



Technical Information and Diagnostic Guide

for Freightliner Cascadia / BPHS

Battery Powered Hvac System

This guide will assist you in becoming more familiar with the working components of the BPHS® System and the proper steps and procedures to completely diagnose the no idle unit.

!! Attention !!

Technicians are responsible for verifying all batteries are in good condition and are properly charged. Do not proceed with any diagnostics without checking batteries and connections first!

Refer to OEM PowerNet diagnostics. This will test the entire PowerNet system, battery, cables, starter, and alternator.



Servicing system components require specific instructions and when applicable will include individual torque requirements for fasteners. Please refer to the instruction sheets provided with replacement parts. Also see specification list on pages 46 - 47.

Communication

The front HVAC control unit, auxiliary control unit, and the BPHS internal control unit communicate through Cabin Can. The front HVAC control unit uses source address (SA) 25 and the auxiliary control unit uses SA 69. The internal BPHS controller uses SA 58. The messaging communicated is used for operation, diagnostics, and data used to monitor the system with DiagnosticLink 8.07 or later.

Links:

NITE system

Battery option:

Auxiliary Fuel Fired Coolant Heater: Espar Hydronic 5

www.nitesystem.com/html/technical_docs.cfm

NorthStar

www.espar.com

Precautions

Installation, service, and repair of these units should be solicited only by trained service technicians who are acquainted with standard service instructions and training material.

All equipment should be installed in accordance with accepted principles and unit installation instructions. Extreme caution should be observed when troubleshooting electrical components. These messages are for your protection and information. Failure to follow these alerted messages may cause bodily injuries to yourself and/or others as well as damages to the specified unit.

Health, Safety, and Environmental Policy

Under any condition Bergstrom Inc. is committed to protecting the health and safety of all working individuals at or visiting our site. We strategize, administer, conduct, and supervise our efforts in agreement with best practice. Hence, we want to ensure all workers have a clear understanding of their accountabilities with that of the company.

Environmental Concerns

Public awareness of and education about the benefits of using green technologies, coupled with energy efficiency, has created renewed interest within the HVAC industry.

When materials are discarded attempt to reclaim and recycle them. To preserve our environment, follow appropriate rules and regulations when disposing of any resources. It is under our obligation to put in place a series of practices and procedures that, when taken together, result in an environmental management system.

Disclaimer of Liability

Descriptions and specifications within this manual were in effect at the time of production. Models and specifications are subject to change.

Contact the "DTNA Customer Assistance Center" for further assistance.

Picture Symbols

Observe all warning and caution notices posted on equipment and in instructions and/or manuals. Pay special attention to directives prefixed by symbols and signals indicated as "Warning", "Caution", and "Note". Do not disregard any of these alerts.

Warning

This picture symbol with the remark "Warning" refers to the risk of imminent danger and can be vital to one's health. The message will convey what the hazards are, results when warnings are not heeded to, and/or how to avoid such injury. Under certain circumstances, failure to comply with these instructions can cause severe or life-threatening impairment.

Caution

This picture symbol with the remark "Caution" refers to a hazardous situation for a person and/or the product. Failure to comply with these instructions can cause bodily injuries to yourself and/or others as well as damage to machinery.

Note

This picture symbol with the remark "Note" contains information for use and helpful tips to assist an individual when repairing a specified unit or vehicle.

Precautions for working with HFC134a (R134a) Refrigerant and Polyvinyl Ether (PVE) Refrigerant Oil

 **WARNING**

- Do not breath A/C refrigerant, oil vapor, or mist. Exposure may cause irritation to the eyes, nose, and throat.
- Instances where there are accidental system discharges; ventilate work area before resuming service.
- For additional health and safety information contact the refrigerant and oil manufactures.

 **CAUTION**

- **The air conditioning system uses HFC134a (R134a) refrigerant and polyvinyl ether (PVE) refrigerant oil, which are not compatible with CFC-12 (R12) refrigerant, mineral oil, or PAG oil. If the refrigerants or oils are mixed, the compressor may fail.**
- Do not attempt to use R-12 servicing equipment. Failure to follow this statement may result in personal injury or equipment damages.
- Use service equipment that is only U.L listed and certified in which meets the required standards of SAE J2210 to remove HFC134a (R134a) from the air condition system.
- Before testing, please authenticate the HFC134a (R134a) refrigerant in the vehicle system and recycling equipment / recovery tank are contaminate free by using a refrigerant identifier.

 **Note**

All equipment must be serviced by trained personnel only.

R134a service equipment and/or vehicle air conditioning systems should not be pressure or leak tested with compressed air.

- Air conditioning system may consist of R134a fluorescent dye to determine leak detection. Examine with a high intensity ultraviolet light system.
- Specified labels on unit will identify systems that contain fluorescent dye.

 **Note**

The air conditioning system is designed only for certain polyvinyl ether (PVE) refrigerant oil for HFC134a (R134a) A/C systems and HFC134a (R134a) components. The only recommended oil for this particular system is Idemitsu FVC68D PVE oil. The PVE oil is very hygroscopic, meaning it absorbs water. Without appropriate sealing, the oil will become moisture saturated and should not be used.

 **Note**

Follow the handling procedures listed below:

- Only use the specified FVC68D PVE oil from a sealed container.
- After use, immediately reseal containers of oil.
- To avoid contamination, do not return oil to original container once it has been dispensed. Additionally, never combine oil with other refrigerant oils.
- Do not allow PVE oil to come in contact with styrofoam parts. In such occurrences, damage may result.
- Do not allow PVE oil in contact with vehicle paint. In such occurrences, damage may result.
- In order to diminish the amount of moisture that enters the system, any connection in the refrigerant loop that is open must be closed as soon as possible.
- It is recommended for components that are replaced to have dust caps left in place until the component is ready to be installed in the refrigerant loop.
- Once components are removed from the refrigerant loop they should have dust caps in place as soon as possible in order to limit and minimize moisture intrusion.

Important Safety Notices

WARNING

Ill-advised practices, negligence, and/or ignoring warning signs may cause death, personal injury, equipment or property damages.

Before proceeding please read and understand all safety precautions and warnings. The list as follows contains the general safety provisions that must be followed.

Work areas should be dry, well lit, ventilated, and free of clutter such as loose tools, parts, ignition sources and hazardous substances. All personnel must be aware of hazardous conditions that can coexist.

- Wear protective shoes when working. Opened toed shoes are not allowed.
- Rotating parts can cause cuts, mutilation, or strangulation. Be alert at all times when operating machinery.
- When working, do not wear loose-fitting or torn clothing. Additionally, do not wear jewelry. These are hazards that may cause personal injury.
- Before beginning any repairs, disconnect the battery (negative [-] cable) from both battery boxes and discharge any capacitors.
- To prevent accidental engine starting disconnect the air starting motor, if equipped.
- To prevent personal injury or harm to the specified unit place a “do not operate” tag in the operator’s compartment or on the controls.
- Before operating, allow the engine to cool.
- Always use blocks or proper stands to support the vehicle or vehicle components before executing service repairs. It is important that one does not operate on anything that is supported only by lifting jacks or a hoist.
- To reduce the probability of personal injury, use a hoist or get assistance when lifting components that weigh 23 kg [50 lbs.] or more. Make certain all lifting devices such as chains, hooks, or slings are in good condition and are of the correct load capacity. Furthermore, all lifting devices must be positioned correctly. When needed, always use a spreader bar. Also, lifting hooks must not be side-loaded.
- When handling corrosion inhibitors and lubricating oils avoid exposure to eyes and repeated contact to skin for they may contain alkali. In case of contact, immediately wash skin with soap and water. When cases are severe, please contact a physician. **Store toxic products and substances out of reach of children.**
- Naptha and Methyl Ethyl Ketone (MEK) are flammable and hazardous materials and must be used with attentiveness. Follow manufacture guidelines to ensure safety when handling materials. **Store toxic products and substances out of reach of children.**
- When operating on a vehicle be attentive and cautious for hot parts on systems that have been turned off, exhaust gas flow, and hot fluids in lines, tubs, and compartments. Direct contact to skin may cause severe burns.
- Always use tools that are in good working condition. Service technicians must be trained and have proper understanding on how to use the tools before administering service.
- When replacing items use the same and/or equivalent fastener part number at all times. Conversely, do not use a fastener of reduced quality if replacement is needed.
- To prevent bodily injury or harm do not perform any repairs when impaired, fatigued or after consuming alcohol or drugs that can impair one’s functioning.
- According to several states and federal agencies within the United States of America it has been evident that used engine oil can be carcinogenic, causing reproductive toxicity. That being said, avoid inhalation of vapors, ingestion, and prolonged contact with used engine oil.
- Be mindful that liquefied petroleum gas is denser than air and can accumulate near the floor, in slumps, and low-lying area.
- Close the manual fuel valves prior to performing maintenance and repairs and when storing the vehicle inside.
- **California Proposition 65 Warning** – Diesel engine exhaust and some of its constituents are known to the state of California to cause cancer, birth defects, and other reproductive harm. To request more information regarding the chemical exposures that are the basis of the warning, contact the manufacture of the product.

TABLE OF CONTENTS

1) External Component Identification and Location

A: Fuse - 100 amp.....9 (main battery power to unit PDM)	9
B: AUX Control Panel	9
C: Sleeper Sensor	9
D: Condenser Fan	9
E: Ambient Outside Air Sensor.....	10
F: Charge Port	10
G: Condenser Fan / Coil.....	10
H: Receiver Dryer.....	10

2) Unit Components

A: Control (PCB) /Compressor Assembly (ECU)	11
B: Phase Harness	11
C: Power Distribution Module (PDM).....	11
D: Compressor	11
E: Thermal Limit Switch.....	12
F: Pressure Transducer	12
G: Evaporator Sensor/Freeze Switch.....	12
H: Evaporator Blower.....	13
I: Blend Door Actuator	13
J: Thermal Expansion Valve (Engine OFF).....	13
K: Evaporator Coil (Engine OFF).....	13

Continued.....

L: HVAC Evaporator Coils Cover	14
M: Engine Off AC - Suction Line	14
N: Engine Off AC – Lines	14
O: Heater Coil	14
P: Evaporator Coil (Engine ON)	15
Q: Thermal Expansion Valve (Engine ON)	15
R: Evaporator Inlet Filter	15

3) Diagnostics Tables	16/18
-----------------------------	-------

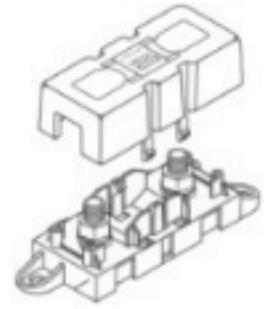
Appendix

A: Batteries	19
B: AUX Control Panel Testing	19
C: Pressure Transducer Testing	20
D: Evaporator Sensor/Freeze Switch Testing	20
E: Compressor Thermal Limit Switch	20
F: Control PCB Assembly	21
G: Power Distribution Module	22
H: Compressor Controller (ECU)	23
I: Condenser Fan Testing	24.....&.....36-39
J: Evaporator Blower Testing	24
K: Compressor Rubber Mounts	24
L: Blend Door Actuator	24-25
M: Sleeper Temperature Sensor	25
N: Outside Air Temperature Sensor	25
O: Evaporator Sensor Chart	26
P: Sleeper Air Sensor Chart	27
Q: Ambient Outside Air Sensor Chart	28
R: BPHS Wiring Diagram	29-30
S: System Controller Pinout Chart	31-32
T: System Fault Codes (Cabin CAN).....	33
U: Transducer chart	34
V: Refrigerant Charge Level	35
W: Condenser Fan Tests	36-39
X: Condenser Coil Cleaning	39
Y: Compressor phase harness	40
Z: Ring Terminal - Compressor and Controller Service	41-46
AA: Specifications	47-48

A: Fuses located on the control center

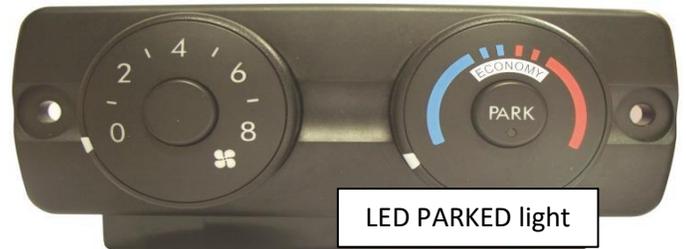
Fuse 100 Amp

This fuse provides protection for the main battery power to the BPHS unit.
This fuse is located in the battery box.



B: AUX Control Panel

Backlights light for 8 seconds when touched in Park mode.
Operates like standard Auxiliary HVAC when the engine is running

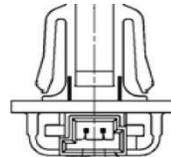


Pushing “PARK” button with Engine off / brakes set starts PARK mode and illuminates PARK button LED. Unit exits PARK when, engine is started, unit is shut off or batteries are depleted. See owner’s manual for Opt-Idle operating instructions.

NOTE: If opt-idle is engaged, PARK button does not function. Unit operates as a standard bunk unit.

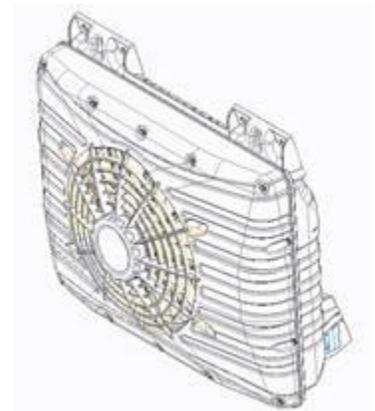
C: Sleeper Sensor

This sensor monitors the sleeper compartment temperature. See appendix M for test instructions.



