temp: -40° to 175°F (-40° to 80°C)
Power Supply Range: 85-265VAC, 50-60 Hz
Working amperage for CT module: 3-200A

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

The CoreSense module connections are standard male electrical flag terminals.

Maximum continuous contactor coil current is 2A with a max inrush current of 20A.

Compressor Lead Wiring

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

CoreSense Module Mounting

The CoreSense module will come pre-mounted inside the compressor terminal box. The module is mounted so all LEDs are in front of the light pipes in the terminal covers so codes are visible when the terminal box cover is installed on the terminal box.

110-220VAC CoreSense Module Power Wiring

The CoreSense module requires 115-230VAC power between to the L1 and L2 terminals. The module should remain powered through all states of compressor on/off operation. Refer to wiring schematic examples.

Demand Wiring

The CoreSense module requires a demand signal to operate properly. The demand signal input, labeled D on the module, should always be connected to the compressor demand so that the demand signal input is 110 or 220VAC with respect to L2. See **Figure 8** for proper wiring diagrams. Choose the appropriate diagram depending on how the demand signal will be fed to the module.

For K5 refrigeration scrolls with CoreSense diagnostics, a relay (indicated by K1 in Figure 8) needs to be installed in series with the "Demand" circuit. The normally open relay should close when demand is present. When the coil is not energized, the demand signal input should be less than 0.5VAC. This is to avoid a "Demand, No Current" alert (steady yellow LED) when the compressor cycles off or goes into a scheduled pump down. Refer to the wiring diagram in **Figure 8** for more detail. Emerson recommends a general purpose / industrial relay with mounting socket. The relay contacts should be rated for 5A at 250VAC and the coil needs to match the system's control voltage (typically 220/240 or 110/120 VAC).

For demand wiring kit see **Table 9.** For an example of wiring the relay see **Figure 14.**

Protection/Contactor Control Wiring

The M1-M2 relay on the CoreSense module is a normally open relay. When the module is powered and there are no protective faults, the relay is energized and does not cycle on/off. On a detected protection condition, the CoreSense module will de-energize the relay to stop the motor from running. The relay is not used as a cycling device for normal compressor operation. The cycling device must be supplied externally from the module.

Discharge Temperature Protection with CoreSense Diagnostics for K5 Compressors

Copeland Scroll K5 compressors for refrigeration with CoreSense diagnostics come standard with discharge temperature protection. Depending on the application and refrigerant a certain mode of protection will be used whether it is a top cap thermistor or DTC valve with discharge line thermistor. The CoreSense module identifies the protection device based on the pin locations in the connector (see **Figure 9**). **Figures 10** and **11** depict the installation of the top cap thermistor and discharge line thermistor, respectively.

Table 1 at the end of this bulletin identifies the discharge temperature protection device by application and refrigerant. **Table 4** identifies the service part numbers for those devices.

Communication DIP Switch Configuration

The communication module on the CoreSense Diagnostics module is equipped with a 10 switch DIP switch used for selection of the MODBUS address, baud rate, parity, and other operating conditions to simplify service and start-up procedures. See **Figure 13.** For more information on DIP switch settings, **Table 10** lists the purpose for each switch.

Note! Cycle power after changing any of the DIP settings for changes to take effect.

The following steps cover the DIP switch settings throughout the commissioning process for a multiple compressor system with communications to the E2:

1. Switches 1 through 5 are used for setting the address. Each CoreSense Diagnostics device that is connected to a rack controller must have a unique node address (as determined by the DIP switch settings).
2. Switch 6 defines the communications baud rate for the CoreSense Diagnostics module. If the switch is “off”, the baud rate is 19200. If the switch is “on” the baud rate is 9600. The baud rate for each of the CoreSense devices should be set to match the rack controller. The default baud rate is 19200 (“off”) for the CoreSense Diagnostics module. To determine the baud rate in the E2, follow these steps:
   - From the main menu select 7 (System Configuration)
   - Press 3 (System Information)
   - Press 1 (General Controller Info)
   - Access the Serial Communications Tab by pressing CTRL + 3
   - Use the Page Down button or scroll down to view the settings for COM4
3. Switch 7 defines the communication parity. The default parity setting for the CoreSense Diagnostics module is no parity. If the switch is set to “on” the module will communicate using even parity. The parity setting must match the parity setting of the rack controller.
4. Switch 8 is used to set the network mode (on) for the module. The default setting is stand alone mode (off). Network mode will generate a communications error if the rack controller fails to communicate with the device. For standalone mode, no communications are expected so the communication error is blocked. 1 These guidelines are based on E2 firmware version 3.0 and are subject to change. Contact your Emerson representative or refer to the operation manual for more details on configuring an E2.

Cable Routing / Daisy Chain Configuration

CoreSense diagnostics can communicate with a rack controller using MODBUS protocol. The communication cable is wired from the rack controller to the first compressor. Additional compressors are wired in a daisy chained configuration. Refer to **Figures 16** and **17**.

A shielded, twisted pair cable such as Belden #8761 (22AWG) should be used for the communication wiring. Passing the communications wire through the grommet in the plastic housing will help reduce abrasion to the wiring. Appropriate strain relief is recommended.

Note! The RS485 is polarity sensitive. “+” wires must connect to other “+” terminals, and “-” wires must connect to other “-” terminals. The shield wire is connected to the center terminal, or “0 volt” position.

Terminations

The last compressor in the daisy chain must be “terminated” by setting the DIP switch number 10 to the "on" (up) position. For all other compressors the number 10 DIP switch should remain in the "off" (down) position.

More information: The E2 jumpers on the Network Interface Board should be set for “terminated”. Refer to **Figure 15**.

COMMISSIONING

Modules using a communications network must be commissioned as part of the E2 rack controller setup. The commissioning process uploads compressor asset information (model and serial number) into the rack controller for future reference. Once the commissioning process is completed, the controller will supervise and communicate with the module unless the node is deleted. Refer to section titled **MODBUS Communication to CoreSense Diagnostics for K5 Compressors** for more details on commissioning the K5 scrolls in an Emerson Retail Solutions E2 rack controllers.

The CoreSense Diagnostics module does not need to communicate to the rack controller in order to provide compressor protection. Using the communication process is optional, but provides for information flow to the controller for proofing, remote reset, asset information, and fault history and compressor status. Skip to section titled **Stand Alone Mode** if the communication feature will not be used.

The commissioning process begins by assigning a unique node address to each module. The address is established by the setting of a DIP switch in the module.

Stand Alone Mode

If running a K5 with CoreSense diagnostics without communication to a rack controller, DIP switch 8 should be set to "Off" (down).

MODBUS Communication to CoreSense Diagnostics for K5 Compressors

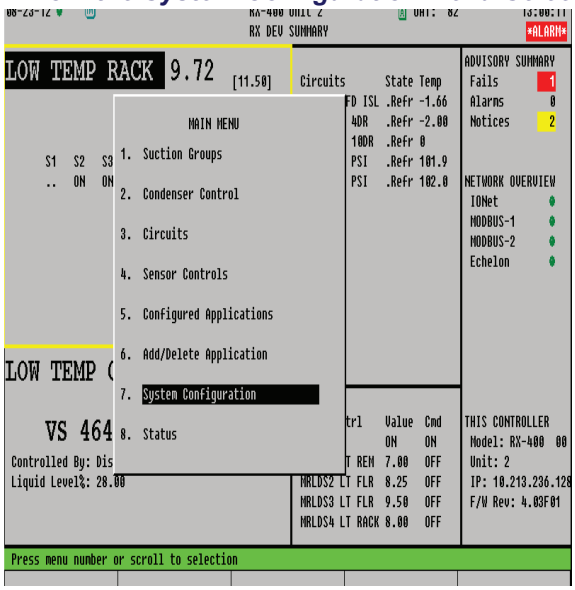
K5 Compressors equipped with a communication module are capable of communicating via open MODBUS to a rack controller. The steps on the following pages are provided to commission K5 scrolls in an Emerson E2 with firmware version 3.0 or newer. For other rack controllers, contact the manufacturer.

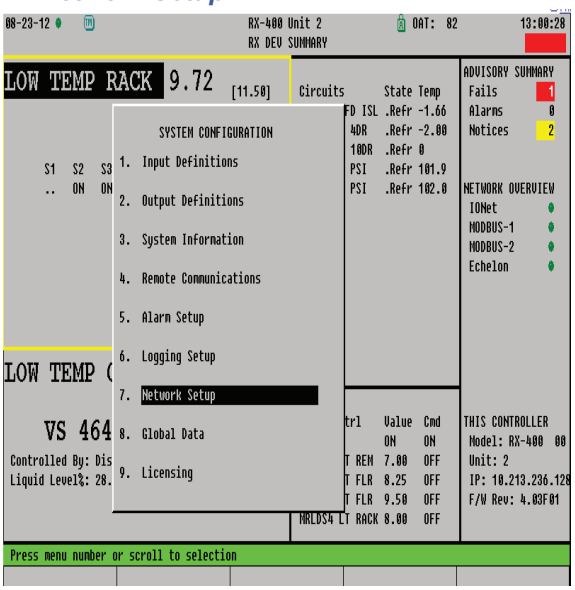
CoreSense K5 Programming Instructions

1. Press 

to Enter the Main Menu. Select 7. System Configuration.

