Technical Information and Diagnostic Guide
for Freightliner *ParkSmart* Rev5/Split No Idle System
July 2011 to March 7, 2016

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

Beginning 3/7/2016 all (NEW) trucks are built with the <u>Optimized Idle compatible unit</u>, including (NEW) trucks that do not have Optimized Idle. Please refer to the Optimized Idle troubleshooting guide for service information.

!! Attention !!

Before proceeding with any diagnostics please call for authorization. Opening the ParkSmart Unit without authorization could void your warranty!

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

Communication

The front HVAC control unit, auxiliary control unit, and the ParkSmart internal control unit communicate over the J1939 datalink. The front HVAC control unit uses source address (SA) 25 and the auxiliary control unit uses SA 58. The internal ParkSmart controller uses SA 68. The messaging communicated is used for operation, diagnostics, and data used to monitor the system with Datalink Monitor.

Links:

NITE system	www.nitesystem.com/html/technical_docs.cfm
Battery option: East Penn	www.eastpenn-deka.com
Auxiliary Fuel Fired Coolant Heater: Espar Hydronic 5	www.espar.com

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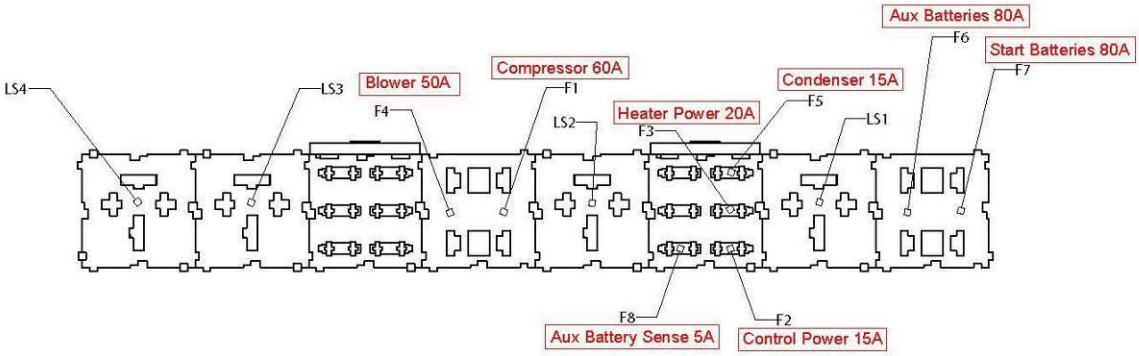
APPENDIX

A: Battery Separator

The battery separator is used for separating the trucks main starting batteries from the **AUX** batteries. It also allows the charging of the **AUX** batteries after the main truck batteries are charged above 13.2 Volts. Mounting is inside the driver's side sleeper storage area.

NOTE: **After July 2011, separator has option of Start/Interrupt and will not interchange with previous separators.**



B: Fuses located on the control center

F1 Fuse 60 Amp (Maxi)
This fuse provides short circuit protection for the compressor.

F2 Fuse 15 Amp (Mini)
This fuse provides short circuit protection for the unit controls.

F3 Fuse 20 Amp (Mini)-Heater
This fuse provides protection for the fuel operated heater.

F4 Fuse 50 Amp (Maxi)
This fuse provides protection for the evaporator blower.

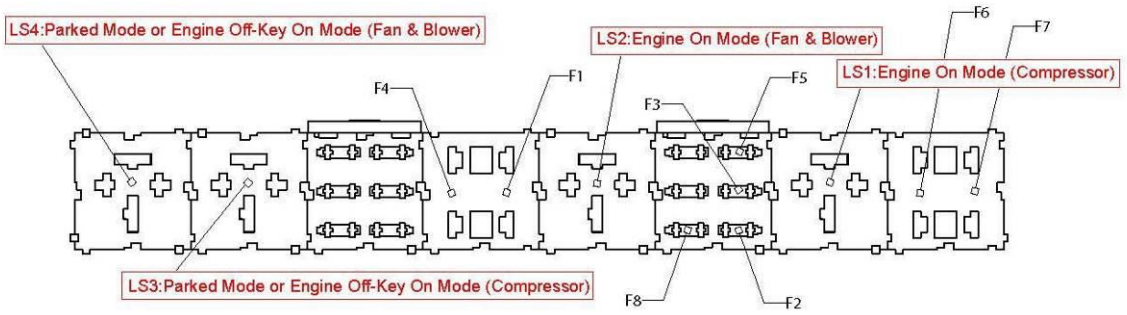
F5 Fuse 15 Amp (Mini)
This fuse provides protection for the condenser fan.

F6 Fuse 80 Amp
This fuse provides protection for the aux battery power to the ParkSmart unit.