D: Condenser

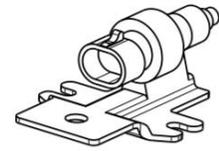
This fan draws air through the condenser coil to cool the refrigerant flowing through the system. The hot air is exhausted away from the truck.



 Cleaning condenser – See page 39

E: Ambient Outside Air Sensor

This sensor monitors the air temperature at the condenser coil. See appendix N page 25 for test instructions.

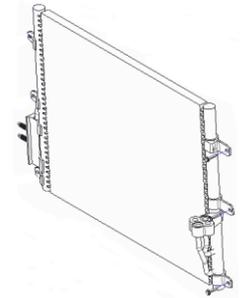
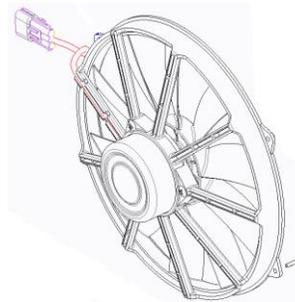


F: Charge Port



G: Condenser Fan / Coil

Fan and coil are serviceable.



G: Receiver Dryer / serviceable

Torque in gradual steps. **20 in-lb's / 50 in-lb's / 15 ft-lb's**



Caution: When loosening the two hex nuts securing the dryer to the condenser assembly, care must be taken to prevent the dryer base from moving. Using a large plier, hold the dryer base to prevent the movement. Failure to secure the base during removal and installation can result in a cracked or damaged coil.



Internal components

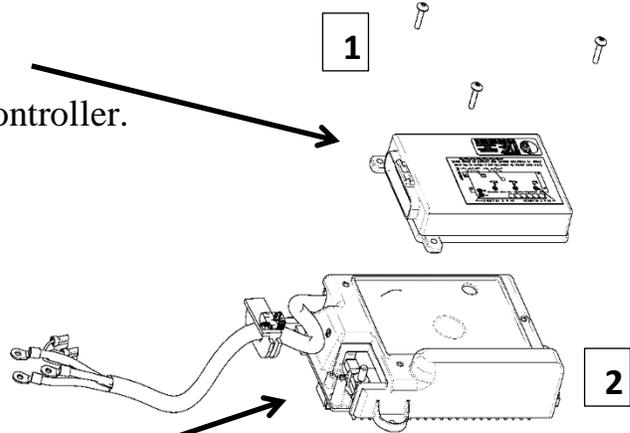
A: System Controller (PCB)

NOTE: The top section (1) is the system controller.

This device stores the operating program and controls the **BPHS** unit.

It is located in the lower right section behind the evaporator blower.

System primary LVD is on Cabin CAN



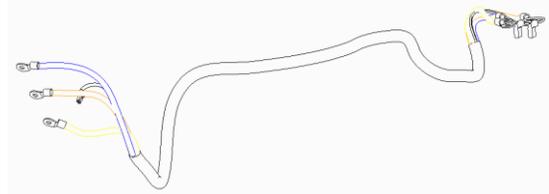
Compressor Controller (ECU)

The lower section (2) controls the compressor.



WARNING: TO AVOID ELECTRIC SHOCK AND PREVENT ARCING AND DAMAGE TO HARNESS AND CONTROLLER,  DISCONNECT POWER FROM SYSTEM PRIOR TO SERVICING!

B: Phase Harness

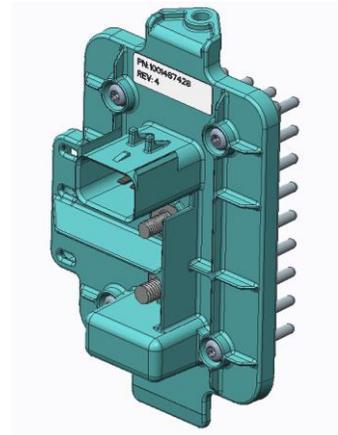


Servicing RING TERMINAL harness or controller, follow instructions on pages 41-46.

C: PDM / Power Distribution Module

This solid state device controls power distribution to evaporator blower, condenser fan, compressor and hydronic heater.

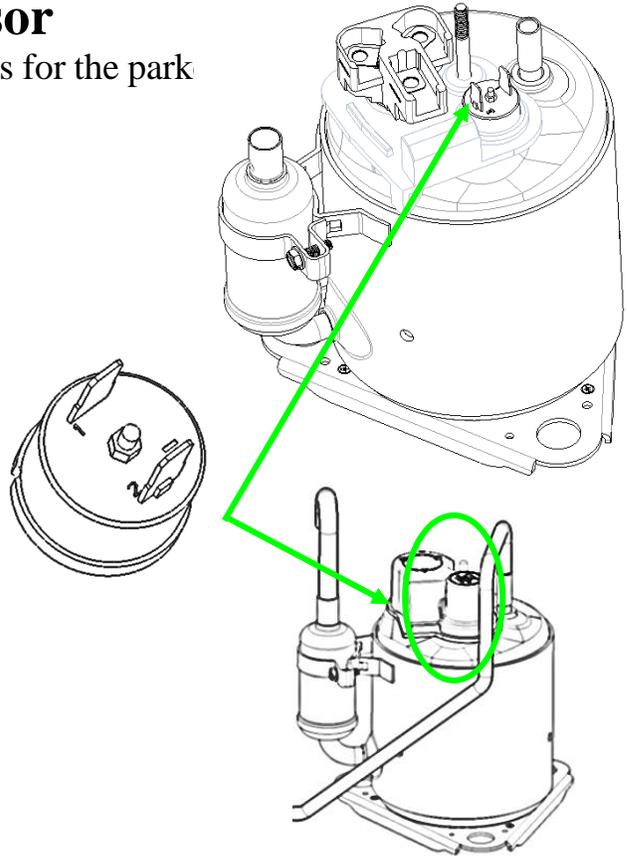
It also provides circuit protection for these components.



When troubleshooting: see additional notes page 18.

D: Ring Terminal Compressor

This serviceable electric compressor is for the park refrigeration system.

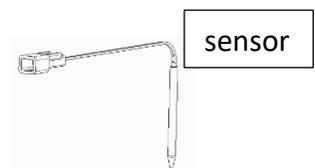
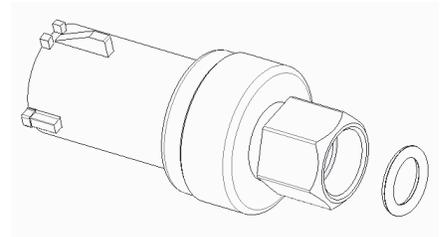


E: Thermal Limit Switch Compressor

This is a normally closed switch to protect the compressor from high temperature.

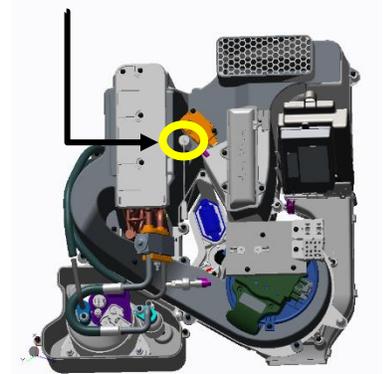
F: Pressure Transducer & O ring

The parked hvac system has a serviceable Schrader-mounted transducer that seals with an o ring. This sensor provides system protection by monitoring the refrigerant pressure, and will signal to the system controller if pressure conditions require the compressor to be stopped. Technical chart on page 33.



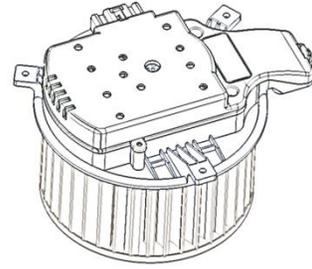
G: Evaporator Sensor/Freeze Switch

The evaporator sensor is located as shown. It is serviceable without removing the cabinet base. This sensor stops and prevents the operation of the compressor if ice forms on the evaporator coil. See appendix D, page 20 for test instructions.



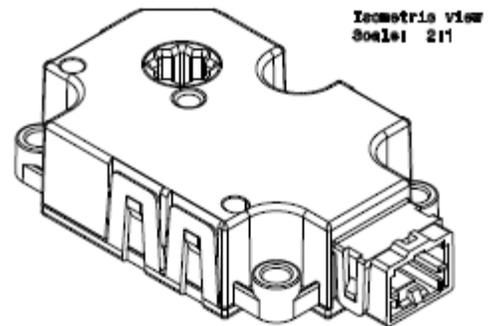
H: Evaporator Blower

This blower pushes air through the evaporators or heater coil to condition the interior of the sleeper.



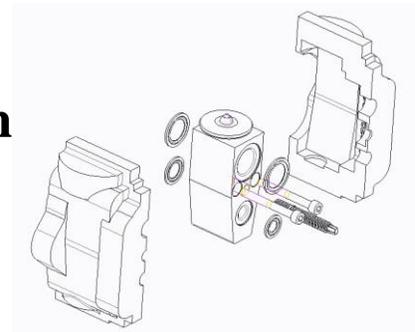
I: Blend Door Actuator

This actuator operates the blend door, changing the air flow path through the BPHS evaporator coil and heater core.



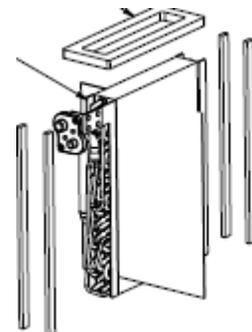
J: Engine OFF - Thermal Expansion Valve - TXV

Meters the refrigerant into the engine-off evaporator coil.

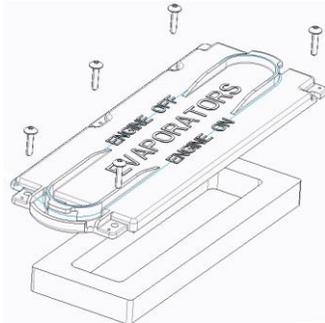


K: Engine Off Evaporator Coil

Servicable refrigerant coil for the parked side of the hvac system.

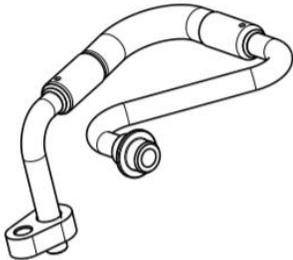


L: HVAC Evaporator Coils Cover



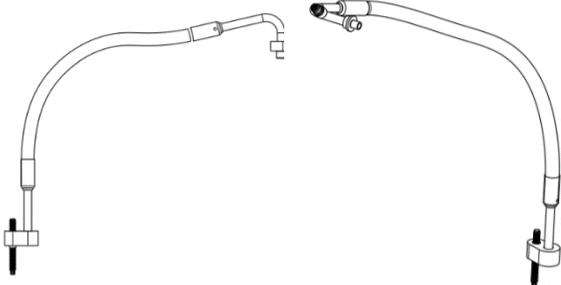
M: Engine Off HVAC Suction Line

Serviceable refrigerant line.



N: Engine Off HVAC Lines

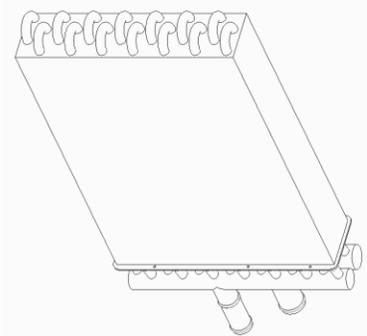
Serviceable refrigerant lines.



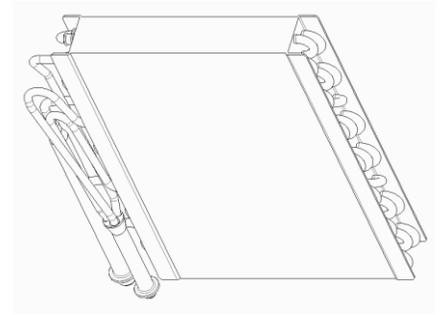
DISCHARGE HOSE

LIQUID HOSE

O: Engine Off HVAC - Heater Coil

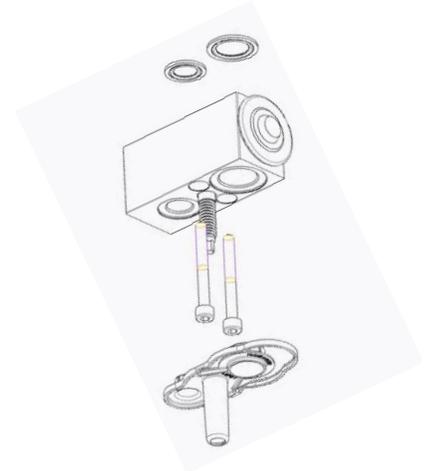


P: Engine ON Evaporator Coil



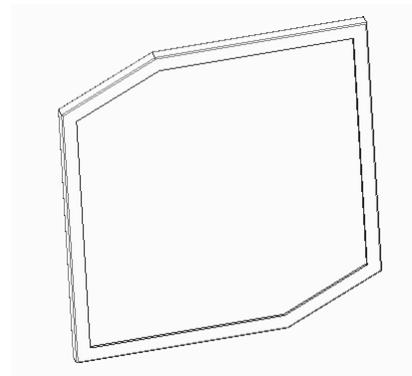
Q: Engine ON: Thermal Expansion Valve – TXV

Meters the refrigerant into the engine-off evaporator coil.



R: Evaporator inlet filter:

This filter protects the evaporator coil from dust and debris. It is washable, and should be serviced every other month by washing dust and debris off with warm water. In environments with pets or dusty environments the filter may need more frequent washing. Failure to do so will affect the performance of the unit and could lead to drain tube clogging.