2. From the System Configuration Menu Select 7. Network Setup



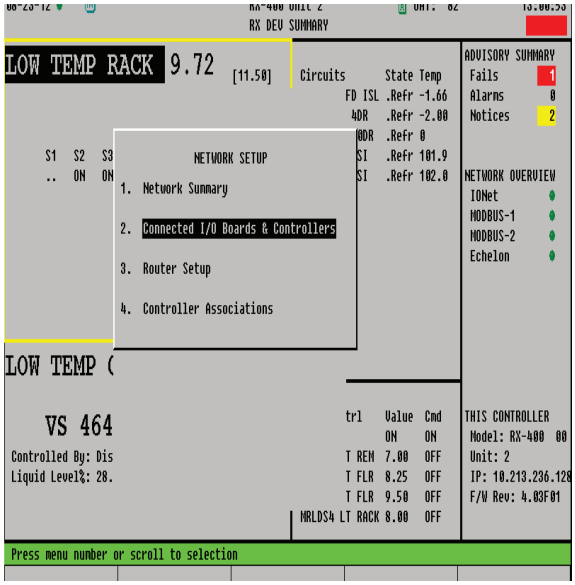


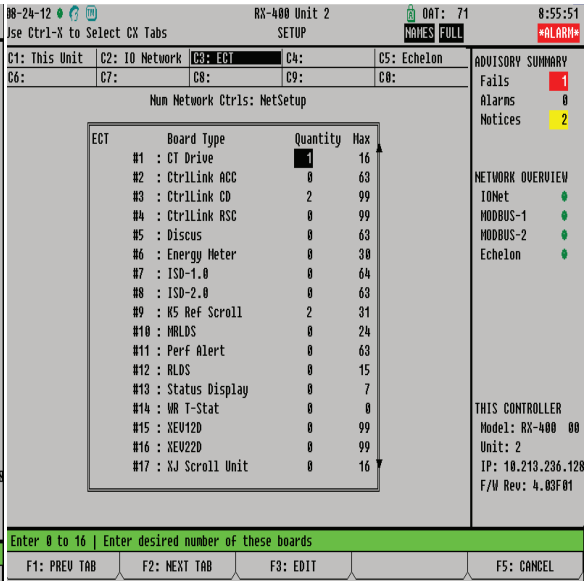
3. From the Network Setup Menu Select 2. Connected I/O Boards and Controllers

4. From the Setup Screen Go To The C3: ECT Tab (Press Ctrl + 3)

5. In Option #9, Enter The Number Of K5 Compressors Being Controlled By The E2.

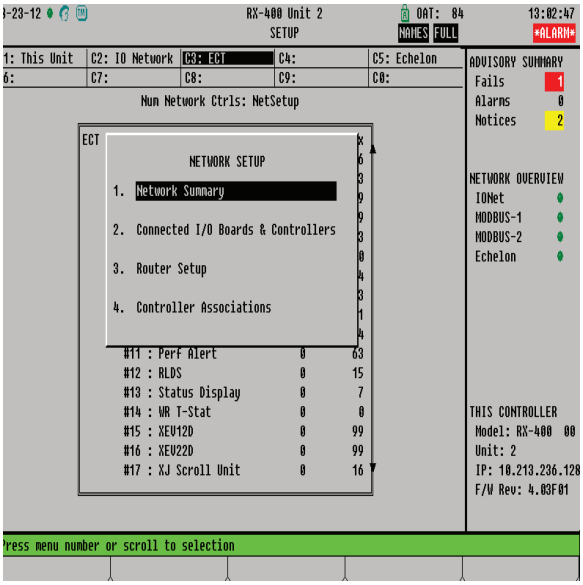
Press 
To Save Changes And Return To The Previous Screen.





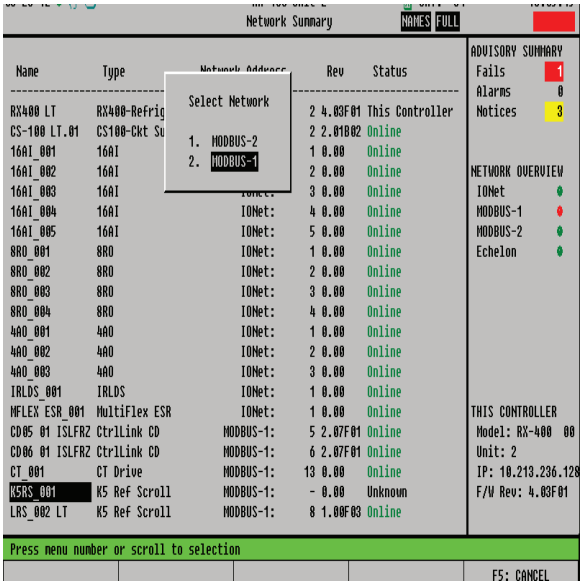
6. From the Network Setup Menu Select 1. Network Summary

7. The CoreSense K5 Devices Should Be Present On the Network. Select the CoreSense K5 module to Be Commissioned. Press F4: Commission

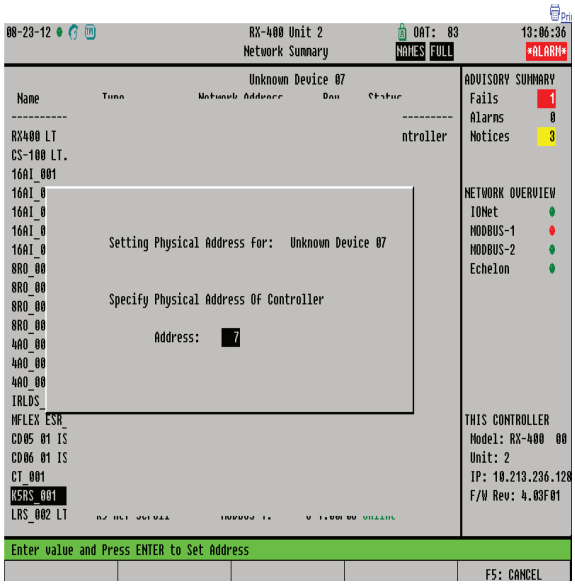


8. Select the modbus that the CoreSense device is connected to. (If only 1 modbus network is connected, this step will automatically complete itself, skip to step 9)

9. From the Modbus Device Menu Select an Unused Space That Matches the DIP Switch Address Of The CoreSense Device And Press Enter..

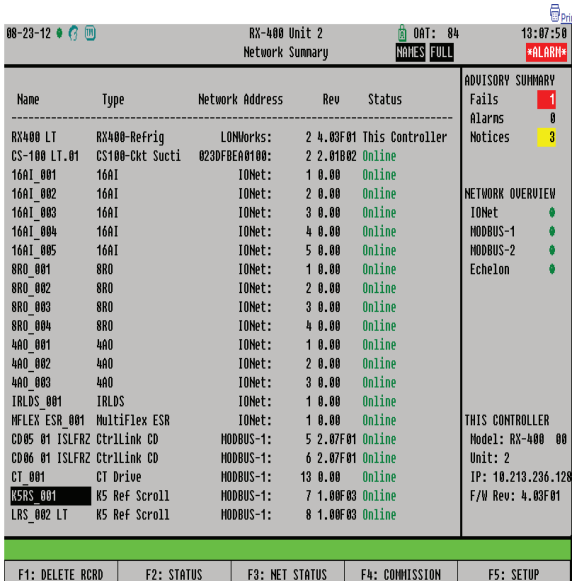


10. Verify The Address Matches The Address Assigned By The CoreSense Module's DIP Swi ***tch settings and press Enter.***



11. Press  ***To Return To The Network Summary Screen. The Device Should Now Be*** "Online".
Repeat Steps 8-10 To Address The Remaining CoreSense K5 Modules .

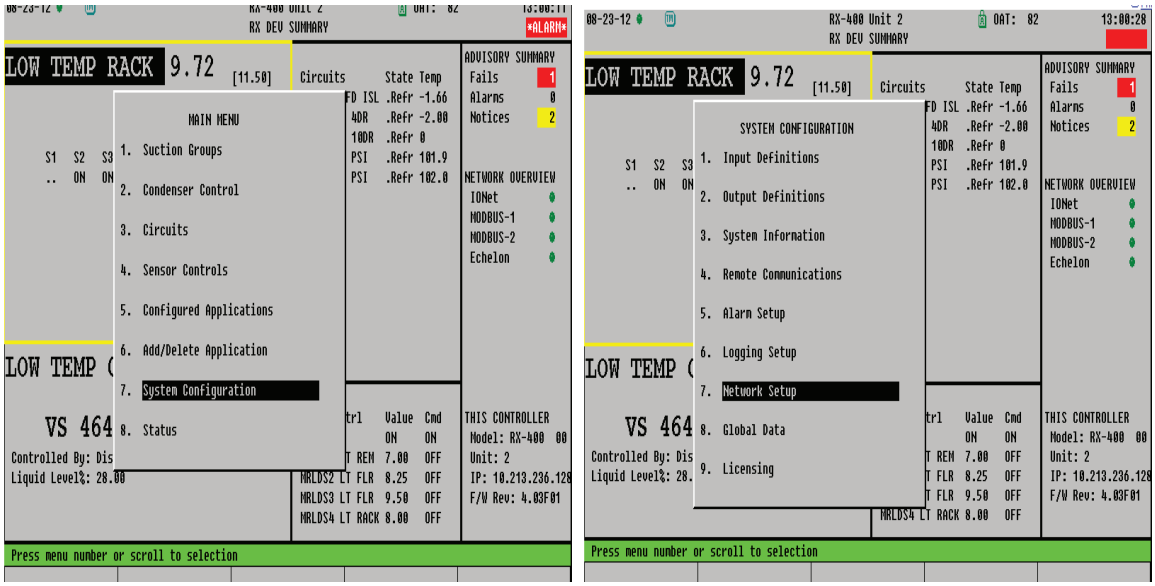
12. Once All The Devices Are Addressed, Press  ***To Save Changes And Exit The Network Summary.***



13. Press 

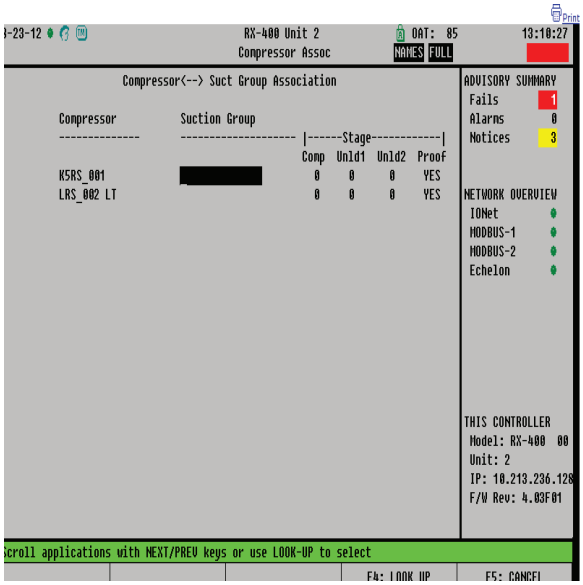
to Enter the Main Menu. Select 7. System Configuration.

