EMERSON Climate Technologies

Application Engineering

Copeland brand products

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CoreSense™ Diagnostics for Copeland Scroll™ Air Conditioning Compressors

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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** • 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. • Failure to follow these warnings could result in serious personal injury.
WARNING	**PRESSURIZED SYSTEM HAZARD** • 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. • Failure to follow these warnings could result in serious personal injury.
WARNING	**BURN HAZARD** • 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. • Failure to follow these warnings could result in serious personal injury or property damage.
CAUTION	**COMPRESSOR HANDLING** • Use the appropriate lifting devices to move compressors. • Personal safety equipment must be used. • Failure to follow these warnings could result in personal injury or property damage.

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

CoreSense™ Diagnostics is a breakthrough innovation for troubleshooting residential air-conditioning and heat pump systems. The CoreSense Diagnostics module is easily installed in the unit electrical panel near the compressor contactor. By using the compressor as a sensor, CoreSense Diagnostics helps the service technician more accurately troubleshoot system and compressor fault conditions.

CoreSense Diagnostics also provides compressor and system protection through its proprietary lockout feature. Depending on the severity and frequency of the fault that caused the trip condition, the CoreSense Diagnostics module can lockout the compressor contactor to prevent damage to the compressor and system components. Less severe fault conditions resulting in an occasional trip will not result in a lockout condition.

Flashing LEDs communicate **ALERT** and **LOCK** codes to the service technician.

CoreSense Diagnostics Part Numbers

Version	OEM Part Number	Service P/N
Two Wire AC:	571-0066-00	971-0066-00
Three Wire HP:	571-0067-00	971-0067-00

Application Restrictions and Types

The CoreSense Diagnostics module is designed and qualified for use with ZP*K5 and ZR*K5 single-phase Copeland Scroll™ fixed speed compressors. CoreSense Diagnostics is not designed for use with Copeland Scroll Variable Speed or Ultratech™ branded scroll compressors.

The CoreSense Diagnostics module is available in two-wire and three-wire configurations. The two-wire module (571-0066-00) uses the demand signal (Y) to power the module. The two-wire module is used primarily in split system cooling applications where 24 volts may not be available at the outdoor unit to power the module. The three-wire module (571-0067-00) is powered continuously by (R) and (C) and is ideal for all packaged unit applications, and for split systems applications where (R) and (C) are available at the outdoor unit. See **Figures 1** and **2**.

Product Specifications

Operating Temp: - 40° to 150°F (- 40° to 65°C)
Storage Temp: - 60° to 175°F (- 49° to 80°C)
Supply Voltage: 19 to 28VAC , 48 to 62Hz
Working amperage for module: 2 to 30A
Maximum Power Consumption: 1.5 VA

Installation

Two #8 or #10 self tapping or sheet metal screws are required for installation of the module. The maximum mounting screw torque is 20 in.lbs. The module can be mounted in any orientation and LEDs should be visible for ease of service.

The COMMON lead wire for the compressor must be routed through the current sensing hollow opening at the top of the module.

NOTICE

The top cover of the module is not designed to be removed.

The current sensor is capable of measuring a minimum of 2 amps. **If the compressor current is less than 2 amps during normal operation, then loop the compressor COMMON lead wire through the current sensing port two times.**

CAUTION

The terminals of the module are in close proximity to each other and care must be used to prevent terminal to terminal shorting. Shorting the terminals may destroy the module and/or the transformer used to power the module.

For module dimensions and terminal identification, refer to **Figure 4**.

Terminal Description

The terminals for the CoreSense Diagnostics module are ¼" spade terminals.

- COMMON (C)
  The 24 volt common terminal for module power.
- DEMAND (Y)
  The demand terminal requires a 24VAC signal measured with respect to the COMMON (C) terminal when there is a call for heating or cooling.
- PROTECTION (PROT)
  The protection terminal is internally wired to the COMMON terminal through a normally closed set of contacts.
- POWER (R)
  This terminal is only on the 571-0067-00 three-wire version. The module requires a constant 24VAC supply power to this terminal.