Items listed are possible causes and are not intended to be followed as exact steps. Many items should be confirmed using Diagnostic

BPHS System Diagnostic Table

TRUCK MUST BE IN PARKED MODE TO PERFORM DIAGNOSTIC TESTS. *DO NOT PERFORM DIAGNOSTICS IN OPT-IDLE MODE*

Please refer to Module 689, 723, 70C for additional information on components and wiring.

When testing AC portion of unit ESPAR HEATER must be disconnected.

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION / SEE APPENDIX
Unit Will Not Run or Turn On	<ol style="list-style-type: none"> Loose connection No power is available Blown 100 amp fuse Loss of power to Aux control panel & PCB from VPDM fuse 27 or defective AUX Control panel. CanBus Communication WAKE UP Control PCB Assembly defective. Park Switch defective or wrong logics. No 12 volts to pin 15 battery sense. Broken wire or defective wire harness PARK button illuminates for a couple of seconds but unit does not run. 	<ol style="list-style-type: none"> Confirm all connections are tight, including ground lugs, wires and battery cables. Check batteries for voltage. Low voltage cut out through Cabin Can and is approx 12.1 volts. Refer to PowerNet Diagnostics to confirm voltages. Check 100 amp fuse for continuity and/or voltage and 12 volt input on PDM – power dist. module. Check for 12 volts and ground at AUX control panel and PCB. See appendix B & F. Check Wake up signal using DiagnosticLink. Wake up is on Cabin CAN. See appendix F Test Control PCB Assembly. See appendix F Check Park brake message on DiagnosticLink. Check 12V power from VPDM fuse 27 to pin 15 on PCB assembly. See Pin Out Chart pages 31-32. Inspect all wiring and harness connections. Check for loss of communication on Cabin CAN.
Unit runs in parked mode but not engine running mode.	<ol style="list-style-type: none"> Truck communication 	<ol style="list-style-type: none"> Inspect all wiring and harness connections, including Cabin CAN.
Unit runs in Engine On mode, but not Engine Off	<ol style="list-style-type: none"> Low Batteries Park Brake Signal Wake Up Signal Wiring Harness 	<ol style="list-style-type: none"> Check batteries. See Appendix A Park brake switch defective, wiring harness issue or wrong switch logics Loss of wake up signal. Check Aux control panel and control PCB Assy. See Appendix B & F Check wiring harness connectors and physical condition.
Front HVAC system runs in optimized idle	<ol style="list-style-type: none"> Cabin CAN 	<ol style="list-style-type: none"> Front unit disable is through Cabin CAN. Check DiagnosticLink

Items listed are possible causes and are not intended to be followed as exact steps. Many items should be confirmed using Diagnostic Link!

TRUCK MUST BE IN PARKED MODE TO PERFORM DIAGNOSTIC TESTS!

<p>Parked - Unit Runs - But Does Not Blow Cold Air</p> <p>CHECK DIAGNOSTIC LINK</p> <p>Refer to OEM manual for additional information.</p>	<p> Check DiagnosticLink for faults (Examples)</p> <ul style="list-style-type: none"> • Ambient outside air temperature • Evaporator temperature / freeze sw. • Sleeper Temperature • Refrigerant pressure binary switch <ol style="list-style-type: none"> 1. Evaporator airflow blockage. 2. Check Sensors 3. Thermal Expansion Valve 4. Overcharged refrigerant system 5. Condenser fan or coil blocked 6. Condenser fan power & speed signal 7. Battery power - PDM to condenser fan 8. Compressor controller power 9. Battery power - PDM to compressor control. 10. Evaporator blower power and signal. 11. Evaporator blower power from PDM 12. Blend door position. 13. Compressor thermal switch. 14. High side pressure transducer 15. Loss of charge. (refrigerant system is serviceable) 16. Defective compressor 	<p>See fault code list for complete listing</p> <p> <u>ADDITIONAL PDM CHECKS PAGE 18</u></p> <ol style="list-style-type: none"> 1. Clear any blockage from recirculation filter, grill and louvers. 2. Check evaporator / sleeper / ambient air sensors. See appendix F, M, and N 3. Thermal expansion valve – refrigerant flow – see page 10 4. Overcharged system – see appendix C 5. Check condenser fan, inlet and outlet for restriction (outside behind sleeper). See appendix I and pages 36-39. 6. Confirm power and signal at fan motor. See appendix G & I page 22,24 and wiring pages 29-30. 7. Confirm battery output from PDM. See appendix G page 22. 8. Confirm battery power at compressor controller. See appendix G page 22. 9. Confirm battery output from PDM - also check for 6 volt power from compressor controller to compressor. See appendix G & H and pages 41-46 10. Check Evaporator blower power and speed signal at motor. See appendix J. 11. Check Evaporator blower power from PDM module. See appendix G page 22. 12. Check blend door operation. See appendix L 13. Check thermal switch. See appendix E 14. Check pressure transducer. Fault codes. See page 33/34 15. If all tests check OK, a loss of charge may have occurred. Check for pressure switch fault. Follow Freightliner service instructions. 16. If all above items are ok and power is detected at the compressor but it does not operate, the system refrigeration compressor and dryer must be replaced. See Freightliner service instructions.
<p>Unit Cycles On And Off</p>	<ol style="list-style-type: none"> 1. Poor electrical connection. 2. Condenser fan inoperative. 3. Air flow blockage causing high pressure or freeze condition. 4. Condenser coil blocked 	<ol style="list-style-type: none"> 1. Check all electrical connections. 2. Check condenser fan. See appendix I & G. 3. Check for restricted airflow at condenser inlet and outlet and at louvers and recirculation filter. Check pressure transducer and/or freeze switch. See appendix C and D 4. Check for blockage/ clean coil. See appendix I pages 36-39.

Note: Heater diagnostics can be performed using Espar’s EDITH diagnostics laptop based program. You must have the ISO cable adapter for the Espar Hydronic heater. Rev 3-4B use the proprietary 4 wire adapter/Rev 5 uses the 8 pin adapter.

Note: Heater diagnostics can be performed using Espar's EDITH diagnostics laptop based program. You must have the ISO cable adapter for the Espar Hydronic heater. Rev 3-4B use the proprietary 4 wire adapter/Rev 5 uses the 8 pin adapter.

Unit Blows Cold Air, But Low Airflow	<ol style="list-style-type: none"> 1. Check all duct work connections. 2. Evaporator coil or filter blocked 3. Evaporator blower motor 	<ol style="list-style-type: none"> 1. Make sure all ducts are connected, sealed and secure. 2. Check for airflow at louvers, replace or clean return air filter. 3. Check evaporator blower motor. See appendix J and G
Unit Runs Correctly, But Less Than Expected Run Time	<ol style="list-style-type: none"> 1. Ground terminal(s). 2. Batteries weak, not charged correctly. 3. High amperage draw 4. NON AGM BATTERIES 	<ol style="list-style-type: none"> 1. Inspect and tighten ALL connections. 2. Check battery condition / state of charge. See appendix A 3. Use DC ammeter to check amps when running. Excessive amperage could signal compressor or internal component issue. Amperage ranges 40A to 75A depending on conditions 4. Non AGM batteries in any location will greatly reduce run time.
Unit is Noisy or Vibrates	<ol style="list-style-type: none"> 1. Evaporator Blower motor. 2. Condenser fan motor. 3. Compressor mounting. 	<ol style="list-style-type: none"> 1. Check evaporator blower. See appendix J 2. Check condenser fan. See appendix I & pages 36-39. 3. Check rubber compressor mounts. See appendix K
Unit runs but does not blow hot air	<ol style="list-style-type: none"> 1. Heater power and ground 2. Heater fuse 3. Wiring harness 4. Heater enable signal 5. Blend Door 6. Park switch 	<ol style="list-style-type: none"> 1. Check for power to PDM 2. Check for power from PDM pin 2 3. Check wiring harness connectors and physical condition 4. Check heater enable 12V at heater pin 7 from PCB pin 22 5. See appendix L 6. Incorrect park brake switch will prevent heater from operating.

ATTENTION: Additional (PDM) Power Distribution Module Checks.

Continuous power output from PDM

- **Condenser runs constantly with system off, stops when door opened – Check for condenser power from PDM not shutting off:**
- **Shut off master disconnect. If condenser goes to high speed, check voltage at PDM_SLEEP (pin 1). If the voltage is > 1V, replace the PDM. If the voltage is <1V, check for short to ground and repair harness or PCU as needed.**

Appendix

A. Battery Condition and Performance:

Battery Voltage is critical for system operation. Special attention should be given to both sets of batteries. Follow Freighliner PowerNet assessment guideline to diagnose battery condition and performance.



Poor quality batteries or a weak alternator will have a Negative impact on **BPHS** unit run time. Always maintain the best possible AGM batteries and charging system.

BPHS Alternator - 270 Amp.

Load test and maintain batteries as required by the manufacturer.

B. AUX Control Panel Testing: Attention! Conduct this test with ENGINE OFF/ KEY OFF AND BRAKES SET!!!

Auxiliary sleeper control panel is powered from VPDM fuse 27 and connected to Cabin CAN. Refer to module 70C in PartsPro for wiring schematic.

Check for proper voltage at the 6 pin connector. You should have 12 volts from VPDM fuse 27. Pushing the parked button signals through the Cabin Can for the BPHS unit to turn on. Check DiagnosticLink for communication.

NOTES: If opt-idle is engaged, PARK button does not function. Unit operates as a standard bunk unit. Front HVAC unit is disabled when opt-idle is engaged.

- C. Pressure Transducer:** Check Cabin CAN for any fault codes.
The Schrader mounted transducer is serviceable (see F page 12).

Pressure transducer mounted on the PBHS unit monitors the refrigerant system pressure. The signal from the transducer provides input to the PCB controller and will be displayed through DiagnosticLink as shown below. If a low or high pressure situation exists, the system controller will stop the compressor and/or condenser fan.



NOTE: High system pressure and poor performance can occur if the system is overcharged! If the system has been serviced / recharged and does not operate correctly, please verify refrigerant charge level is correct. See page 31.

- D. Evaporator Sensor/Freeze Switch Testing: Location:** Top of unit under cabinet base center support, see item G, page 12. **IF THE SENSOR OR CIRCUIT HAS A SHORT OR OPEN, a fault code will be set.**

The freeze switch is a temperature sensor. To verify the condition you will need a Volt/OHM meter. If a freeze condition occurs, temperature at or below 42°, the unit will stop the compressor. If the freeze condition is corrected, the compressor will restart and the **BP**HS unit will continue to run. See chart page 22 for sensor test data.

Thermal Expansion valve blocked or partially blocked can cause improper refrigerant flow and a freeze up condition at the evaporator coil. Check for ice on tubes. TXV is serviceable.

- E. Compressor Thermal Limit Switch:** You must remove the compressor cover of the BP

HS unit to access the switch. This device is a normally closed switch. If the compressor gets too hot, the thermal limit switch will open and the compressor will stop. Checking with a meter you should always have continuity between the two terminals when it is cool. Also check harness and connection at circuit board.

F: Control PCB Assembly:

Do not attempt to test the controller or compressor until you have completely eliminated all other possibilities.

System controller PCB is located in the lower area behind the evaporator blower and is mounted on top of the compressor controller ECU.



Power to the PCB on pin 30 from VPDM, Vehicle Power Distribution Module, fuse 27 must be present. Also battery power to pin 15 (battery sense) must be above battery LVD.

Starting the system:

With engine off, key off and brakes set, turn the AUX control blower speed to the max setting and the temperature setting to full cold. Push the (PARK) button to start the system.

The AUX control panel communicates the (WAKE UP) signal through the Cabin Can.

If all safeties are ok, such as the pressure transducer, temperature sensor / freeze switch and the compressor thermal limit switch, the PCB will signal to the PDM to send power out. In AC mode the condenser fan and evaporator blower will begin to operate at a speed determined by the AUX control panel and PCB system controller. At the same time, the PCB system controller will send enable and speed signals to the compressor controller ECU to start the refrigerant compressor.

When the compressor control ECU receives the enable signal on pin 2 and the speed signal on pin 6, the ECU will send the 6 volt pulse voltage out to the compressor through the phase harness.

If the PARK button does not start the system:

1. Check Aux control panel - power from VPDM fuse 27
2. Check 100 amp fuse (in battery box) - main system power
3. Determine communication with Diagnostic Link for (Wake up)
4. Check (DiagnosticLink?)for power from Sam module at PCB control
5. Check (DiagnosticLink?)for power at battery sense on PCB
6. Check PDM input from PCB – this input should activate the PDM

G: Power Distribution Module – (PDM)

When the Power Dist. Module receives the (PDM_sleeper) signal from PCB pin 27, the PDM will wake up and send battery power to the appropriate components. The PDM also provides circuit protection for condenser fan, evaporator blower and compressor controller as well as the hydronic (coolant) heater.

No blower output power will set a fault.

No condenser fan power will set a transducer fault when high pressure is reached

Testing PDM outputs: Turn BPHS system off.

Step 1: Disconnect the PCB 32 pin connector. Confirm battery voltage >12V is present on PDM main battery post and pin 27 of the PCB harness connector. If no voltage is present on pin 27, PDM is defective.

Step 2: Using #1 - 1.0mm Dia. Male pin tool from tool kit DK1470E16022 , probe the harness connector pin 27 (PDM_sleeper). Connect probe to a suitable wire and connect pin 27 to battery negative. This (grounding) will (wake up) the PDM. If you have battery power on main battery post coming from the battery bank and the PDM wakes up, you should have battery voltage (output) on each component circuit - heater, condenser fan, evaporator blower and compressor.