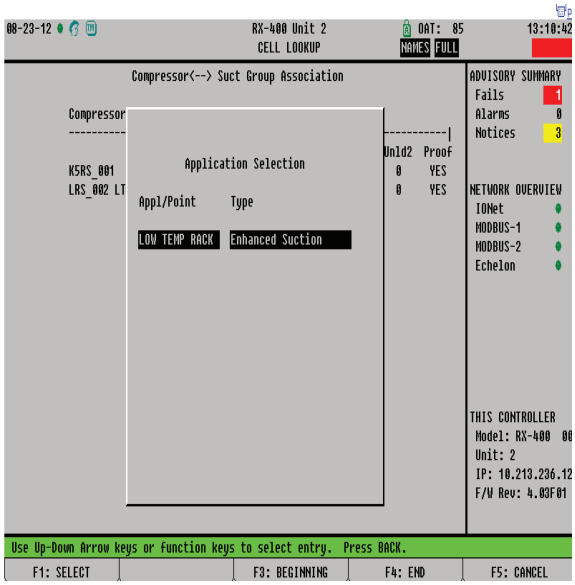
14. From the System Configuration Menu Select 7. Network Setup



15. From the Network Setup Menu, Select 4. Controller Associations . Then Select 4. Compressor (Press Enter)

16. Highlight The Suction Group2 Field Select F4: Look Up (Press F4) And Select The Appropriate Suction Group For The Device And Press Enter.

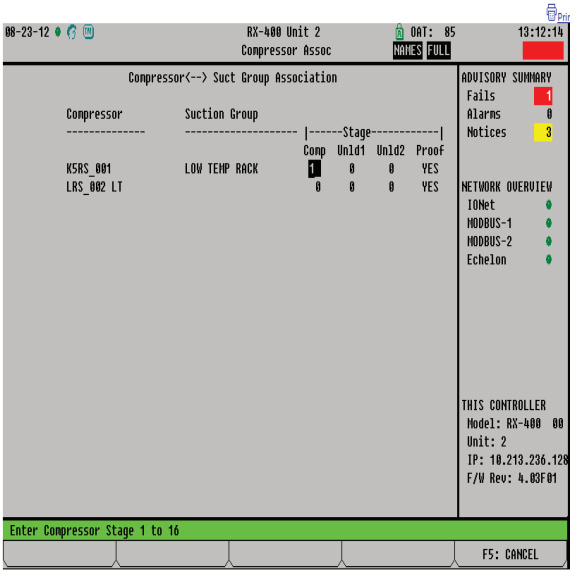




2 For More Information On Setting Up Suction Groups In The E2 Consult Your Emerson Retail Solutions Representative

17. Scroll Over To The Comp Stage And Type In The Compressor Stage. (CoreSense Protection Provides Proofing Only On The Compressor)

Note! The Compressor Stage Number Should Correspond To The Stage Numbers in the Suction Group Setup (Step 7)