F7 Fuse 80 Amp
This fuse provides protection for the main battery power to the ParkSmart unit.

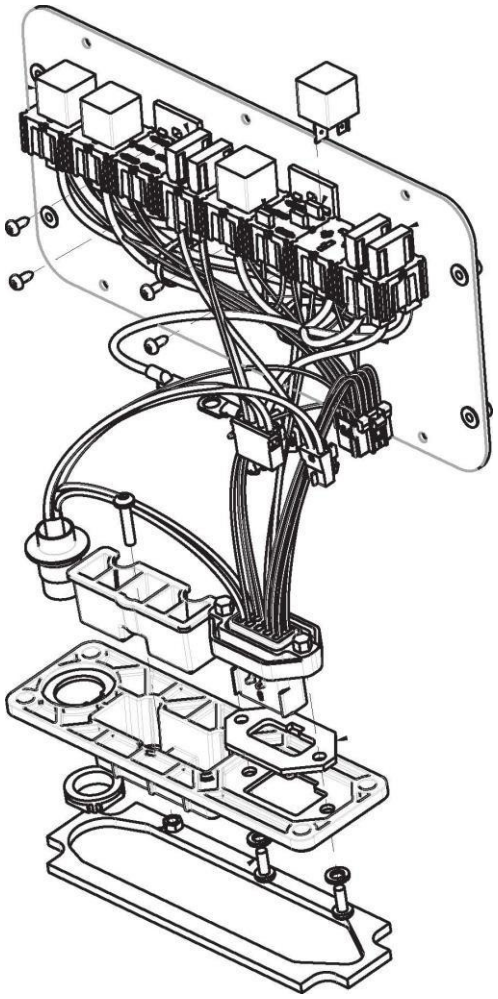
F8 Fuse 5 Amp
This fuse provides protection for the aux battery sense wire.

5 amp fuse for separator remote sense is not numbered (see wiring diagram)



C: Relays – All 100 amp

Location: On the control center



LS1. This relay controls the voltage to the compressor controlling section of the Control PCB Assembly when in the (**ENGINE ON** MODE)

LS2. This relay controls the voltage to the condenser fan and the evaporator blower when in the (**ENGINE ON** MODE)

LS3. This relay controls the voltage to the compressor controlling section of the Control PCB assembly when in the (**PARKED MODE** OR **ENGINE OFF-KEY ON** MODE)

LS4. This relay controls the voltage to the condenser fan and the evaporator blower when in the (**PARKED MODE** OR **ENGINE OFF-KEY ON** MODE)

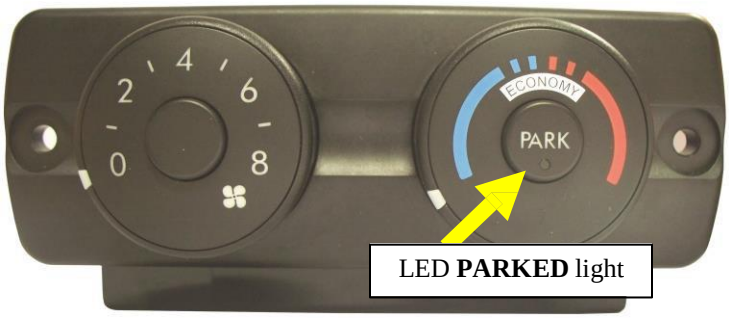
D: Blend Door Actuator

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

E: AUX Control Panel

Backlights light for 8 seconds when touched in Park mode.

Operates like standard auxiliary HVAC when the engine is running.



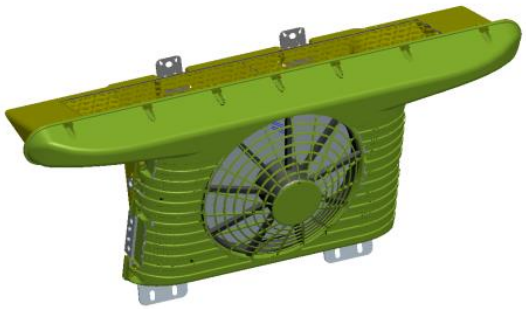
Pushing "PARKED" button with engine off/brakes set starts parked mode and illuminates parked button LED.

Unit exits parked when, engine is started, unit is shut off or Parked batteries are depleted.

F: Condenser Fan

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.