While the grounding jumper is connected use a voltmeter and check for each output.

NOTE: The condenser fan should start at high speed any time the PDM wakes up. When no speed signal is present, the condenser fan will operate at high speed.

Check for battery voltage at evaporator blower - pin 4.

Check for battery voltage at heater - harness connector pin 8.

Check for battery voltage to compressor ECU - main stud.

If any of the outputs from the PDM are not present, disconnect all devices from the system. Disconnect and reconnect ground to pin 27 resetting PDM and recheck the outputs with (NO LOAD) present at the PDM.

If the output returns, reconnect components and recheck. If an output is not working after a reset, replace PDM.



Reminder: See specification page for proper torque settings when reconnecting battery harnesses.

H. Compressor Controller ECU: Do not attempt to test the controller or compressor until you have completely eliminated all other possibilities. ECU assembly has a removable phase harness.

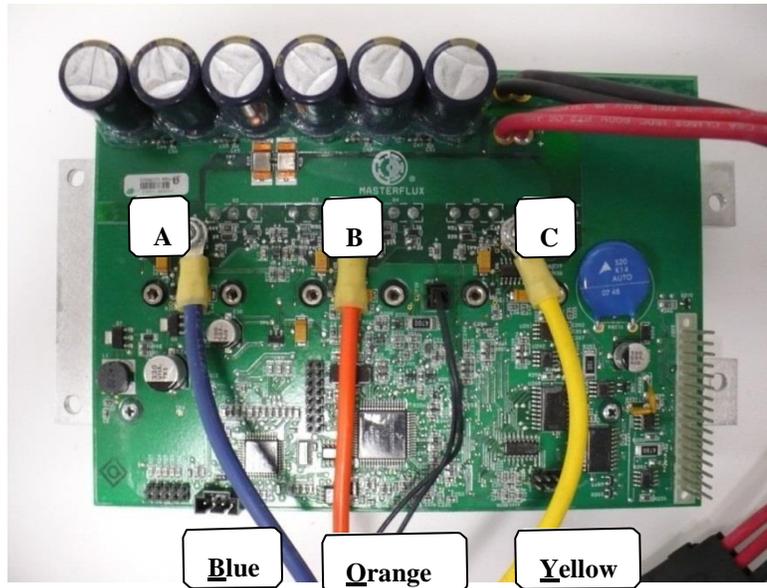


Photo is generic. If replacing a harness, be sure to follow the original OE routing path. See pages 40-45 for proper routing across the board.

Wires must always be connected in this order and torqued to 20 inch lbs +/- 2.

! See warning on page 40 for testing controller with phase wires disconnected!

Follow steps on pages 41-46 for removal of the phase harness. One end of the harness must be disconnected to properly test ECU 6 volt outputs.

With the phase harness disconnected, BPHS unit on, 12 volts present from PDM and DiagnosticLink showing requested compressor speed, use a volt meter to check each post, positive on (A, B or C) negative to battery ground. If you do not have a 6 volt pulse voltage out on each post, replace the ECU controller. Pulse voltage means the controller will cycle to each colored wire. You may see the voltage appear and disappear continuously depending on your meter. It cycles fast and some meters may not pick up the cycles.

If you do have a 6 volt pulse voltage out on each post and at the compressor and the compressor does not run you have a defective compressor.

! If disconnecting the three wires from the compressor, you must always use new screws and connect blue to A, orange to B, and yellow to C.



I. Condenser Fan Motor Testing: First do a visual inspection of all fan parts. Also see appendix W pages 36-39. Condenser is located outside the truck on rear sleeper wall.

Using a DC ammeter you can check the amperage draw of the fan.
Amps 12-13.



Caution: If attempting to connect the fan to an outside power source, internal electronic components are sensitive to arcing or reverse polarity! Damage will occur!!

Anytime the unit has been operating and shuts down or is turned off, the condenser fan will continue to run for 90 seconds to cool the system.

J. Evaporator Blower Motor Testing: First do a visual inspection of all blower parts. Check Diagnostic Link for any fault codes.

Using a DC ammeter you can check the amperage draw of the blower. amp

Caution: If attempting to connect blower to an outside power source, internal electronic components are sensitive to arcing or reverse polarity! Damage will occur!

K. Compressor Rubber Mounts:

Visual inspection of the compressor rubber mounts may be necessary if excessive vibration is present. Check for loose mounting fasteners.

L. Blend Door Actuator: For blend door is located on top of the BPHS unit, under the cabinet base – center section. Check Diagnostic Link for any fault codes.

Physical inspection can be seen through the top of the unit by removing the main controller or evaporator blower. Continued next page...

This actuator motor drives the blend door. Each time the unit is powered up the door sets to full cold.

When in the heat mode, the blend door will direct air through the heater core as directed by the Aux. Control Panel in order to maintain a preset temperature. The Espar Hydronic coolant heater will provide a constant flow of heated coolant through the heated core for internal bunk heat as well as engine heat.

You cannot bench test this actuator.

Check for 12V at pin 4 on the actuator, this is power from pin 29 on the Control PCB Assembly. Use pin 1 for ground when checking this voltage. With unit operating, phases A, B, C and D are switched to ground in a sequence. With the door in a stationary position check for 12V, you should have 12V on each phase. When the door is being positioned, these phases will be switched to ground. The voltage will be near zero on a switching phase.

M. Sleeper Temperature Sensor: Location see Freightliners instructions This sensor monitors the sleeper internal temperature. See chart located after appendix for testing data.

IF THE SENSOR OR CIRCUIT HAS A SHORT OR OPEN, the fault code will be seen on J1939

If this sensor fails, the unit will default to 72 degrees.

N. Ambient Outside Air Temperature Sensor:

This sensor monitors the ambient air temperature. See chart located after appendix for testing data.

If this sensor fails open or shorted a fault code will be set and viewable on diagnostic link.

If this sensor has a partial failure and reads an incorrect temperature, it may prevent compressor operation.

Sensor is located in the condenser unit outside the truck on rear sleeper wall.

Evaporator Sensor / Freeze Switch Resistance Chart

TEMP (°C)	R (min)	R (cent)	R (max)	R (min)	R (max)
-30	84.45	86.75	89.11	-2.7%	2.7%
-29	79.39	81.51	83.68	-2.6%	2.7%
-28	74.68	76.62	78.61	-2.5%	2.6%
-27	70.28	72.06	73.89	-2.5%	2.5%
-26	66.16	67.80	69.48	-2.4%	2.5%
-25	62.32	63.82	65.36	-2.4%	2.4%
-24	58.72	60.10	61.51	-2.3%	2.3%
-23	55.35	56.62	57.92	-2.2%	2.3%
-22	52.20	53.37	54.55	-2.2%	2.2%
-21	49.25	50.32	51.41	-2.1%	2.2%
-20	46.49	47.47	48.47	-2.1%	2.1%
-19	43.89	44.80	45.71	-2.0%	2.0%
-18	41.46	42.29	43.13	-2.0%	2.0%
-17	39.18	39.94	40.71	-1.9%	1.9%
-16	37.04	37.74	38.44	-1.8%	1.9%
-15	35.03	35.67	36.32	-1.8%	1.8%
-14	33.14	33.73	34.32	-1.7%	1.8%
-13	31.37	31.90	32.45	-1.7%	1.7%
-12	29.70	30.19	30.69	-1.6%	1.6%
-11	28.13	28.58	29.03	-1.6%	1.6%
-10	26.65	27.06	27.48	-1.5%	1.5%
-9	25.26	25.64	26.02	-1.5%	1.5%
-8	23.95	24.30	24.64	-1.4%	1.4%
-7	22.72	23.03	23.35	-1.4%	1.4%
-6	21.56	21.84	22.13	-1.3%	1.3%
-5	20.46	20.72	20.98	-1.3%	1.3%
-4	19.43	19.66	19.90	-1.2%	1.2%
-3	18.45	18.67	18.88	-1.2%	1.2%
-2	17.53	17.73	17.92	-1.1%	1.1%
-1	16.66	16.84	17.01	-1.1%	1.1%
0	15.84	16.00	16.16	-1.0%	1.0%
1	15.05	15.21	15.37	-1.1%	1.1%
2	14.30	14.46	14.62	-1.1%	1.1%
3	13.60	13.75	13.91	-1.1%	1.2%
4	12.93	13.09	13.24	-1.2%	1.2%
5	12.30	12.46	12.61	-1.2%	1.3%
6	11.70	11.86	12.01	-1.3%	1.3%
7	11.14	11.29	11.45	-1.3%	1.4%
8	10.61	10.76	10.91	-1.4%	1.4%
9	10.10	10.25	10.40	-1.4%	1.5%
10	9.626	9.771	9.918	-1.5%	1.5%
11	9.174	9.316	9.461	-1.5%	1.5%
12	8.745	8.885	9.027	-1.6%	1.6%
13	8.339	8.477	8.616	-1.6%	1.6%
14	7.954	8.089	8.226	-1.7%	1.7%
15	7.589	7.722	7.856	-1.7%	1.7%
16	7.243	7.373	7.504	-1.8%	1.8%
17	6.914	7.041	7.170	-1.8%	1.8%
18	6.602	6.727	6.853	-1.9%	1.9%
19	6.306	6.428	6.552	-1.9%	1.9%
20	6.025	6.144	6.265	-1.9%	2.0%
21	5.758	5.875	5.993	-2.0%	2.0%
22	5.504	5.618	5.734	-2.0%	2.1%
23	5.263	5.374	5.488	-2.1%	2.1%
24	5.034	5.142	5.253	-2.1%	2.2%
25	4.816	4.922	5.030	-2.2%	2.2%
26	4.608	4.712	4.818	-2.2%	2.2%
27	4.411	4.512	4.615	-2.2%	2.3%

TEMP (°C)	R (min)	R (cent)	R (max)	R (min)	R (max)
28	4.223	4.322	4.422	-2.3%	2.3%
29	4.044	4.140	4.239	-2.3%	2.4%
30	3.874	3.968	4.064	-2.4%	2.4%
31	3.711	3.803	3.897	-2.4%	2.5%
32	3.557	3.646	3.738	-2.5%	2.5%
33	3.410	3.497	3.586	-2.5%	2.5%
34	3.269	3.354	3.441	-2.5%	2.6%
35	3.135	3.218	3.303	-2.6%	2.6%
36	3.007	3.088	3.171	-2.6%	2.7%
37	2.886	2.964	3.045	-2.7%	2.7%
38	2.769	2.846	2.925	-2.7%	2.8%
39	2.658	2.733	2.810	-2.7%	2.8%
40	2.553	2.625	2.700	-2.8%	2.8%
41	2.451	2.522	2.595	-2.8%	2.9%
42	2.355	2.424	2.495	-2.9%	2.9%
43	2.262	2.330	2.399	-2.9%	3.0%
44	2.174	2.240	2.307	-2.9%	3.0%
45	2.090	2.154	2.219	-3.0%	3.0%
46	2.009	2.072	2.136	-3.0%	3.1%
47	1.932	1.993	2.055	-3.0%	3.1%
48	1.859	1.918	1.978	-3.1%	3.2%
49	1.788	1.846	1.905	-3.1%	3.2%
50	1.721	1.777	1.834	-3.2%	3.2%
51	1.656	1.711	1.767	-3.2%	3.3%
52	1.594	1.647	1.702	-3.2%	3.3%
53	1.535	1.587	1.640	-3.3%	3.4%
54	1.478	1.529	1.581	-3.3%	3.4%
55	1.424	1.473	1.524	-3.3%	3.4%
56	1.372	1.420	1.469	-3.4%	3.5%
57	1.322	1.369	1.417	-3.4%	3.5%
58	1.274	1.320	1.367	-3.4%	3.6%
59	1.228	1.273	1.318	-3.5%	3.6%
60	1.185	1.228	1.272	-3.5%	3.6%
61	1.142	1.184	1.228	-3.5%	3.7%
62	1.102	1.143	1.185	-3.6%	3.7%
63	1.063	1.103	1.144	-3.6%	3.7%
64	1.026	1.065	1.105	-3.6%	3.8%
65	0.9902	1.028	1.067	-3.7%	3.8%
66	0.9559	0.993	1.031	-3.7%	3.8%
67	0.9229	0.9589	0.9960	-3.7%	3.9%
68	0.8913	0.9263	0.9630	-3.8%	3.9%
69	0.8609	0.8950	0.9304	-3.8%	4.0%
70	0.8317	0.8649	0.8994	-3.8%	4.0%
71	0.8036	0.8360	0.8697	-3.9%	4.0%
72	0.7766	0.8082	0.8410	-3.9%	4.1%
73	0.7506	0.7815	0.8135	-3.9%	4.1%
74	0.7257	0.7558	0.7870	-4.0%	4.1%
75	0.7017	0.7310	0.7615	-4.0%	4.2%
76	0.6786	0.7072	0.7369	-4.0%	4.2%
77	0.6564	0.6843	0.7133	-4.1%	4.2%
78	0.6351	0.6622	0.6905	-4.1%	4.3%
79	0.6145	0.6410	0.6686	-4.1%	4.3%
80	0.5947	0.6206	0.6475	-4.2%	4.3%
81	0.5756	0.6009	0.6271	-4.2%	4.4%
82	0.5573	0.5819	0.6075	-4.2%	4.4%
83	0.5396	0.5636	0.5886	-4.3%	4.4%
84	0.5226	0.5460	0.5704	-4.3%	4.5%
85	0.5062	0.5290	0.5528	-4.3%	4.5%