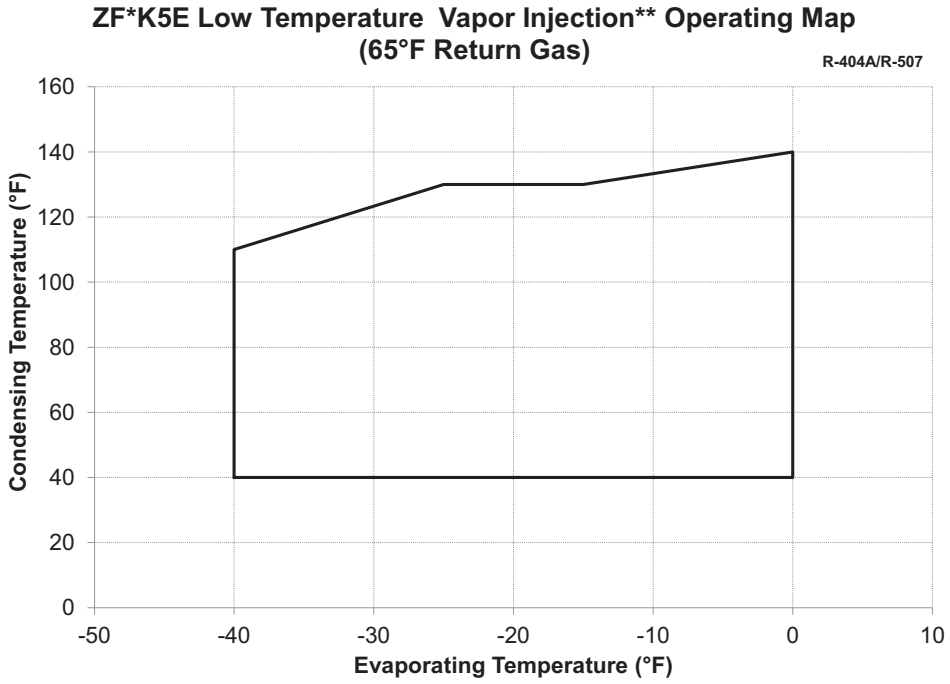


Figure 1A

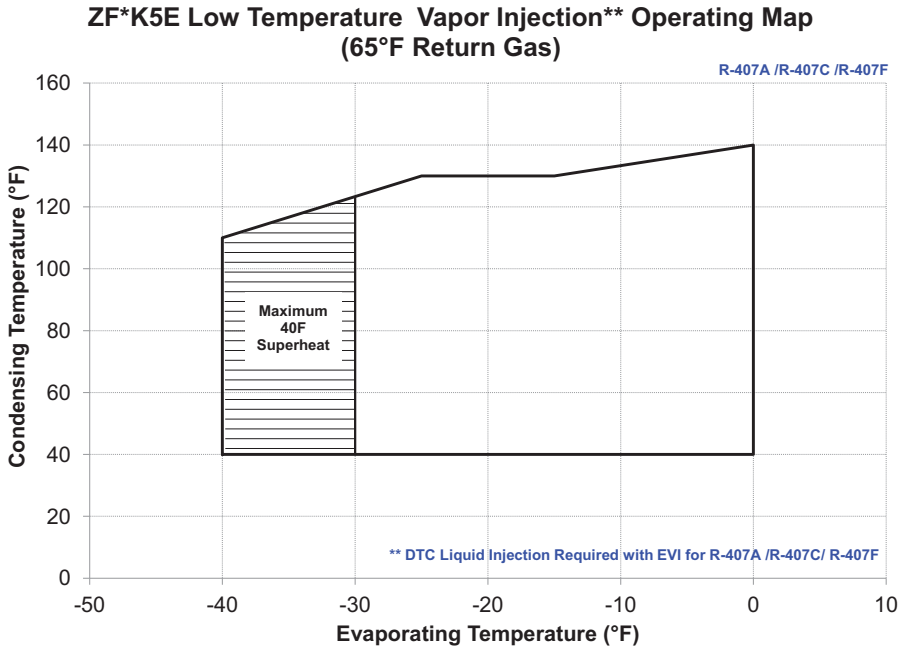


Figure 1B

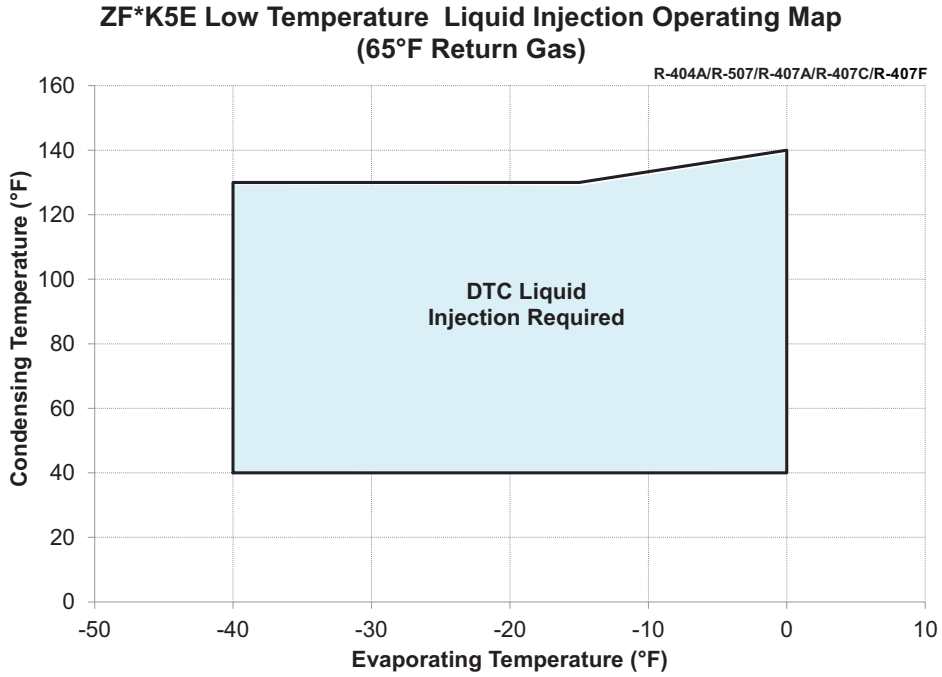


Figure 1C

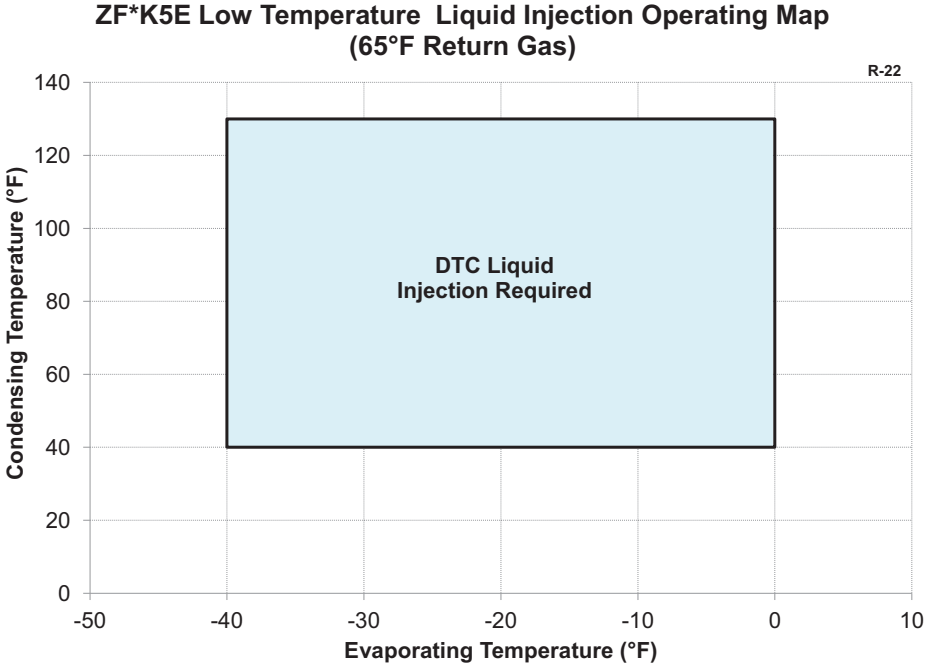


Figure 1D

ZB*K5E Medium Temperature Operating Map
(65°F Return Gas)

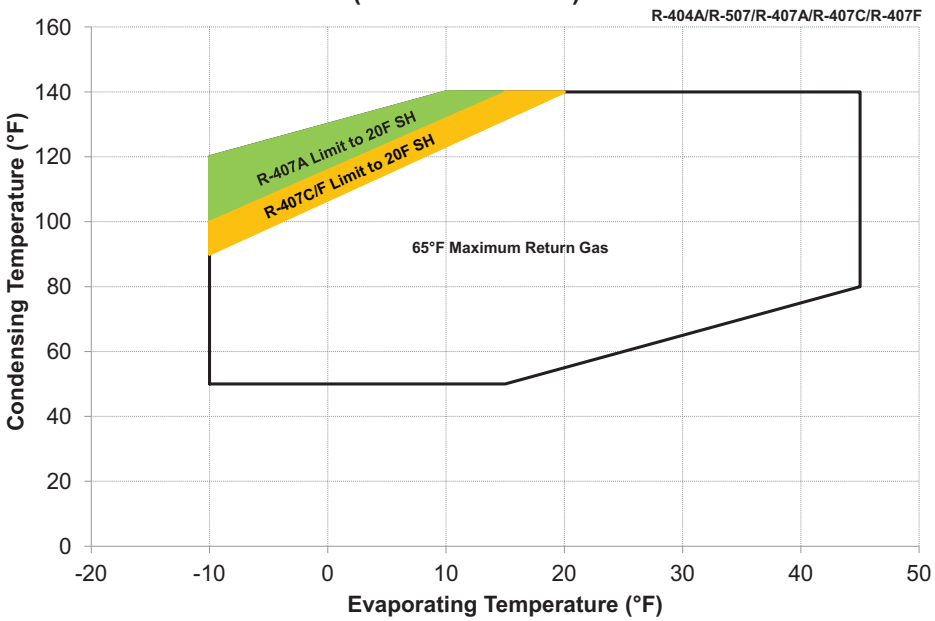


Figure 1E

ZB*K5E Medium/High Temperature Operating Map
(65°F Return Gas)

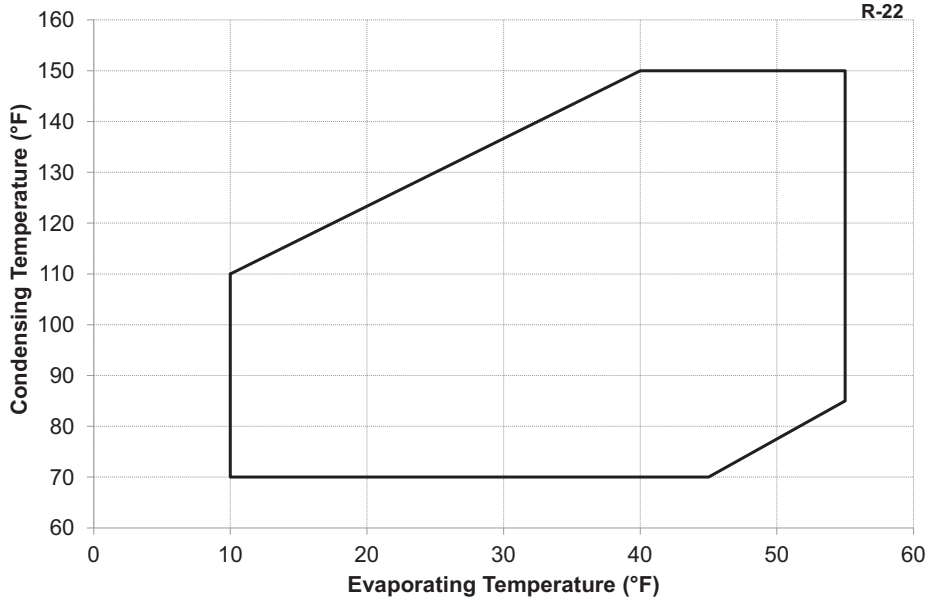


Figure 1F

Note: For operating maps at different return gas conditions, contact your Application Engineer.