Compressor Protection

The CoreSense Diagnostics module utilizes proprietary algorithms to protect the compressor and system from repeated trips of system pressure controls and the compressor internal overload. The protection terminal of the module should be wired in series with the system low pressure and high pressure cutouts, as well as the compressor contactor. When the module detects a series of trips as described below, it will activate a lockout feature that opens the normally closed protection contacts in the module, thereby cutting power to the contactor and shutting off the compressor.

Module LED Description

RUN/ALERT LED (Yellow)

A solid yellow LED indicates the module is powered and the compressor/system is running normally. Abnormal system conditions are indicated through a unique yellow flash code. The Yellow RUN/ALERT LED will flash consecutively, pause and then repeat when adverse conditions are detected within the compressor or system. The number of consecutive flashes, defined as the flash code, correlate to a particular abnormal condition. See **Tables 1** and **2**.

TRIP/LOCK LED (Red)

A solid red LED indicates the compressor is in a TRIP state where the module detects the presence of a demand signal from the thermostat, however no current to the compressor is detected by the module. A compressor trip typically indicates the compressor's internal overload is open or may indicate missing supply power to the compressor. The Red TRIP/LOCK LED will flash consecutively, pause and then repeat when the compressor lockout feature is active. The number of consecutive flashes, defined as the flash code, correlate to a particular lock condition. See **Table 2**. **(Note: The Yellow Run/Alert LED will be turned off)**

Module Operation/Code Description

The following is a description of the protection coding of the CoreSense Diagnostics module:

Code 1 - **Long Run Time**

The module will flash yellow one time when the compressor operates for longer than 18 continuous hours. This is an alert code only, and the module will not lockout the compressor for this condition.

Code 2 - **Compressor (Pressure) Trips**

The module will flash yellow two times when the compressor operates from 12 seconds to 15 minutes followed by a trip condition lasting longer than seven minutes. When four consecutive Code 2 events are recorded, the module will lockout the compressor and flash red two times.

Code 3 - **Pressure Switch Cycling**

The module will flash yellow three times when the compressor operates from 12 seconds to 15 minutes followed by a trip condition lasting between 35 seconds to 7 minutes. When four consecutive Code 3 events are recorded, the module will lockout the compressor and flash red three times. A lockout will also occur in the case that 10 events have been recorded without resetting the alert.

Code 4 - **Locked Rotor Trips**

The module will flash yellow four times when the compressor trips within 12 seconds of operation, and does not reset and start within 35 seconds. When 10 consecutive Code 4 events are recorded the module will lockout the compressor and flash red four times.

Code 5 - **Compressor (Moderate Run) Trip**

The module will flash yellow five times when the compressor has operated between 15 minutes and 18 hours, followed by a compressor trip lasting longer than 7 minutes. When four consecutive Code 5 events are recorded, the module will lockout the compressor and flash red five times. A lockout will also occur if ten Code 5 events are recorded without resetting the alert (see **Resetting Alert Codes** below).

Code 9 - **Over-Current Protection**

When the current at the PROT terminal is greater than 2A for 40ms, the module will flash a Code 9. The red LED will flash 9 times with the yellow LED remaining off. This alert indicates that the module is mis-wired or the contactor coil is shorted to ground.

NOTICE

Code 9 is not specified on the module label.

Low Supply Voltage

If the 24 VAC supply voltage to the module drops below the required amount to power the processors, the processor will be continuously reset. Both LEDs may flicker, and the alerts on the module will be reset.

Resetting Alert Codes

When the CoreSense Diagnostics module has detected a series of adverse conditions that have caused it to

lockout the compressor, and after the issue has been resolved, it is necessary to manually reset the module in order to clear the present alert code.