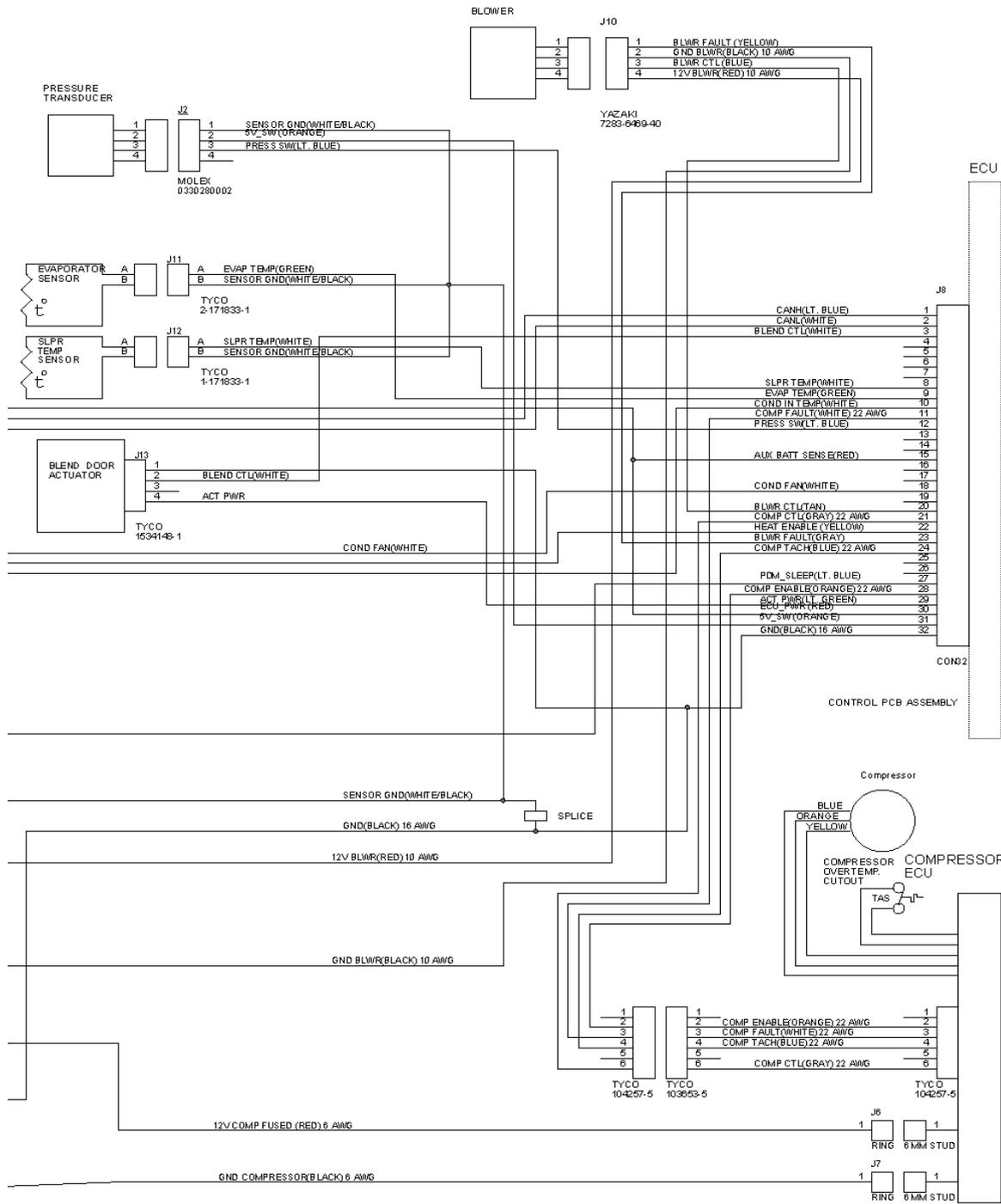
Sleeper Air Sensor Resistance Chart

	A	B	C	D
1	Sleeper, Air Temperature Sensor			
				Voltage
4	-40.0	-40.0	336500.0	4.86
5	-31.0	-35.0	242589.0	4.80
6	-22.0	-30.0	177000.0	4.73
7	-13.0	-25.0	130370.0	4.64
8	-4.0	-20.0	97070.0	4.53
9	5.0	-15.0	72929.0	4.40
10	14.0	-10.0	55330.0	4.24
11	23.0	-5.0	42315.0	4.04
12	32.0	0.0	32650.0	3.83
13	41.0	5.0	25388.0	3.59
14	50.0	10.0	19900.0	3.33
15	59.0	15.0	15708.0	3.06
16	68.0	20.0	12490.0	2.78
17	77.0	25.0	10000.0	2.50
18	86.0	30.0	8057.0	2.23
19	95.0	35.0	6531.0	1.98
20	104.0	40.0	5327.0	1.74
21	113.0	45.0	4369.0	1.52
22	122.0	50.0	3603.0	1.32
23	131.0	55.0	2986.0	1.15
24	140.0	60.0	2488.0	1.00
25	149.0	65.0	2083.0	0.86
26	158.0	70.0	1752.0	0.75
27	167.0	75.0	1481.0	0.65
28	176.0	80.0	1258.0	0.56

Ambient Outside Air Sensor Resistance Chart

	A	B	C	D	E
1	Ambient, Air Temperature Sensor				
2	Resistance (KOHM)				
3	Temp(°F)	Temp (°C)	Minimum	Normal	Maximum
4	-76	-60	1353.41	1596	1838.59
5	-58	-50	619.8	723.22	826.64
6	-40	-40	291.49	335.6	381.71
7	-22	-30	155.2	177.4	199.6
8	-4	-20	85.85	97.12	108.39
9	14	-10	49.25	55.34	61.43
10	32	0	29.33	32.66	35.99
11	50	10	17.99	19.9	21.81
12	68	20	11.37	12.49	13.61
13	77	25	9.12	10	10.88
14	86	30	7.37	8.06	8.75
15	104	40	4.9	5.325	5.75
16	122	50	3.33	3.605	3.88
17	140	60	2.31	3.605	2.57
18	158	70	1.63	2.49	1.87
19	176	80	1.17	1.75	1.34

AUX Control Panel is powered from the VPDM fuse 27 and also communicates through the Cabin CAN. See chassis diagrams for references.



WIRE SIZE IS 20 AWG TXLUNLESS OTHERWISE SPECIFIED

System Controller Pinout Chart

Connector Pin	Circuit ID	Wire Color	Function	Typical Voltage	Other End of Circuit
1	CANH	Yellow	CAN bus	2.5V+	Cabin CAN
2	CANL	Green	CAN bus	2.5V-	Cabin CAN
3	BLEND_CTL	White	LIN Control for actuator	0-12V serial signal	Actuator
4	N/C				
5	N/C				
6	N/C				
7	N/C				
8	SLPR_TEMP	White	Sleeper Temperature	1.5-4V	Sleeper Temp Sensor (in sleeper control panel)
9	FREEZE	Green	Evaporator Freeze protection	1.5V-4V	Freeze sensor
10	COND_IN_TEMP	White	Outside Air Temperature	1.5V-4V	Condenser Temp Sensor
11	COMP_FAULT		Compressor controller fault output	<1V (no fault) 5V (fault present)	Compressor controller
12	PRESS_SW	Lt. Blue	Liquid Line Refrigerant Pressure	0-5V	Pressure Transducer
13	N/C				
14	N/C				
15	BATT_SENSE	Red	Supply voltage sense	Supply voltage to NITE ECU and control panel	ACU Fuse (PDC)
16	N/C				
17	N/C				
18	COND_SIG	White	Condenser PWM control signal	<0.5V (off)	Condenser
19	N/C				
20	BLWR_CTL	Blue	Blower PWM control signal	2.4V-7V	Blower motor

Continued next page,

Continued,

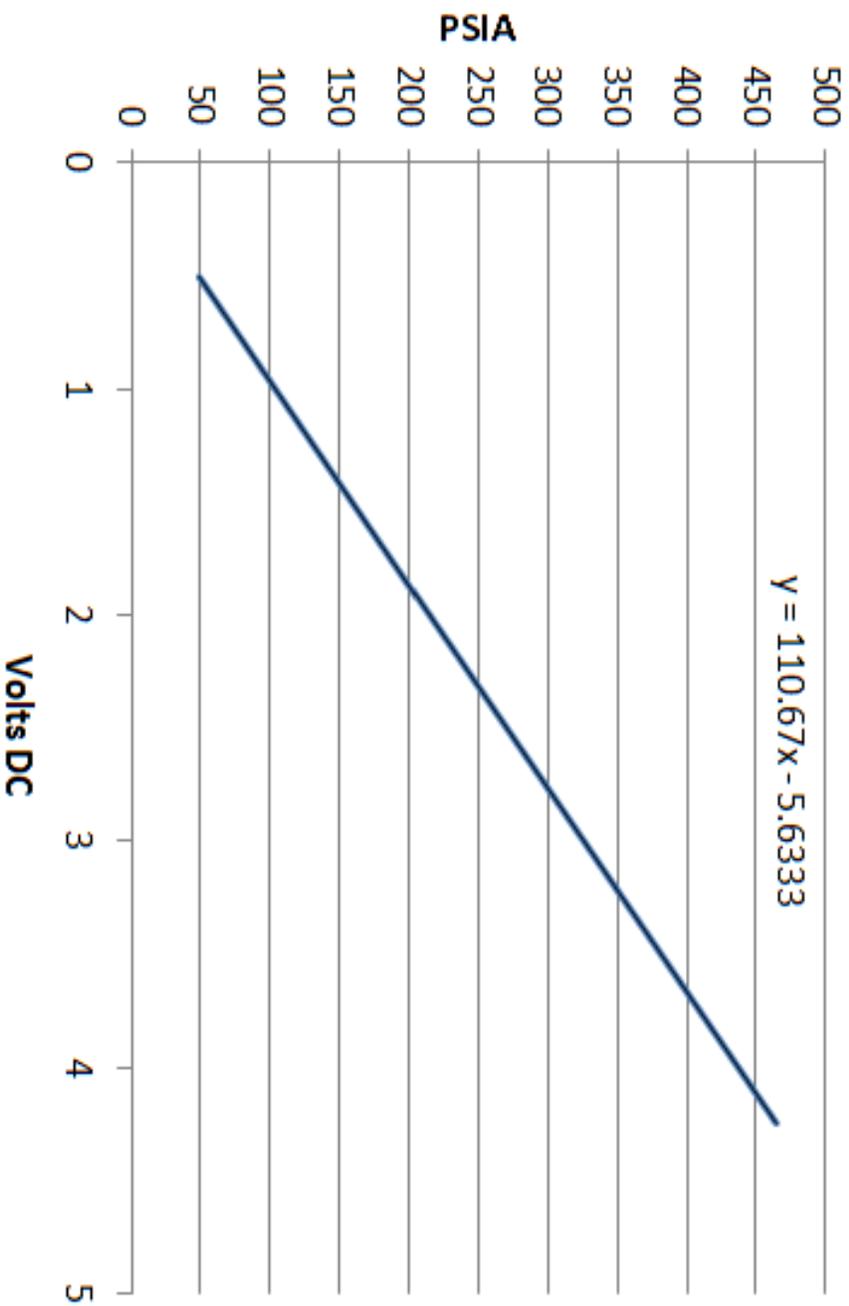
System Controller Pinout Chart

21	COMP_SPD	Grey	Compressor speed control signal	<0.6V (compressor off) 1-4V (compressor on)	Compressor Controller
22	HTR_ENABLE	Yellow	Enables Espar Heater Operation	<1V (heater off) >11V (heater on)	Underfloor connector to Espar Heater
23	BLWR_TACH	Yellow	Tach signal from blower	0-5V (pulses)	Blower motor
24	COMP_TACH	Blue	Tach signal from compressor controller	0-5V (pulses)	Compressor Controller
25	N/C				
26	N/C				
27	PDM_Wake	Lt. Blue	PDM Wakeup Signal	12V (power off) <1V (power on)	PDM
28	COMP_ENABLE	White	Compressor controller logic circuit power	<1V (compressor off) >11V (compressor on)	Compressor Controller
29	ACT_PWR	Green	Power for blend door actuator	<1V (unit off) >11V (unit on)	Blend Door Actuator
30	CTL_FUSED	Red	Power for ECU	Battery voltage	ACU Fuse (PDC)
31	5V	Red	5V Power for Pressure Transducer	4.8-5.2V	Pressure Transducer
32	Ground	Black	Ground for ECU	Ground	Harness ground splice

Fault Code List

hex DTC Number	SPN (Suspect Parameter Number)	FMI (Failure Mode Identifier)	Error text	Failure Mode Identifier
0x0B0604	1547	4	Evaporator Sensor - Shorted to ground	Voltage Below Normal, Or Shorted To Low Source
0x0B0605	1547	5	Evaporator Sensor - Shorted to battery or open circuit	Current Below Normal Or Open Circuit
0x0C0603	1548	3	COTC sensor - Voltage above normal or shorted to high source	Voltage Above Normal, Or Shorted To High Source
0x0C0604	1548	4	COTC sensor - Shorted to Ground	Voltage Below Normal, Or Shorted To Low Source
0x36FCE2	523318	2	PCU Blower - Over/Under voltage	Data Erratic, Intermittent Or Incorrect
0x36FCE7	523318	7	PCU Blower - Lock Rotor	Mechanical System Not Responding Or Out Of Adjustment
0x36FCFF	523318	31	PCU Blower - Over temperature	Condition Exists
0x44FCEB	523332	11	Temp Blend Doors Actuator - Internal Fault	Root Cause Not Known
0x6C0303	876	3	PCU Condenser in Temp - Shorted to battery or open circuit	Voltage Above Normal, Or Shorted To High Source
0x6C0304	876	4	PCU Condenser in Temp - Shorted to ground	Voltage Below Normal, Or Shorted To Low Source
0xBAFCEB	523450	11	PCU Compressor - Internal Fault	Root Cause Not Known
0xBCFCE0	523452	0	PCU Highside Pressure Sensor - Pressure High	Data Valid But Above Normal Operational Range - Most Severe Level
0xBCFCE1	523452	1	PCU Highside Pressure Sensor - Pressure Low	Data Valid But Below Normal Operational Range - Most Severe Level
0xBCFCE3	523452	3	PCU Highside Pressure Sensor - Open or Shorted High	Voltage Above Normal, Or Shorted To High Source
0xBCFCE4	523452	4	PCU Highside Pressure Sensor - Shorted to Ground	Voltage Below Normal, Or Shorted To Low Source
0xC0FCE4	523456	4	Heater enable - Shorted to ground	Voltage Below Normal, Or Shorted To Low Source

Pressure vs. Voltage



Series1
Linear (Series1)

701 — Approved Leak Detection Methods

The BPHS system uses a non-conductive compressor oil. Use only polyvinylether (PVE) refrigerant oil in this system. The system should never be recovered to check AC charge. The BPHS system does not need any oil added unless refrigerant loop components have been replaced, or the system has been recovered in excess of 4 times. Addition of improper oil types, or too much oil, will cause damage to the compressor.