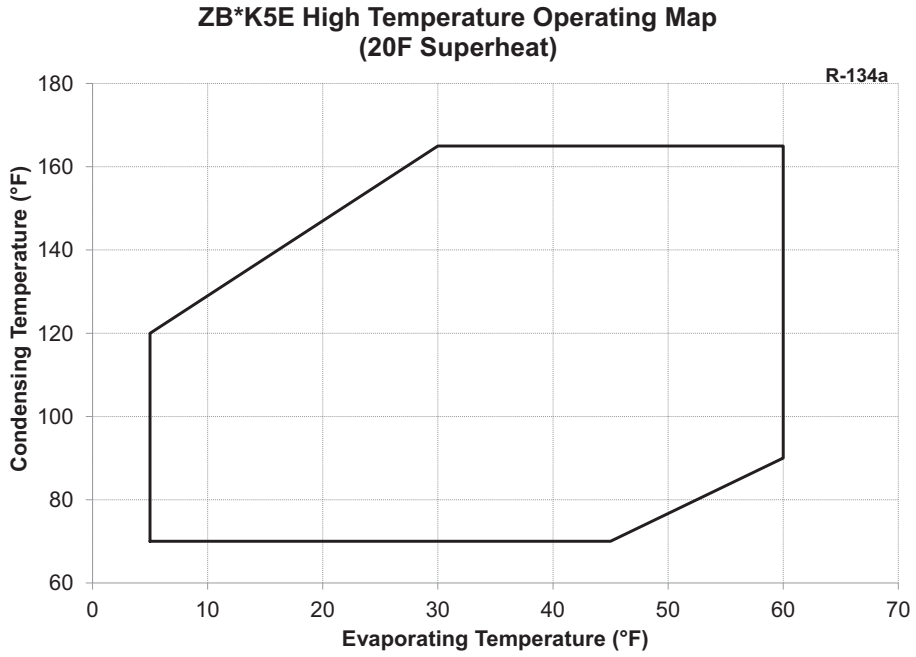


Figure 1G

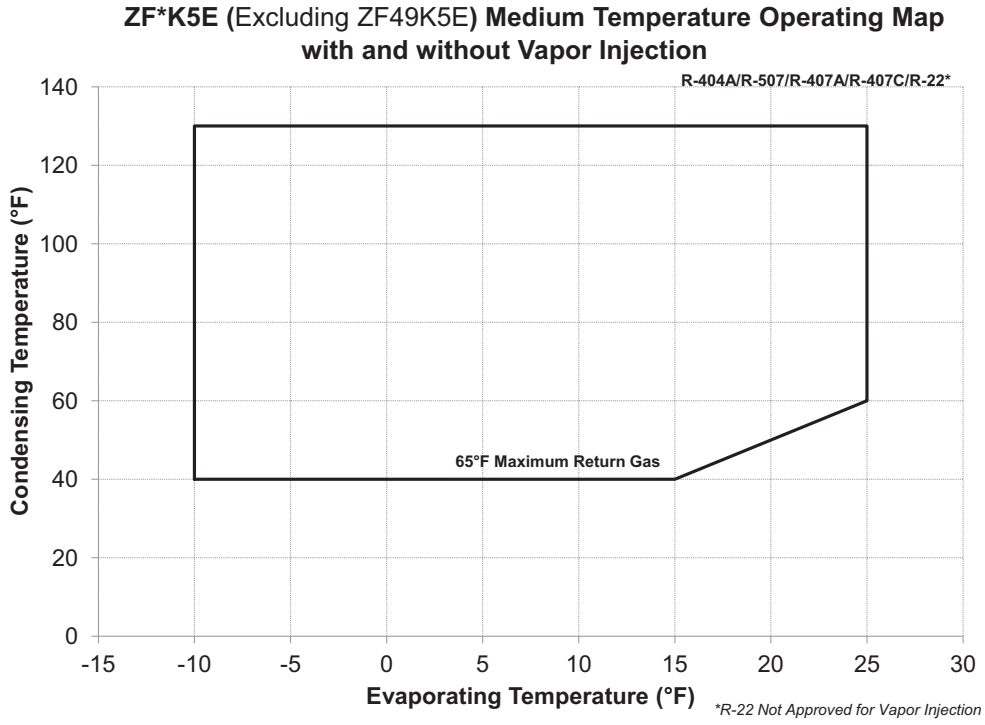


Figure 1H

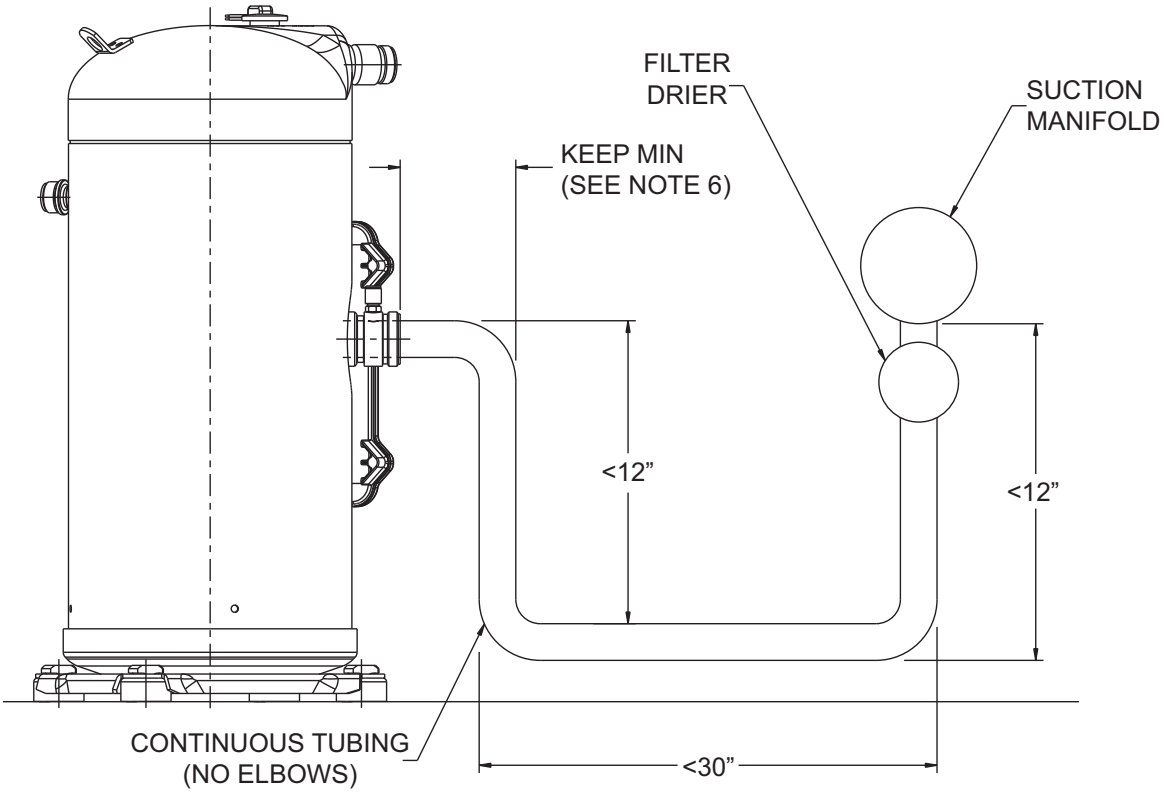


Figure 2A
Typical Suction Tubing

Notes:

(1) The above tubing configurations are guidelines to minimize tube stress.

(2) Follow similar guidelines for discharge tubing and oil return tubing as needed.

(3) If a run over 30” is required, intermediate clamps may be necessary.

(4) Do not hang weights on tubing (e.g. filter drier on suction tubing) except after clamps or close to the header.

(5) This dimension should be made as short as possible but still insuring a proper braze joint.

(6) The above tubing recommendations are based on “no elbow joints”. The use of continuous tubing is preferred.

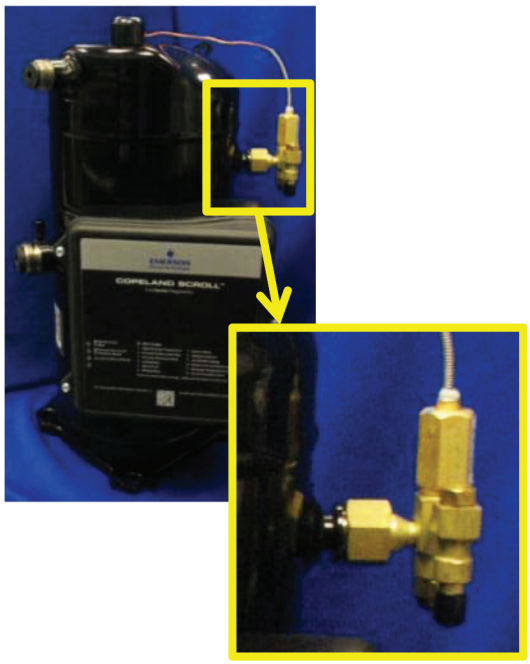


Figure 2B
Liquid Injection Scroll with DTC Valve

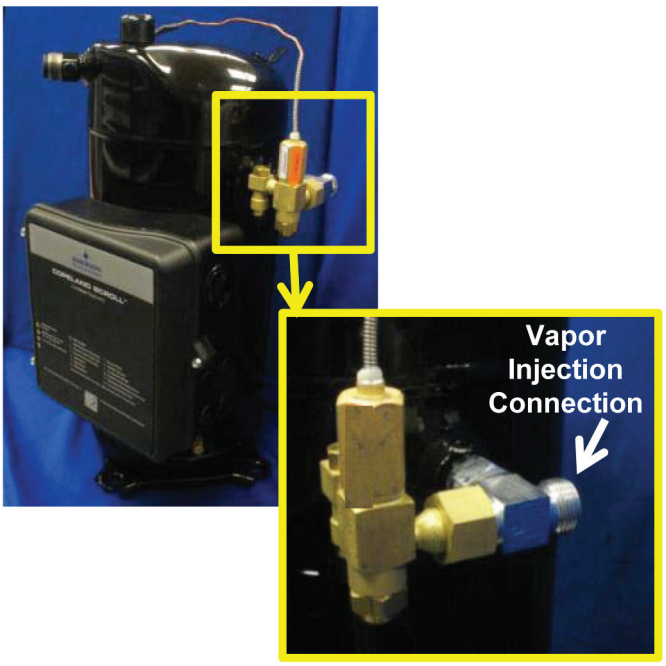


Figure 2C
EVI Scroll with DTC and T-fitting Adapter

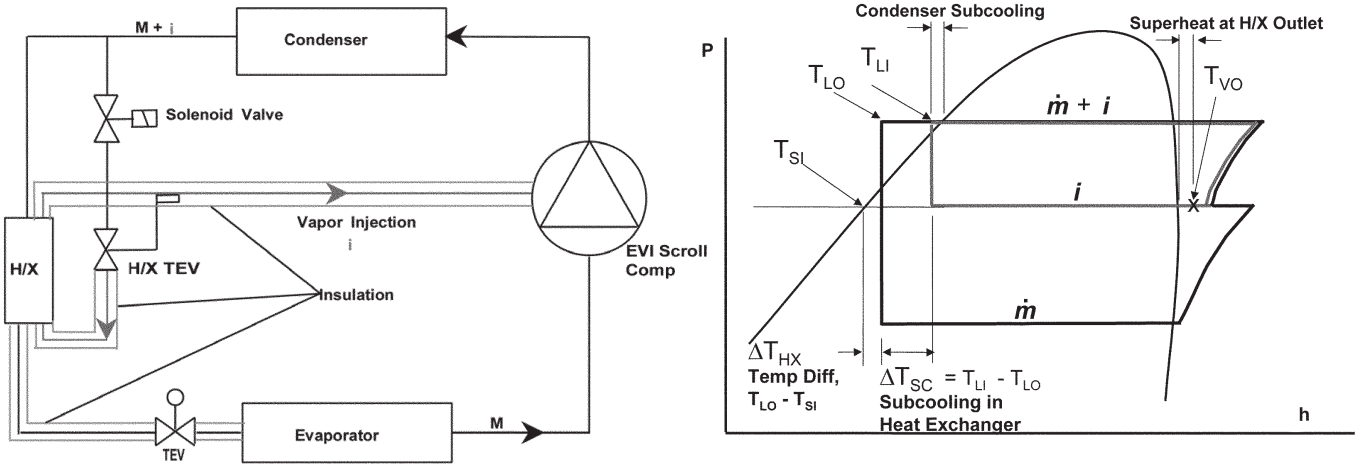


Figure 3 – Circuit Diagram and Cycle for EVI

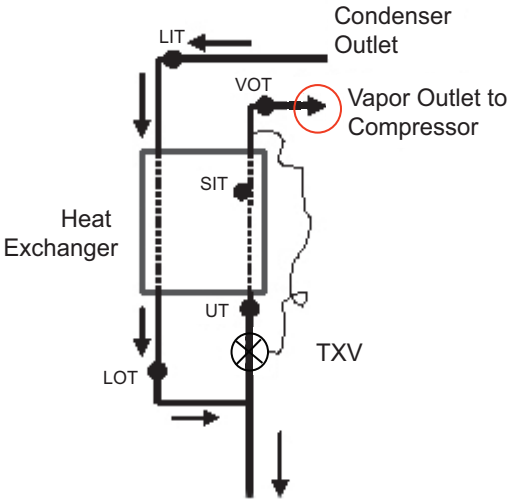


Figure 4 – Downstream Extraction

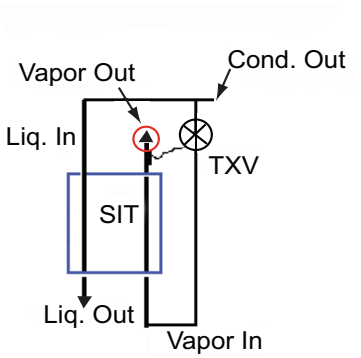


Figure 5 – Upstream Extraction

VO = Vapor temperature leaving H/X
VI = Vapor temperature entering H/X
LI = Liquid temperature entering H/X
LO = Subcooled liquid leaving H/X