The primary way of clearing the code and resetting the alert is to press the reset button located on the module. Note: Pressing the reset will require a pin or mini/electronics screwdriver. This button must be pressed and held for a minimum of one second for the module to be reset. Pressing the reset button clears the immediate lock code and the seven day operating history. It will not clear the permanent module history. In the case of the three-wire module, the codes can be reset or cleared by cycling power to the module. This can be done by disengaging the Common (C) terminal. This will not clear the seven day operating history.

Note: For the 571-0066-00 module, if a fault is present, it is expected that the thermostat demand will remain present and the module will stay powered and function similar to the 571-0067-00 module. If the thermostat demand cycles off, then the 571-0066-00 module will reset and alert will clear.

Module History Download

The CoreSense Diagnostics module is capable of communicating with a personal computer, tablet, or laptop, via Emerson Climate Technologies computer software interfaces (HVACR Fault Finder PC Edition) and USB connection (TTL-232R-5V-WE), in order to download and store fault history and module operation time. This information can be used to help diagnose and review data from troubled systems in the field. HVACR Fault Finder PC Edition kit (9989-0099-01) with software and cable. For more information, please contact your Emerson Climate Technologies Application Engineer.

Warranty Information

Emerson Climate Technologies, Inc. warrants its diagnostic module to be free from defects in materials and workmanship under normal use for a period of one year from the date of purchase or twenty months from manufacture, whichever comes first. During this period, Emerson Climate Technologies, Inc. will replace any defective diagnostic module without charge.

For more information on product warranty please visit EmersonClimate.com

Support

For more information visit EmersonClimate.com, or contact Emerson Climate Technologies, Inc. at 1-888-EMR-9950.