CHARGE LEVEL



System refrigerant charge is 24 OZ R134a.

Always follow recommended charging instructions and use virgin refrigerant. The receiver drier contains a dye wafer.

Adding additional dye to the system is not required or recommended.

Subject: Diagnosis of Intermittent System Operation Resulting in Low or No Cooling Performance

Background

Various conditions can cause a system to operate intermittently and have little or no cooling ability. When servicing a specified unit for operation or performance, it is necessary to make sure the condenser fan is operating correctly.

The condenser fan motor may exhibit “dead spots” prohibiting start-up when the HVAC unit is turned on. This motor is made-up of 24 cog positions roughly 1½ inches apart on the condenser blade.

Driver Observation

- BPHS no-idle system is not operating continuously or no cooling.

Diagnostic Procedure for Technicians (Estimated time – 10 minutes)

1. Follow manufacture safety guidelines when servicing this vehicle. Verify the following: Engine off, key off, and parking brakes set.
2. Start the BPHS no-idle system in parked mode and adjust settings to full cold and high blower speed to which the parked button must be pushed. Visually inspect condenser fan to verify proper operation. If the condenser fan is not operating, verify for 12 volts across the red and black wires at the condenser fan plug. Also, verify signal voltage is present at the connector. **If the condenser fan has 12 volts and signal voltage but is not working properly please replace fan.**

Note: For complete fan diagnostics it is necessary to perform additional phase tests. This preliminary test in *step 2* only confirms the condenser fan operates on one phase of the motor.

If the condenser fan appears to be working properly continue diagnostic and verify the following:

3.  Disconnect power to the condenser fan before advancing through the diagnostic procedure. Failure to follow this step may cause bodily injuries to yourself and/or others as well as damages to the specified unit. This warning is for your protection and information.
4. Remove all 17 mounting screws from the condenser fan cover.
5. Mark “fan blade” with silver permanent marker as shown. This will be the home location.



Location 1

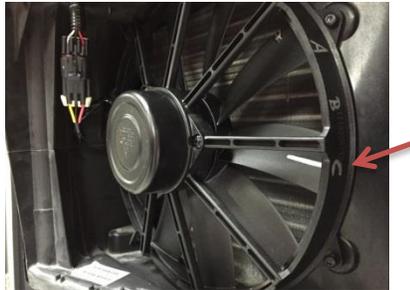


Mark “A” as the first test location

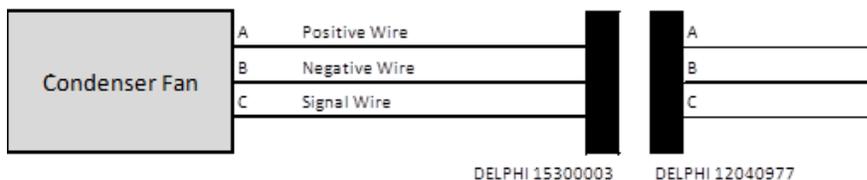
6. Rotate clockwise 1 cogging torque position and mark the second test location “B”.



7. Rotate clockwise 1 cogging torque position and mark the third test location “C”.



8. Return fan blade to the home location (“A”) and reconnect power to the condenser fan.
9. Start the BPHS no-idle system and adjust settings to full cold and high blower speed. Visually inspect condenser fan to verify proper operation. If the condenser fan is not operating, verify for 12 volts across the red and black wires at the condenser fan plug. Also, verify signal voltage is present at the connector. **If the condenser fan has 12 volts and signal voltage but is not working properly**

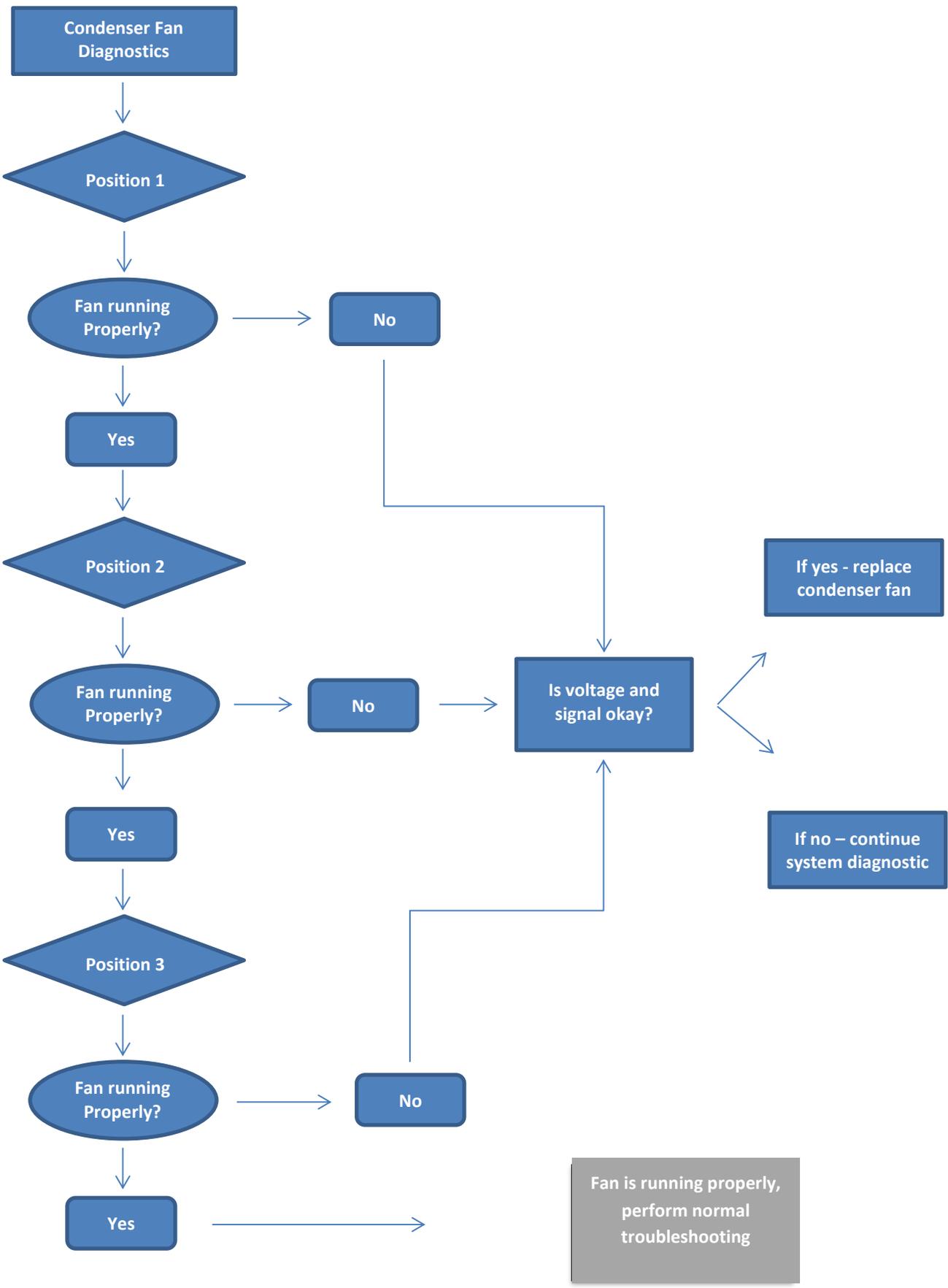


please carry out the service replacement procedure.

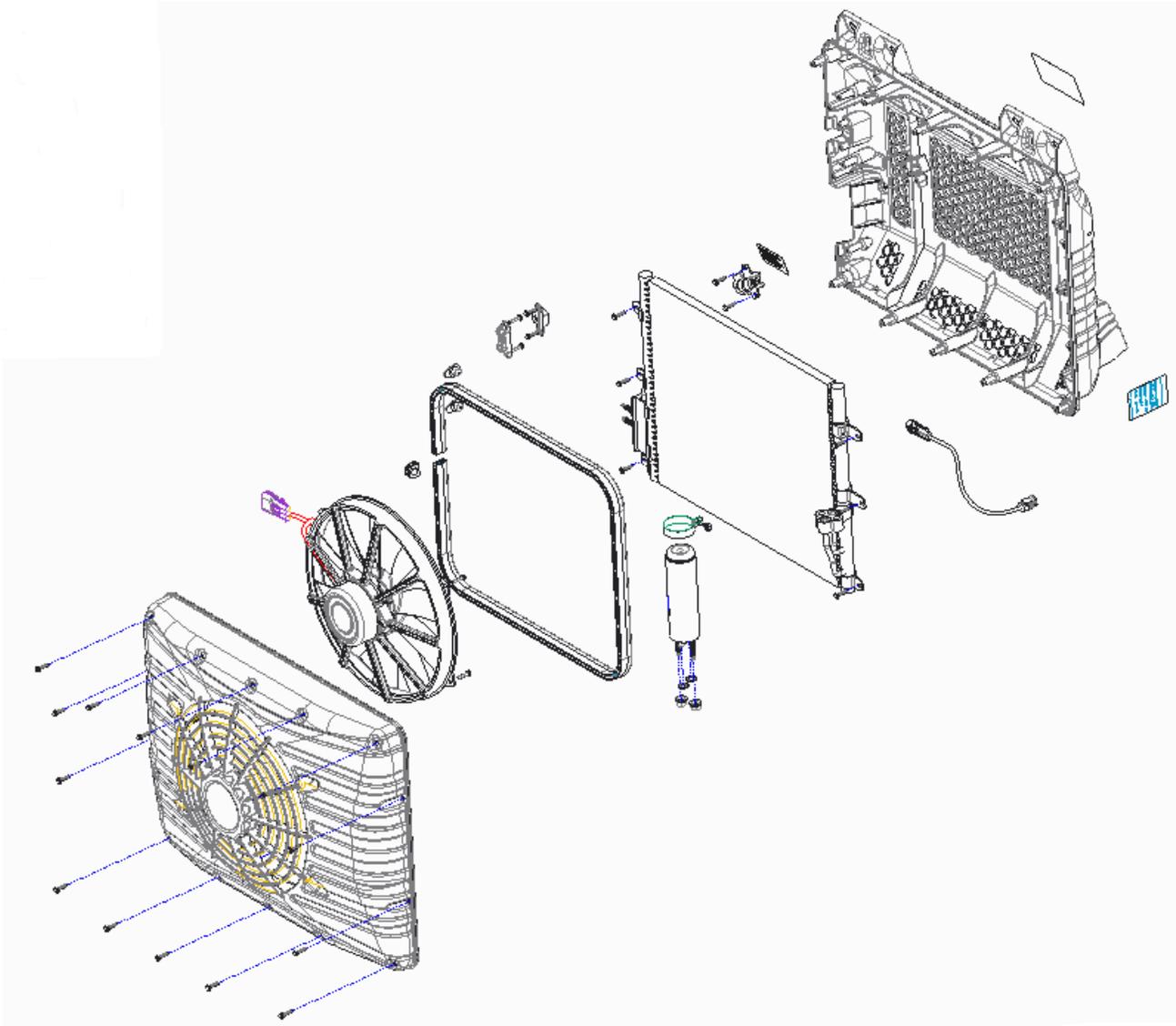
10. Once fan has been confirmed functional, shut down the BPHS no-idle system and disconnect power to the condenser fan.
11. Wait until the fan completely stops running.
12. Repeat steps 9-11 for test locations B and C.
13. If the condenser fan is working properly in positions A, B, and C the diagnostic procedure is complete. No further testing is required. Reconnect the condenser fan and reinstall the cover.

Service Replacement Procedure (Only required for confirmed failures)

1. Verify the BPHS no-idle system is turned off and the condenser fan power harness has been disconnected.
2. Remove all the condenser fan mounting hardware and remove the fan from the assembly.
3. Mount the new condenser fan assembly and install the fasteners at 20 in/lbs torque. Do not overtighten.
4. Reconnect the condenser fan and reinstall the cover.
5. Retest BPHS unit – follow step 9 above.