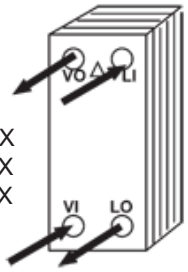


Figure 6 – H/X Piping Arrangement

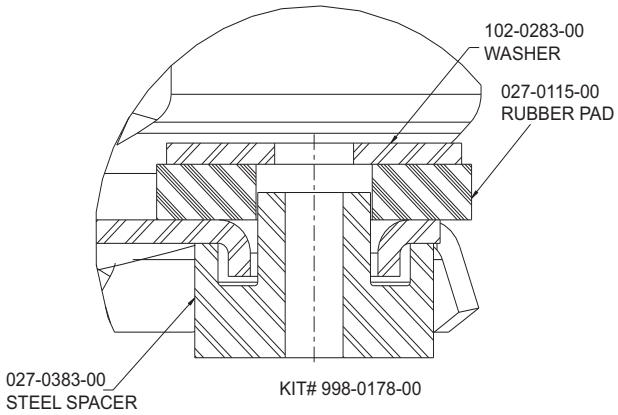


Figure 7A
8 - 15 HP Copeland Scroll Compressor Rack Mounting

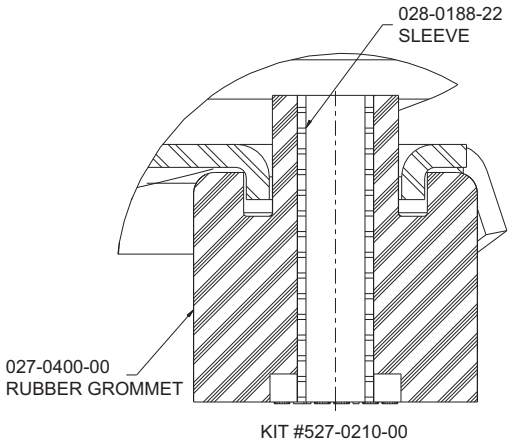


Figure 7B
8 - 15 HP Condensing Unit Mounting

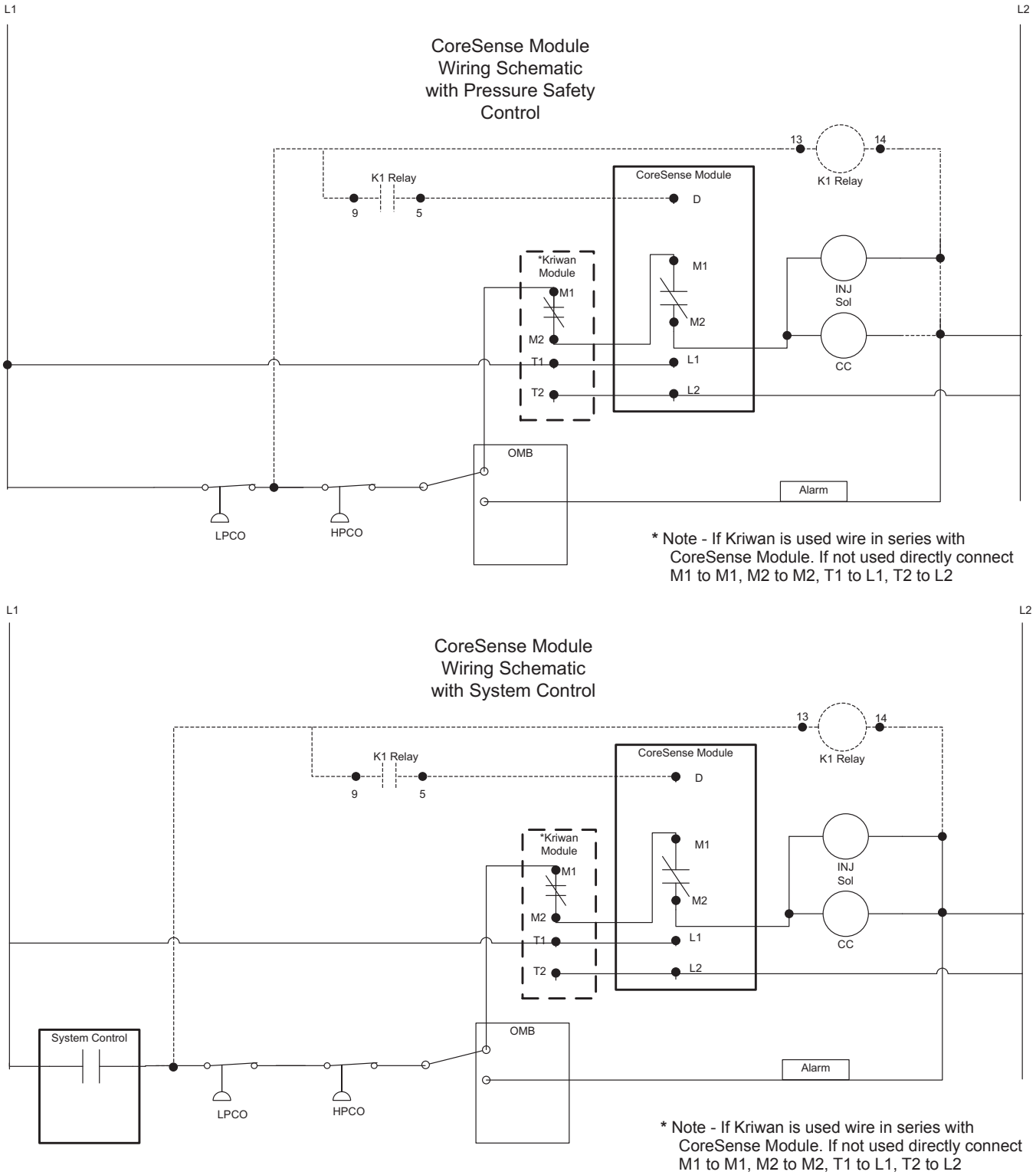


Figure 8 – Wiring Schematic with Pressure Safety Control or System Control

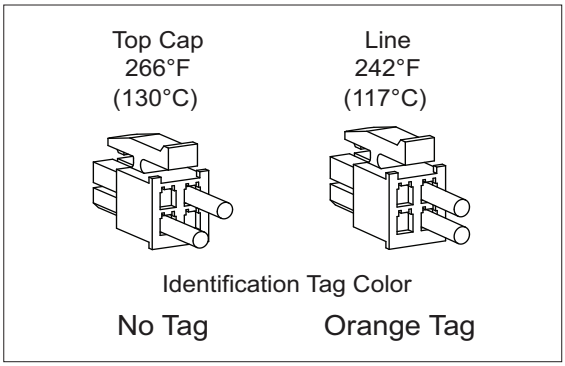


**Figure 9 – Discharge Thermistor Connector (Viewed from Wire Side)
Nominal Shutdown Temperature**

Figure 10 – Top Cap Thermistor

The top cap thermistor should be installed with di-electric grease applied on the probe. When attaching the probe to the compressor, a high temperature silicone type sealant should be used not only to adhere the probe to the compressor, but to also prevent any moisture from entering the thermal well.

Figure 11 – Discharge Line Thermistor

The discharge line thermistor should be attached to the discharge about 6 inches from the discharge of the compressor.

Note! Although not depicted in this figure, the thermistor should be well insulated to ensure accurate temperature sensing.