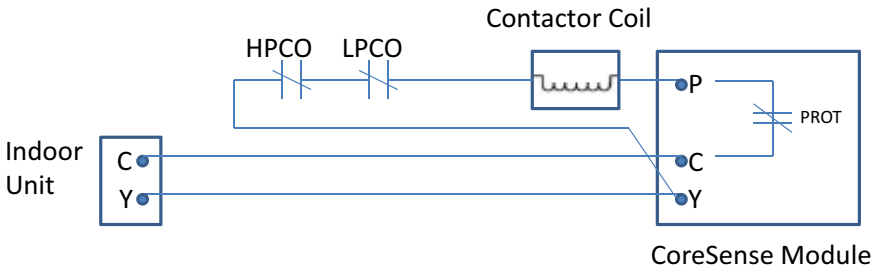

Figure 1
571-0066-00 Two-Wire Diagram

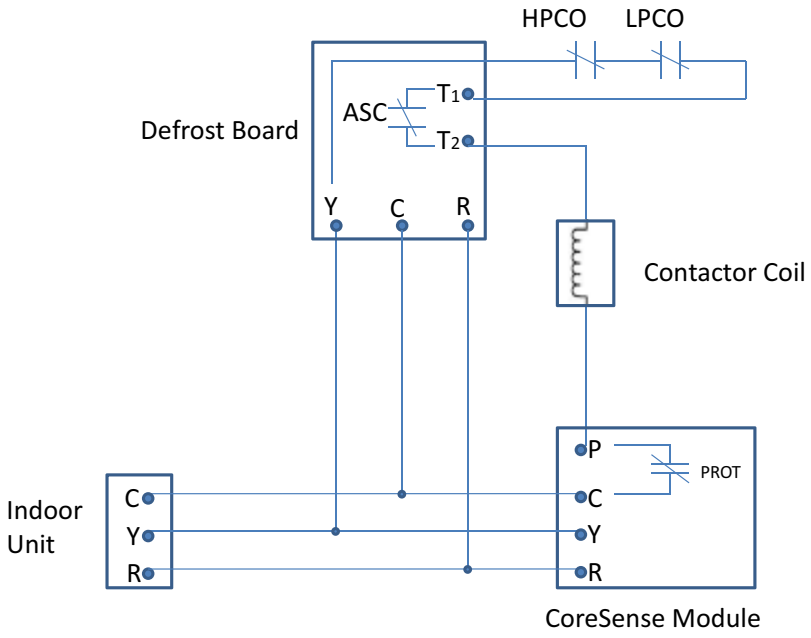

Figure 2
571-0067-00 Three-Wire Diagram

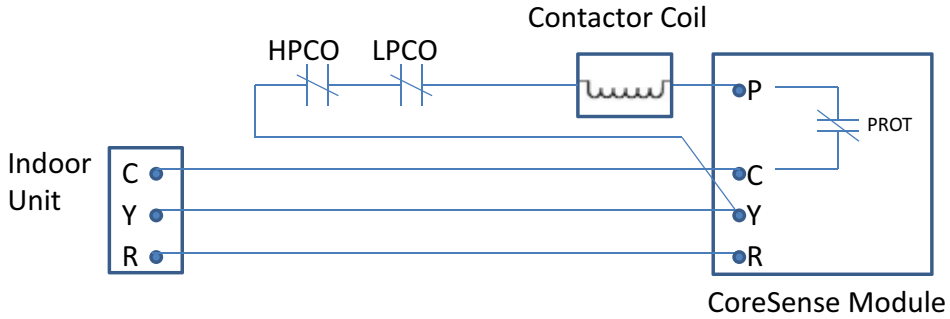

Figure 3
571-0067-00 Three-Wire Diagram

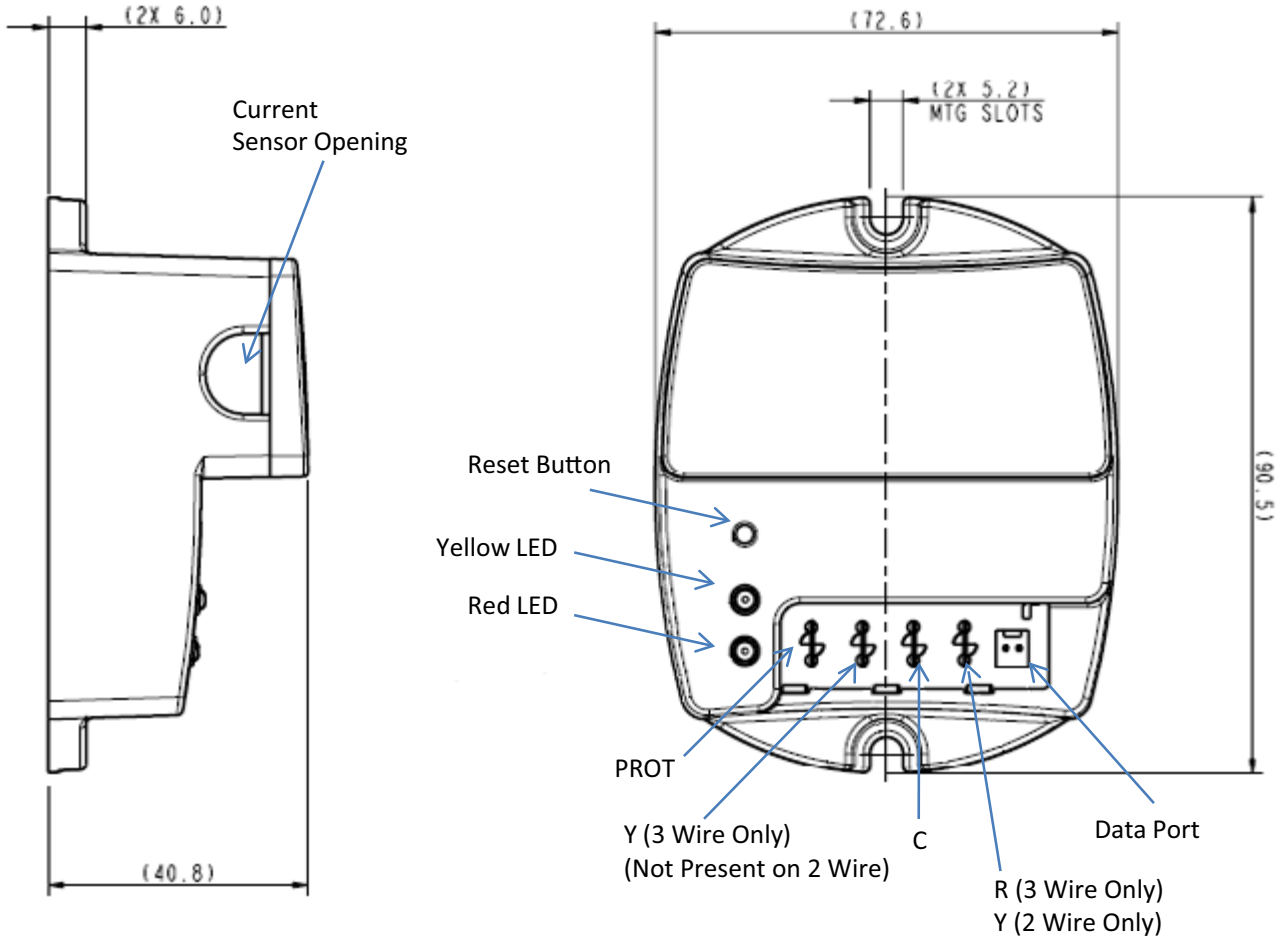

Figure 4
Dimensions are in Millimeters

Table 1 - Quick Reference Table

Alert Code	Alert Condition	Lock Level	Lock Indication
Normal Run Solid Yellow	Normal operation, no trip.	N/A	N/A
Code1 Yellow Flash 1	Long run time. Compressor is on running for more than 18 hours. (Code1 is disabled in Heat Pump mode.)	N/A	N/A
Code2 Yellow Flash 2	Compressor (pressure) trip. Compressor runs for 12 sec to 15 min followed by a compressor trip condition lasting longer than 7 min.	4x consecutive	Red: Flash 2 Yellow: Off
Code3 Yellow Flash 3	Pressure switch cycling. Compressor runs for 12 sec to 15 min followed by a compressor trip lasting between 35 sec to 7 min.	4x consecutive or 10x total	Red: Flash 3 Yellow: Off
Code4 Yellow Flash 4	Locked rotor. Compressor trips within a compressor run time of 12 sec and does not start within 35 sec.	10x consecutive	Red: Flash 4 Yellow: Off
Code5 Yellow Flash 5	Compressor (moderate run) trip. Compressor runs for 15 min to 18 hrs followed by a compressor trip lasting longer than 7 min.	4x consecutive or 10x total	Red: Flash 5 Yellow: Off
Code9 Red Flash 9	The current to the PROT terminal is greater than 2A	Current >2A for 40ms	Red: Flash 9 Yellow: Off
Trip Solid Red	Demand is present, but compressor is not running	N/A	N/A

Table 2
CoreSense Diagnostics LED Troubleshooting Information

Flash Code number corresponds to the number of LED flashes, followed by a pause and then repeated.
TRIP and ALERT LEDs flashing at same time means control circuit voltage is too low for operation.