Condenser Unit Exploded View



! Cleaning Condenser: “It is recommended to clean the condenser coil every 25k miles in the summer months with an A/C core cleaner that is approved for copper and aluminum cores. Additionally, low pressure water can also be used to clean it. It is also recommended to use a core cleaner that is non caustic, detergent-based alkaline coil cleaner, biodegradable, and releases no VOCs.”

All system controllers!



Attention: Removing the phase harness for testing

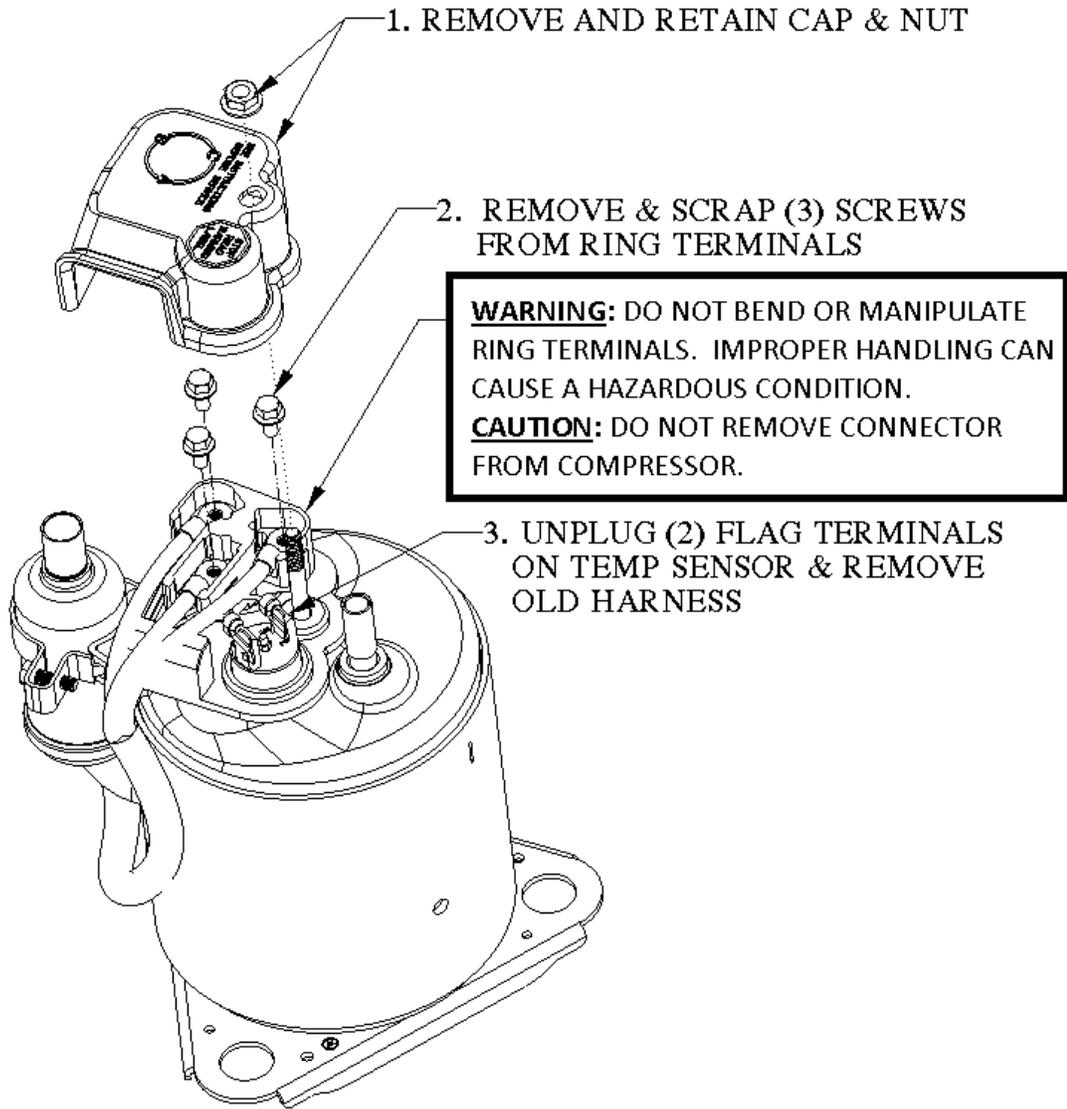
Operating the system for troubleshooting purposes with the phase harness disconnected can result in a locked out system.

With no active fault codes, the controller should always attempt to start the compressor up to 10 times in a period of approx. 2 minutes; even when the phase harness is disconnected. If the controller does not see the compressor start after 10 attempts, it will time out and stop sending voltage to the compressor. The controller will remain in locked out mode until power is cycled. Please make sure the time does not expire during the test procedure. If necessary, cycling the power switch off and back on will reset the controller. NOTE: "The compressor could take up to 2 minutes to start up after the power switch has been cycled."

Service Instructions for Phase Harness / Ring Terminal Compressor Only



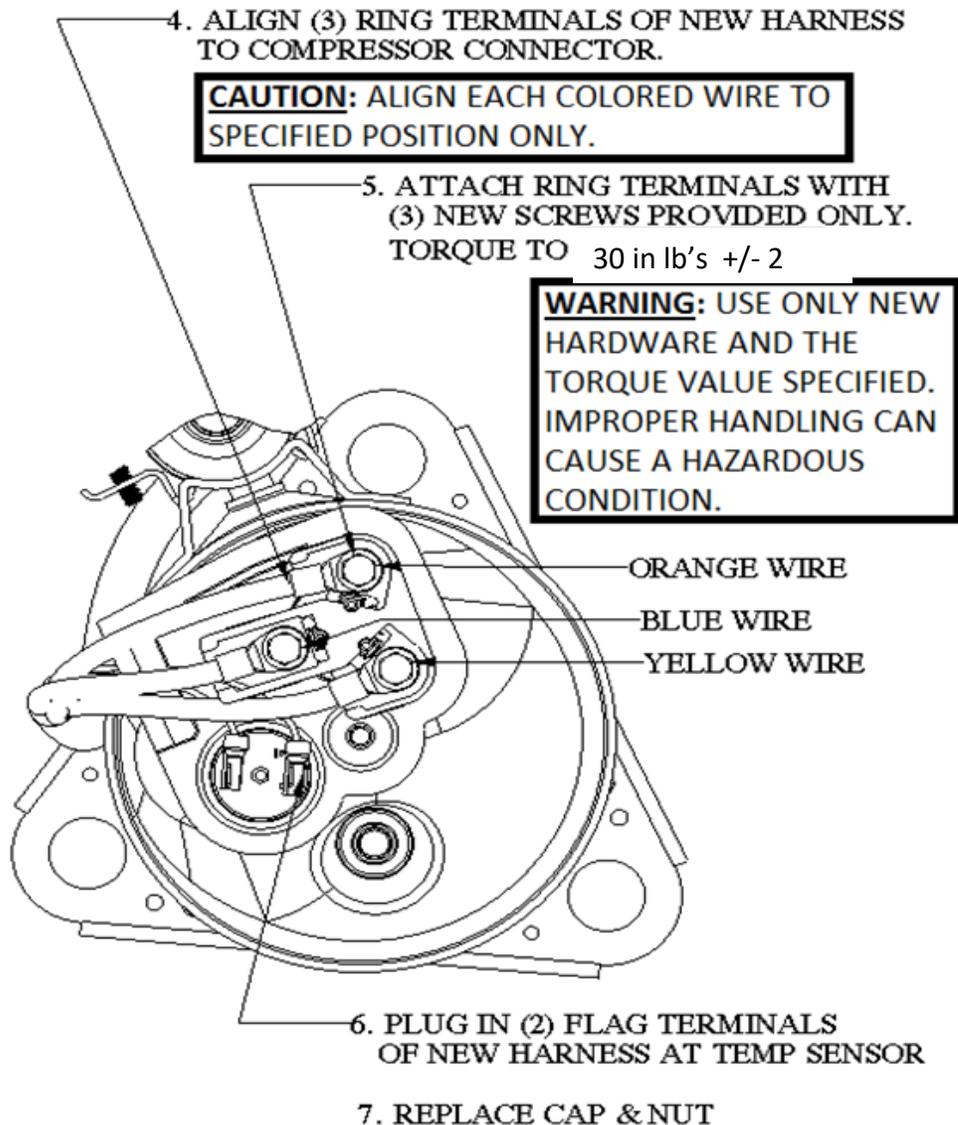
WARNING: To avoid potential property damage or personal injury, Read Important Safety Warnings and ALL instructions before attempting to install or service product.



Service Instructions for Phase Harness / Ring Terminal Compressor Only

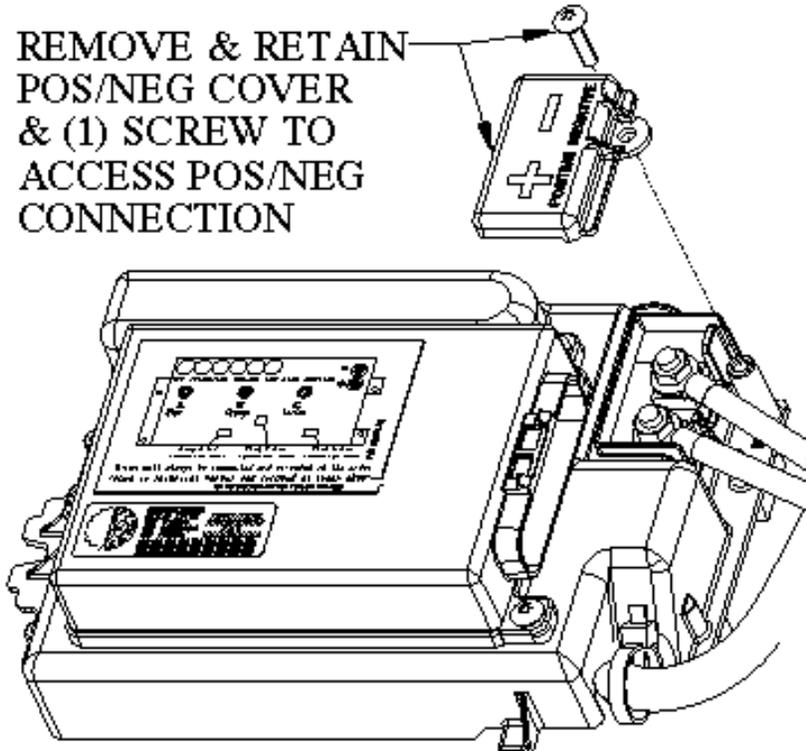


WARNING: To avoid potential property damage or personal injury, Read Important Safety Warnings and ALL instructions before attempting to install or service product.



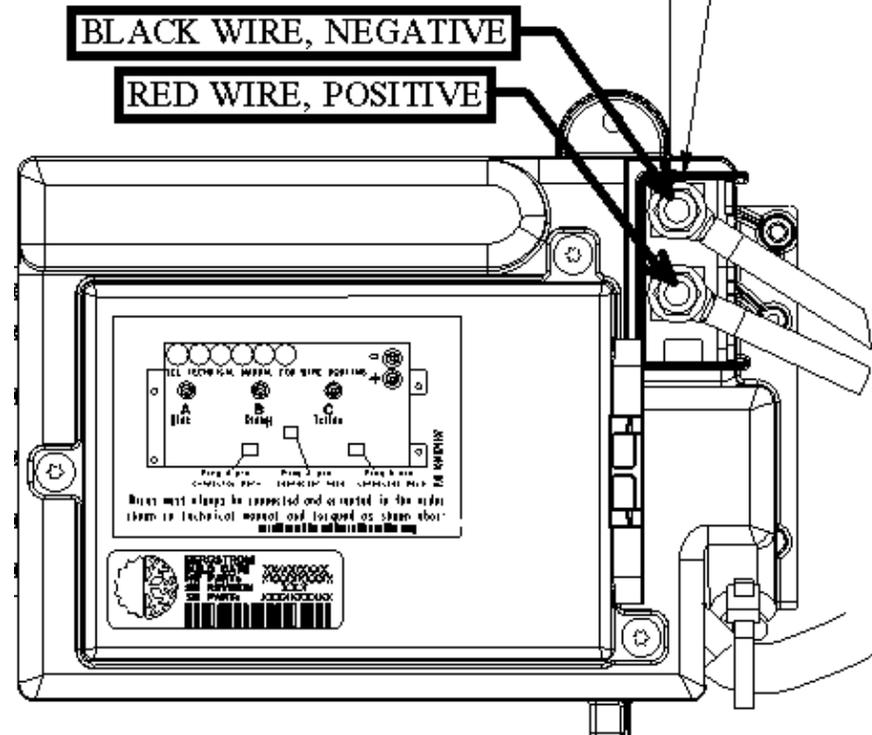
! WARNING: TO AVOID ELECTRIC SHOCK AND PREVENT ARCING AND DAMAGE TO HARNESS AND CONTROLLER, ! DISCONNECT POWER FROM SYSTEM PRIOR TO SERVICING!