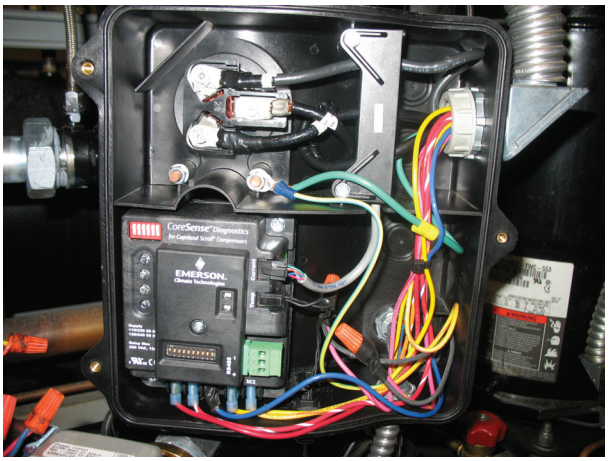


Photo of Actual Box

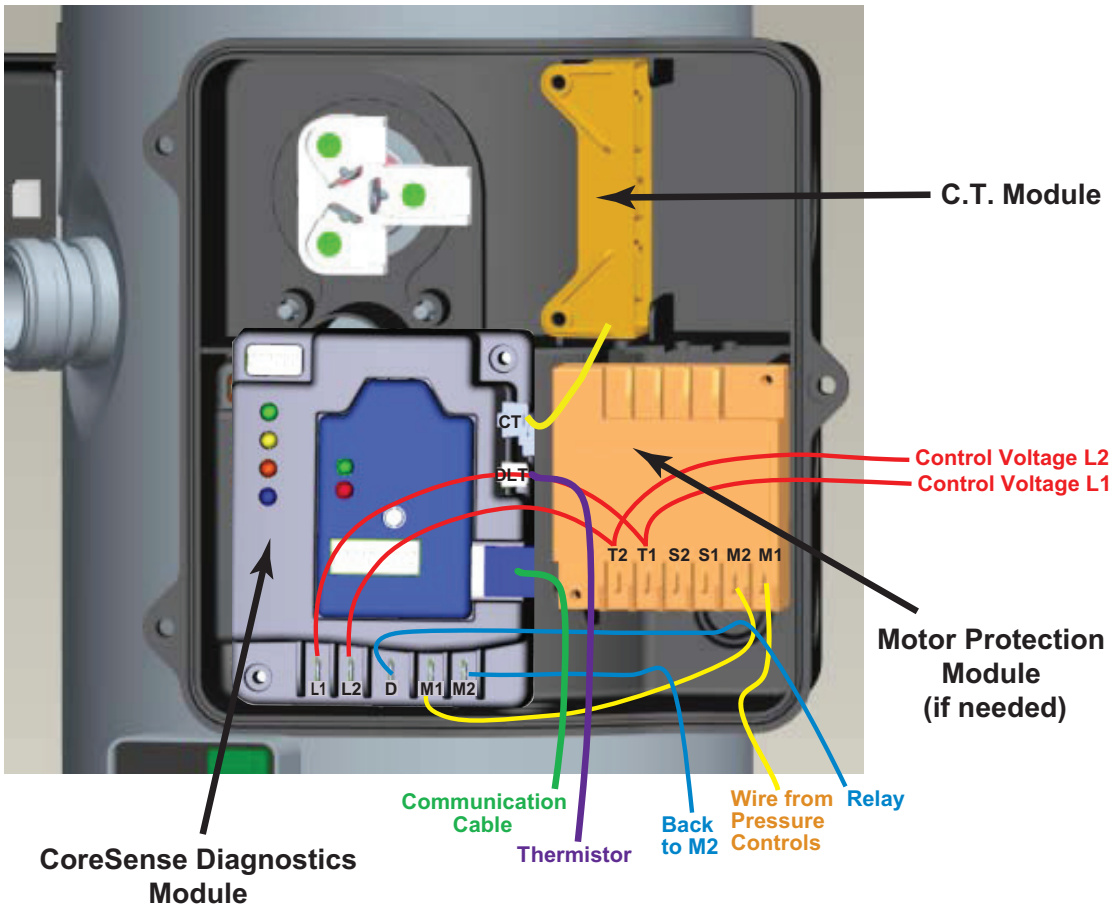


Figure 12
CoreSense Terminal Box

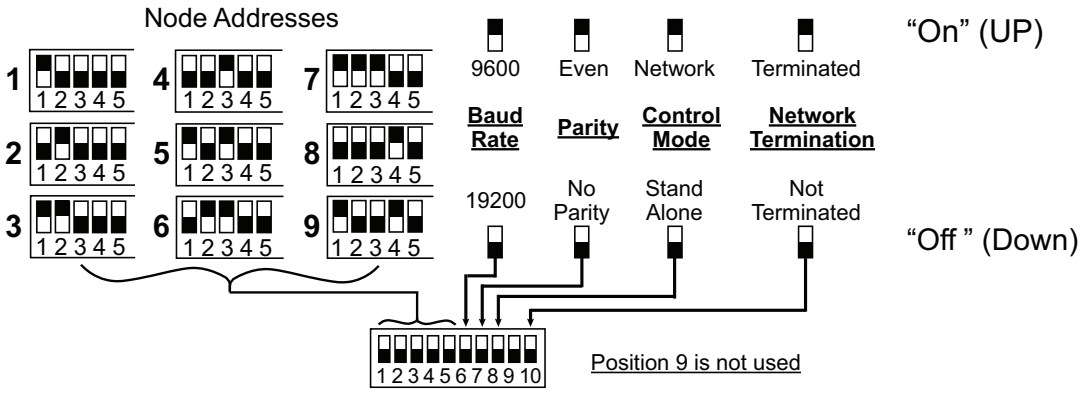


Figure 13 – K5 Communication Module DIP Switch Settings

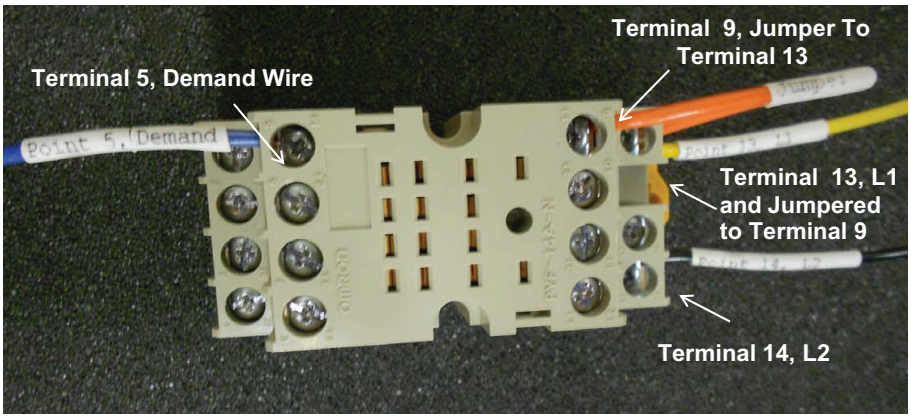


Figure 14 – Wiring Relay Example

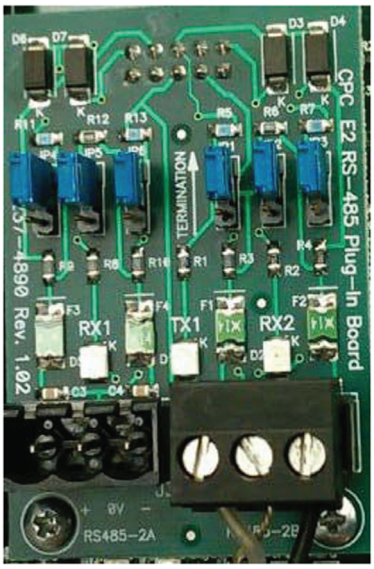


Figure 15 – E2 Jumpers

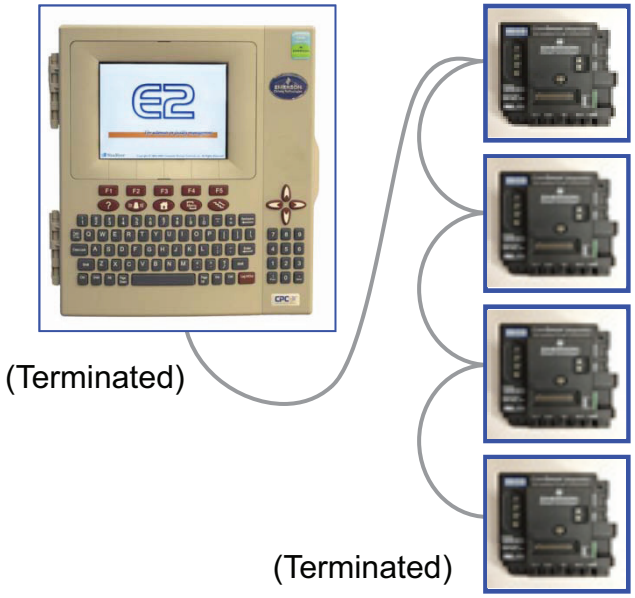


Figure 16 – RS485 Daisy Chain Connection

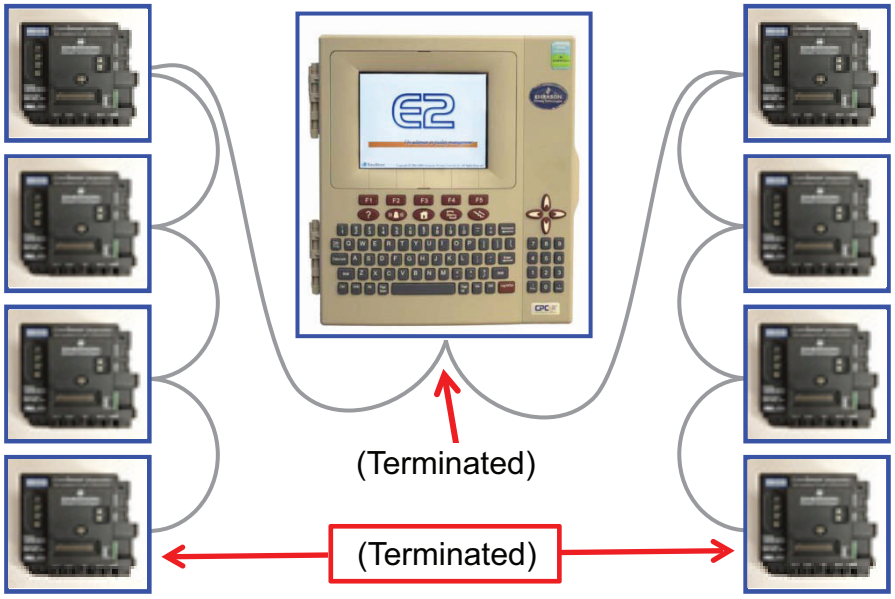


Figure 17 – Two Rack Daisy Chain Connection

Table 1
Injection Accessories

Application	Injection	Refrigerants	Required Kits	Reference Figure
ZB (Medium Temp)	N/A	All	Top Cap Thermistor is Factory Installed (no kits required)	See **Figure 10**
ZF (Low Temp)	Vapor Injection	404A/507	998-0229-00: Top Cap Thermistor Kit *Top Cap Thermistor is factory installed on -260 BOM	See **Figure 10**
		407A/C	998-0500-03: 250°F DTC Kit Including Temperature Probe 998-0177-00: DTC Vapor Injection Adapter	See **Figure 2C**
	Liquid Injection	All	998-0500-03: 250°F DTC Kit Including Temperature Probe	See **Figure 2B**

Table 2
External Wrap-Around Crankcase Heaters

Crankcase Heater Kit P/N	Crankcase Heater P/N	Volts	Watts	Lead Length (in)	Ground Wire Length (in)	Conduit Ready Box for Crankcase Heater
918-0047-00	018-0091-00	120	90	48	48	998-7029-00
918-0047-01	018-0091-01	240	90	48	48	
918-0047-02	018-0091-02	480	90	48	48	
918-0047-03	018-0091-03	575	90	48	48	

Table 3
Kriwan INT69 Module Specifications

Emerson P/N	071-0660-00
Emerson Kit P/N	971-0641-00
Manufacture P/N	Kriwan 22 A 601
T1-T2 Module Power	
Voltage Supply	120/240V
Frequency	50/60 Hz
M1-M2 Module Output Contacts	
Maximum Voltage	264 VAC
Maximum Current	2.5 Amps
Minimum Current	100 milliamps
S1-S2 Thermal Protection	
Trip Out Resistance	4500 ±20%
Reset Resistance	2750 ±20%
Reset Time	30 min ±5 min.
Manual Reset	T1-T2 interrupt for minimum of 5 sec.