Status	Description	Troubleshooting Information
Solid Yellow "RUN"	Module has power and operating normally	Supply voltage is present at module terminals
Solid Red "TRIP"	Thermostat demand signal Y is present, but the compressor is not running	1. Compressor protector is open • Check for high head pressure • Check compressor supply voltage 2. Outdoor unit power disconnect is open 3. Compressor circuit breaker or fuse(s) is open 4. Broken wire or connector is not making contact 5. High pressure switch open if present in system 6. Compressor contactor has failed open
"ALERT" Flash Codes		
Yellow "ALERT" Flash Code 1	Long Run Time; Compressor is running extremely long run cycles indicative of low capacity due to a system low-side fault	1. Low refrigerant charge 2. Evaporator blower is not running • Check blower relay coil and contacts • Check blower motor capacitor • Check blower motor for failure or blockage • Check evaporator blower wiring and connectors • Check indoor blower control board • Check thermostat wiring for open circuit 3. Evaporator coil is frozen • Check for low suction pressure • Check for excessively low thermostat setting • Check evaporator airflow (coil blockages or return air filter) • Check ductwork or registers for blockage 4. Faulty metering device • Check TXV bulb installation (size, location and contact) • Check if TXV/fixed orifice is stuck closed or defective 5. Liquid line restriction (filter drier blocked if present in system) 6. Thermostat is malfunctioning • Check thermostat sub-base or wiring for short circuit • Check thermostat installation (location, level)
Yellow "ALERT" Flash Code 2	Compressor (Pressure) Trip; Discharge pressure out of limits or compressor overloaded	1. Condenser fan is not running • Check fan capacitor • Check fan wiring and connectors • Check fan motor for failure or blockage 2. High head pressure • Check high pressure switch if present in system • Check if system is overcharged with refrigerant • Check for non-condensable in system 3. Condenser coil poor air circulation (dirty, blocked, damaged)
Yellow "ALERT" Flash Code 3	Short Cycling; Compressor is running only briefly	1. Thermostat demand signal is intermittent 2. Time delay relay or control board defective 3. Low or high pressure switch is cycling

Status	Description	Troubleshooting Information
Yellow “ALERT” Flash Code 4	Locked Rotor	1. Run capacitor has failed 2. Low line voltage (contact utility if voltage at disconnect is low) • Check wiring connections 3. Excessive liquid refrigerant in compressor 4. Compressor bearings are seized • Measure compressor oil level
Yellow “ALERT” Flash Code 5	Compressor (Moderate Run) Trip	1. Evaporator blower is not running • Check blower relay coil and contacts • Check blower motor capacitor • Check blower motor for failure or blockage • Check evaporator blower wiring and connectors • Check indoor blower control board • Check thermostat wiring for open circuit 2. Faulty metering device • Check TXV bulb installation (size, location and contact) • Check if TXV/fixed orifice is stuck closed or defective 3. Condenser coil poor air circulation (dirty, blocked, damaged) 4. Low refrigerant charge
“LOCK” Flash Codes		
Red “LOCK” Flash Code 2 Yellow Off	Compressor (Pressure) Trip; Compressor is locked out after 4 consecutive or 10 total compressor (pressure) trip events	1. Condenser fan is not running • Check fan capacitor • Check fan wiring and connectors • Check fan motor for failure or blockage 2. High head pressure • Check high pressure switch if present in system • Check if system is overcharged with refrigerant • Check for non-condensable in system 3. Condenser coil poor air circulation (dirty, blocked, damaged)
Red “LOCK” Flash Code 3 Yellow Off	Short Cycling; Compressor is locked out after 10 consecutive short cycling events	1. Thermostat demand signal is intermittent 2. Time delay relay or control board defective 3. If high pressure switch present go to Flash Code 2 information
Red “LOCK” Flash Code 4 Yellow Off	Locked Rotor; Compressor is locked out after 10 consecutive locked rotor events	1. Run capacitor has failed 2. Low line voltage (contact utility if voltage at disconnect is low) • Check wiring connections 3. Excessive liquid refrigerant in compressor 4. Compressor bearings are seized • Measure compressor oil level
Red “LOCK” Flash Code 5 Yellow Off	Compressor (Moderate Run) Trip; Compressor is locked out after 4 consecutive or 10 total compressor (moderate run) trip events	1. Evaporator blower is not running • Check blower relay coil and contacts • Check blower motor capacitor • Check blower motor for failure or blockage • Check evaporator blower wiring and connectors • Check indoor blower control board • Check thermostat wiring for open circuit 2. Faulty metering device • Check TXV bulb installation (size, location and contact) • Check if TXV/fixed orifice is stuck closed or defective 3. Condenser coil poor air circulation (dirty, blocked, damaged) 4. Low refrigerant charge