1. REMOVE & RETAIN POS/NEG COVER & (1) SCREW TO ACCESS POS/NEG CONNECTION



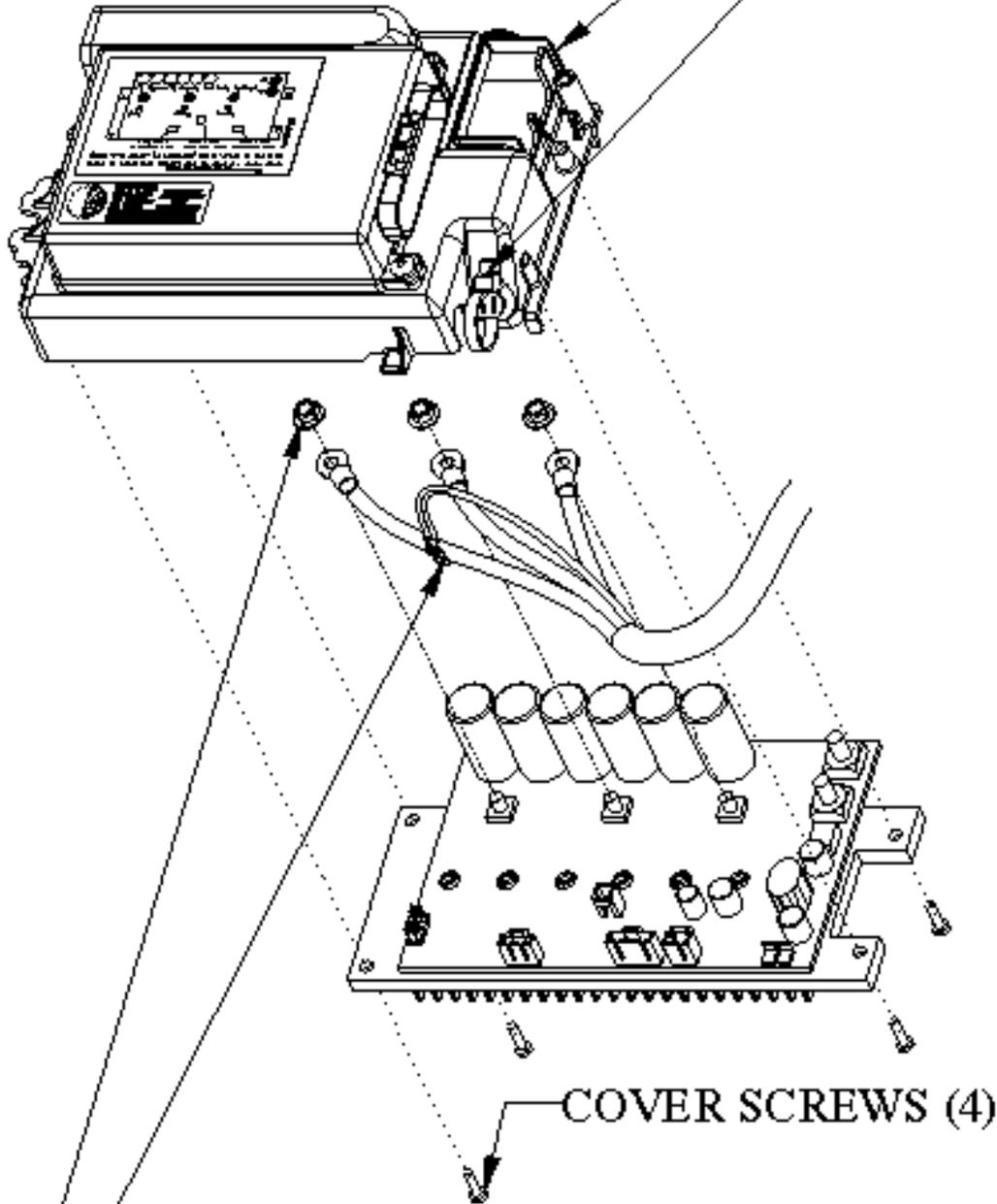
2. REMOVE & SCRAP (2) NUTS

3. REMOVE RED (POS) & BLACK (NEG) RING TERMINALS FROM POSTS ON PCB



4. CUT & SCRAP WIRE TIE
HOLDING PHASE HARNESS

5. REMOVE & RETAIN COVER
ASSEMBLY & (4) SCREWS



6. UNPLUG 2-PIN CONNECTOR FROM
PCB & REMOVE PHASE HARNESS

7. REMOVE (3) NUTS HOLDING PHASE
HARNESS RING TERMINALS TO PCB.

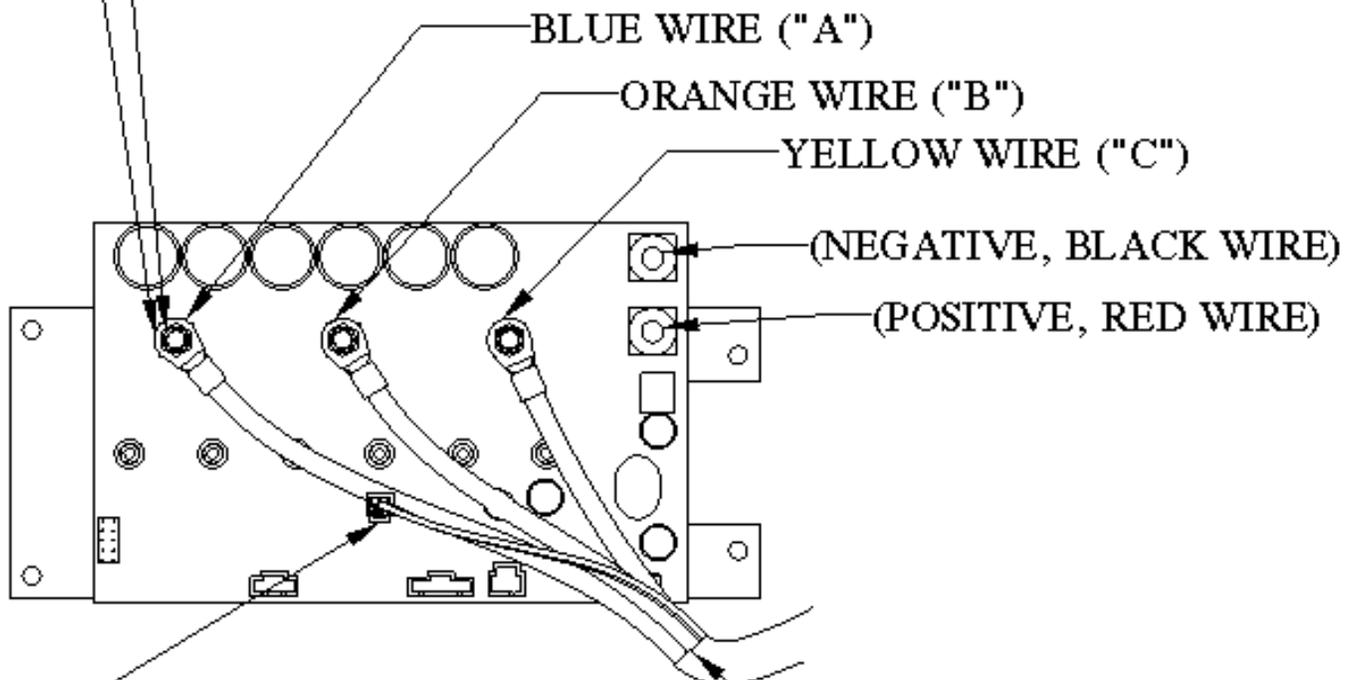
8. SLIDE (3) RING TERMINALS OF PHASE HARNESS OVER THREADED POSTS OF PCB.

CAUTION: ALIGN EACH COLORED WIRE TO SPECIFIC THREADED POST IDENTIFIED ONLY.

SECURE WITH 3 NUTS REMOVED IN STEP 7.

TORQUE TO **20 ± 2 INCH-LBS**

CAUTION: USE ONLY THE TORQUE VALUE LISTED WHEN INSTALLING PHASE HARNESS TO PCB!



10. PLUG 2-PIN CONNECTOR OF NEW HARNESS INTO PCB

ORIENT RING TERMINALS AND ROUTE HARNESS OUT OF COVER AS SHOWN

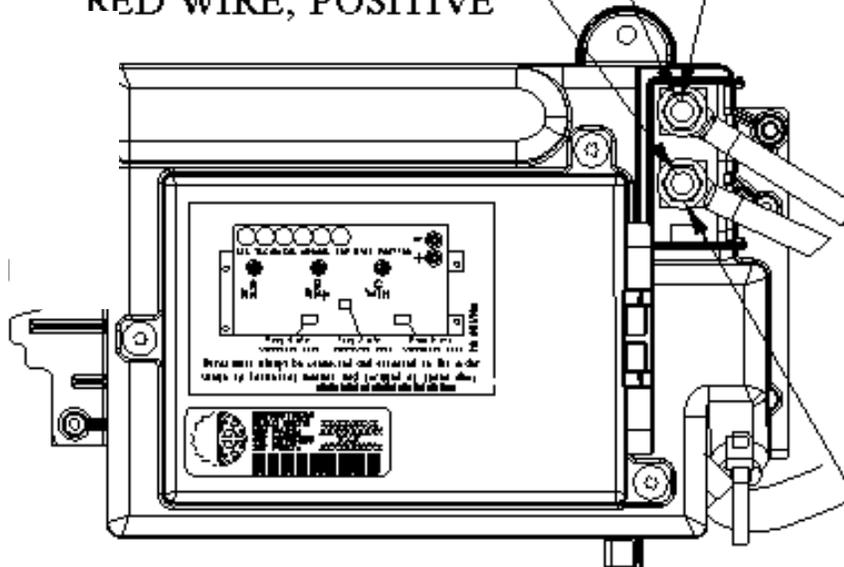
11. REPLACE COVER ASSEMBLY & (4) SCREWS.
SECURE NEW WIRE-TIE (PROVIDED)
AROUND PHASE HARNESS

12. SLIDE BLACK AND RED RING TERMINALS OF UNIT HARNESS OVER THREADED POSTS OF PCB.

WARNING: ALIGN BLACK AND RED WIRES TO SPECIFIC THREADED POST IDENTIFIED ONLY. REVERSING THE POLARITY CAN CAUSE A HAZARDOUS CONDITION.

BLACK WIRE, NEGATIVE

RED WIRE, POSITIVE



13. SECURE WITH (2) NEW, LARGE NUTS PROVIDED ONLY.

TORQUE TO 38 in lbs +/- 2



CAUTION: USE ONLY NEW HARDWARE AND THE TORQUE VALUE SPECIFIED.

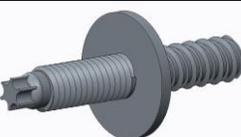
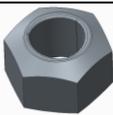
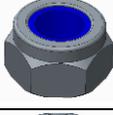
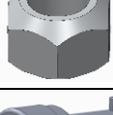
14. REPLACE SMALL (POS/NEG) COVER & (1) SCREW

CAUTION: DO NOT ALLOW THE RING TERMINALS OF THE BLACK AND RED WIRES TO BE IN CONTACT AFTER ROUTING WIRES AND REPLACING COVERS.

Appendix AA:

44G HVAC UNIT TORQUE SPECS

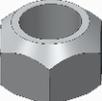
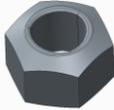
updated 26Mar2018

GRAPHIC	QTY	WHERE USED	DESCRIPTION	TORQUE Nm	TORQUE In-Lbs
	67	Case, Heater & Evap Covers, Blower	#8-16 x 19.1 Tri-Lobe Screw	2.3 +/- 0.22	20 +/- 2
	5	TXV Cover	#8-16 x 19.1 Tri-Lobe Hex Screw	2.3 +/- 0.22	20 +/- 2
	4	TXV	M5 Socket HD Cap x 45L Screw	9.5 +/- 1.0	84 +/- 8.9
	3	Compressor-Phase Harness	#10-32 x 0.5, Hex Conical Sems Screw	3.4 +/- 0.22	30 +/- 2
	6	Bottom Case	M8 Stud, Hi/Lo	9.5 +/- 1.0	84 +/- 8.9
	3	Slimline Fitting, TXV	M8 x 1.25 x 51 Stud	2.8 +/- .28	25 +/- 2.5
	7	Cond. Conn., Slimline Fitting, TXV Insulation	M8 x 1.25 Serr Hex Flange Nut	11 +/- 2	100 +/- 10
	1	PDM	M6 Tri-Lobe Locknut	4.3 +/- 0.22	38 +/- 2
	3	Compressor Holddown	8mm Locknut	2.3 +/- 0.22	20 +/- 2
	1	Compressor stud	1/4 - 28 Hex Flange Nut	2.3 +/- 0.22	20 +/- 2
	1	Controller - Phase Harn, PDM	M5 x 0.8 Hex Locknut	2.3 +/- 0.22	20 +/- 2
	1	TXV	Pressure Transducer	7.0 +/- 1	62 +/- 9

44G CONDENSER UNIT TORQUE SPECS

GRAPHIC	QTY	WHERE USED	DESCRIPTION	TORQUE Nm	TORQUE In-Lbs
	30	Cases, Fan & Sensor Brackets	#8-16 x 19.1 Tri-Lobe Hex Screw	1.7 +/- 0.5	15 +/- 4
	2	Receiver Drier	M8 – 1.25 Nut w/ Conical Keps Washer	15 +/- 2	133 +/- 18
	1	Receiver Drier Clamp	#10 – 32 x 3/8 SH SS Screw	3.4 +/- 0.22	30 +/- 2

44G SYSTEM / COMPRESSOR CONTROLLER TORQUE SPECS

GRAPHIC	QTY	WHERE USED	DESCRIPTION	TORQUE Nm	TORQUE In-Lbs
	3	Cover Top	#8 - 16 x 19.1 Tri-Lobe Screw	2.3 +/- 0.22	20 +/- 2
	8	Cover Bottom	#6 – 19 x 1/2L Hi-Lo Pan Screw	0.9 +/- 0.1	8.0 +/- 0.9
	3	Phase Harness	M5 x 0.8 Hex Locknut	2.3 +/- 0.22	20 +/- 2
	2	Main Harness Studs	M6 Tri-Lobe Locknut	4.3 +/- 0.22	38 +/- 2