Table 4
K5 Compressor for Refrigeration Additional Accessories

Accessory	Part Description	P/N
Mounting Parts	55-65 Durometer Mounting Parts Kit (for single compressor applications)	527-0210-00
	Hard Mounting Parts Kit (for parallel rack applictions)	998-0178-00
Service Valve Kits	Suction and Discharge Service Valves with Seals	998-5100-27
	Suction Rotalock Service Valve with Seal - 1 3/8 Stub Tube	998-0510-46
	Discharge Rotalock Service Valve with Seal - 7/8 Stub Tube	998-0510-39
Rotalock to Stub Tube Adapter Kits	Discharge Rotalock to Stub (1 1/4 12 Thread to 7/8 Sweat)	998-0034-08
	Suction Rotalock to Stub (1 3/4 12 Thread to 1 3/8 Sweat)	998-0034-13
	1 14 Thread to 1/2 Sweat	998-0034-18
Stub Tube to Rotalock Connection Adapter	Discharge Stub Tube to Rotalock (7/8 Sweat to 1 1/4 12 Thread)	998-0034-02
	Suction Stub Tube to Rotalock (1 3/8 Sweat to 1 3/4 12 Thread)	998-0034-04
Motor Protection	External Motor Protection Module (for ZB95K5E-TWC & ZB114K5E-TWC)	971-0641-00
Oil Monitoring OMB (Emerson Flow Controls P/Ns)	Oil Management Control w/ Junction Box 24V 50/60Hz	065365
	Oil Management Control w/ Series Relief Connector 24V 50/60Hz	065366
	Copeland Scroll Adapter for Large Refrigeration Scroll	066077
CoreSense Diagnostics	CoreSense Module	943-0151-00
	CoreSense Current Sensor Module	943-0159-00
	Thermistor Kit (includes top cap, and two DLT themistors)	998-0176-00
	Top Cap Thermistor Kit (Top Cap Thermistor ONLY)	998-0229-00

Table 5
K5 Compressor for Refrigeration (8 to 15 HP) Fitting Sizes

Fitting	Size (in.) -Thread
Suction Rotalock Connection	1 3/4"-12
Discharge Rotalock Connection	1 1/4"-12
Liquid/Vapor Injection Rotalock Connection	1"-14

Table 6
High and Low Pressure Control Settings

Model	Control Type	R-404A / 507	R-134A	R-22 / R-407A / R-407C/R-407F
ZF* K5E	Low High	0 psig min. 400 psig max	---	2 in. Hg Min. 335 psig Max
ZB*K5E	Low High	17 psig min. 450 psig max	4 psig min. 263 psig max	37 psig min. 381 psig max

Table 7
CoreSense™ Diagnostics Fault Codes

Fault Code	Code Description	Protection Shutdown (Default)	Protection Off Time (Default)	Consecutive Detections Until Lockout
Lockout Feature is NOT enabled from the factory except on code 7				
1	High Discharge Temp See Diagram For Setting	Yes	20 Min.	4
2	Excess System Limit Trips - 4 Consecutive System Limit Trips Having 1-15 Min Runtime Each	Yes	5 Min.	No Lockout
3	Excessive Demand Cycling - Default is 240 Cycles Per 24 Hr Period	No	-	-
4	Locked Rotor - Compressor Did Not Start Within Alloted Time	Yes	20 Min.	4
5	Demand Present - No Current Detected Over 4 Hr Period	No	-	-
6	Phase Loss Detected	Yes	20 Min.	10
7	Reversed Phase Detected	Yes	Until Module Is Reset	1
8	Welded Contactor - Current Detected Without Demand	No[1]	-	-
9	Low Module Voltage	Yes	5 Min.	No Lockout
10	Module Communications Error	No	-	-
11	Discharge Temperature Sensor Error	No	-	-
12	Current Transducer Error	No	-	-
Lockouts Can Be Enabled By Dip Switch 6 Setting				
[1] Code 8 Displays For 24 Hr After Last Detection The M1-M2 relay only opens during a protection shutdown. To reset module, cycle module power.				

Table 8
CoreSense™ Diagnostics Module Troubleshooting

Status LED	Status LED Description	Status LED Troubleshooting Information
Green Alert LED Solid	Module has power	Supply voltage is present at module terminals
Green Alert LED 3 Flashes	Short Cycling 2 to 480 run cycles in 24hours ending with normal Alert Default is set to 240 per 24 hours	1. Check pressure or temperature control 2. Possible loss of refrigerant 3. Blocked Condenser
Green Alert LED 5 Flashes	Open Circuit Demand signal is present but no compressor current for four hours	1. Compressor circuit breaker or fuse(s) is open 2. Compressor contactor has failed open 3. High pressure switch is open and requires manual reset 4. Open circuit in compressor supply wiring or connections 5. Long compressor protector reset time due to high ambient temperature 6. Compressor windings are damaged
Green Alert LED 8 Flashes	Welded Contactor No demand signal, but current has been detected in one or both phases Displayed for 24 hrs after last detection	1. Contactor welded closed 2. Control circuit transformer is overloaded 3. Thermostat demand signal not connected to module 4. Verify Wiring
Green Alert LED 10 Flashes	Loss of Communication Communication lost between rack controller and module for 10 minutes or more	1. Check communications wiring 2. Verify wiring follows application guidelines
Green Alert LED 11 Flashes	Discharge Temperature Sensor Error Short or Open Circuit Detected	1. Check discharge temperature sensor wiring and mounting 2. Verify sensor is not shorted. 86k @ 77°F
Green Alert LED 12 Flashes	Current Transducer (CT) Error	1. Verify CT is plugged into module 2. Verify CT is not shorted
Yellow Alert LED Solid	Trip Demand present, no current is detected	1. Compressor protector is open - Check for high head pressure - Check compressor supply voltage 2. Compressor circuit breaker or fuse(s) is open 3. Broken wire or connector is not making contact 4. Safety cutout switches open (HPCO, LPCO, OMB, etc.) 5. Compressor contactor has failed open
Yellow Alert LED 1 Flash	High Discharge Line Temperature Trip See inside label to determine cut out temp.	1. Possible loss of refrigerant charge 2. Blocked condenser 3. Verify that discharge valve is open 4. On low temperature scroll compressors check liquid injection
Yellow Alert LED 2 Flashes	System Trip Four consecutive compressor trips after run time of 1-15 minutes each	1. Excessive suction pressure or discharge pressure 2. Improper wiring

CoreSense™ Diagnostics Module Troubleshooting (Continued)

Status LED	Status LED Description	Status LED Troubleshooting Information
Yellow Alert LED 4 Flashes	Locked Rotor Compressor is drawing current without rotating or four consecutive compressor trips after run time of 1-15 seconds	1. Low line voltage (contact utility if voltage at disconnect is low) 2. Verify presence of all legs of power line 3. Excessive liquid refrigerant in compressor 4. Compressor bearings are seized 5. Verify operating current
Yellow Alert LED 6 Flashes	Missing Phase Demand signal is present but current is missing in one phase	1. Improper wiring. Correct order of phases in wires 2. Failed contactor. Check contacts for pitting 3. Compressor current could be too low. Refer to specifications. 4. Verify presence of all legs of power line
Yellow Alert LED 9 Flashes	Low Voltage Detected Control voltage dips below 85V for 110V or 170V for 220V	1. Low line voltage (contact utility if voltage at disconnect is low) 2. Check wiring connections
Red Alert LED 1 Flash	LOCKED OUT ON: High Discharge Line Temperature Trip See inside label to determine cut out temp.	1. Possible loss of refrigerant charge 2. Blocked condenser 3. Verify that discharge valve is open 4. On low temperature scroll compressors check liquid injection
Red Alert LED 4 Flashes	LOCKED OUT ON: 4 Consecutive Locked Rotors Detected Compressor is drawing current without rotating or four consecutive compressor trips after run time of 1-15 seconds	1. Low line voltage (contact utility if voltage at disconnect is low) 2. Verify presence of all legs of power line 3. Excessive liquid refrigerant in compressor 4. Compressor bearings are seized 5. Verify operating current
Red Alert LED 6 Flashes	LOCKED OUT ON: 10 Missing Phase Detections Demand signal is present but current is missing in one phase	1. Improper wiring. Correct order of phases in wires. 2. Failed contactor. Check contacts for pitting. 3. Compressor current could be too low. Refer to specifications. 4. Verify presence of all legs of power line
Red Alert LED 7 Flashes	LOCKED OUT ON: 1 Reverse Phase Detected Demand signal is present but current is not detected in the correct sequence	1. Improper wiring. Correct order of phases in wires. 2. Compressor current could be too low. Refer to specifications. 3. Verify presence of all legs of power line

Table 9 – Demand Wiring

Demand Wiring Kit (998-0188-00)		
Item	Control Voltage	
	110/120	220/240
Relay Socket	032-0766-00	
Relay	040-1086-00	040-0187-00

Table 10 – K5 Dip Switch Settings

Dip Switch Number	On	Off
1 Through 5	MODBUS Module Address	
6	Baud Rate= 9600	Baud Rate= 19,200
7	Even Parity	No Parity
8	Network	Stand Alone
9	Not Used	
10	Terminated	Not Terminated