Prior to 10-2015



New model beginning 10-2015 has serviceable receiver drier

⚠**Cleaning condenser – See page 33**

G: Ambient Outside Air Sensor

This sensor monitors the air at the condenser coil. See appendix O Page 19 for test instructions. Part no. 1000281234

H: Refrigerant Charge Port

A: Control PCB Assembly

This device stores the operating program and controls the **ParkSmart** Unit, as well as controls the output voltage to the variable speed compressor. It is located in the upper section next to the evaporator blower. **NOTE:** Photo (A) PCB assembly will not interchange with any Rev 3/4B unit built prior to July 2011.

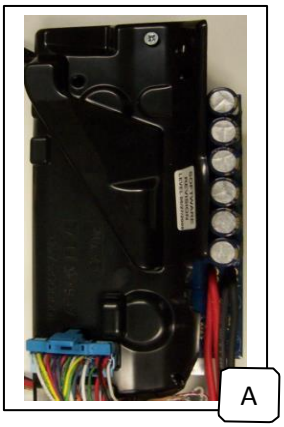
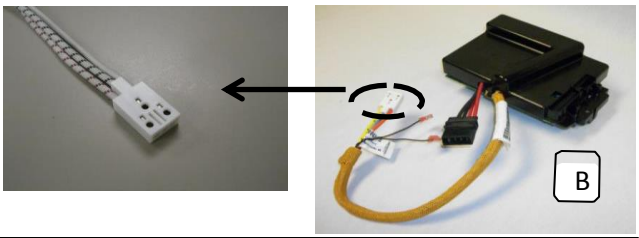


Photo (B) shows Control Assembly for units built after March 6, 2012 with a cluster block connection.



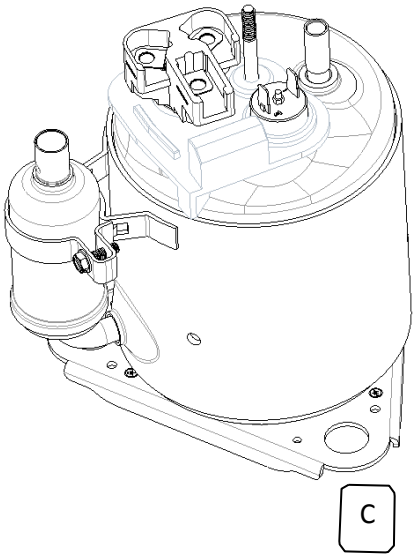
WARNING: System controllers do not interchange! Please verify your controller matches the chassis.

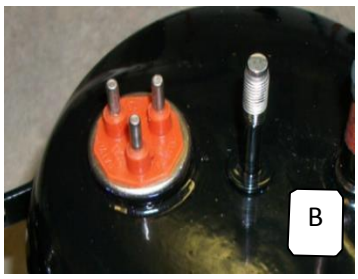
NON opt Idle trucks built before 3-7-2016 use a battery separator and require a non-opt Idle system controller.

B: Compressor

This unit is part of the hermetically sealed refrigeration system.

Units built prior to March 6, 2012 use flag terminals, (Photo A). Units built March 6, 2012 to Oct, 2015 use cluster block terminals, (Photo B). Units built from October 2015 to current use ring terminals, (Photo C).





For servicing cluster block Harness or Controller, follow instructions on pages 34-36.

For servicing RING TERMINAL harness or controller, follow instructions on pages 37-40.

New 10-2015

C: Thermal Limit Switch on Compressor

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

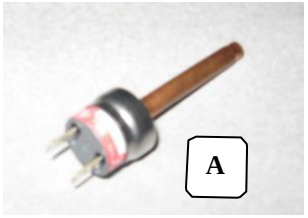
D: Evaporator Blower

This blower pulls air through the evaporator coil to cool the interior of the sleeper.

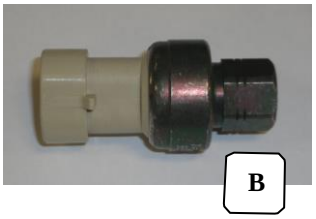
<u>Blower motor change 4-2015. Installing a new style motor in an older unit will require a jumper harness.</u>

E: High Pressure Switch

Units built before March 22, 2012 use (A). This normally closed, brazed pressure switch will open and prevent the operation of the compressor if high internal pressure develops in the system. It is NOT serviceable.

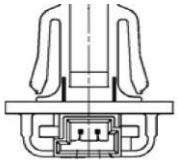


<u>Units built after March 22, 2012 use a serviceable Schrader mounted switch (B). This binary switch opens for low or high-high side pressure.</u>



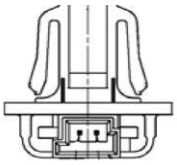
F: Evaporator Sensor/Freeze Switch

This sensor stops and prevents the operation of the compressor if ice was to form on the evaporator coil. See appendix G for test instructions.



G: Sleeper Sensor

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



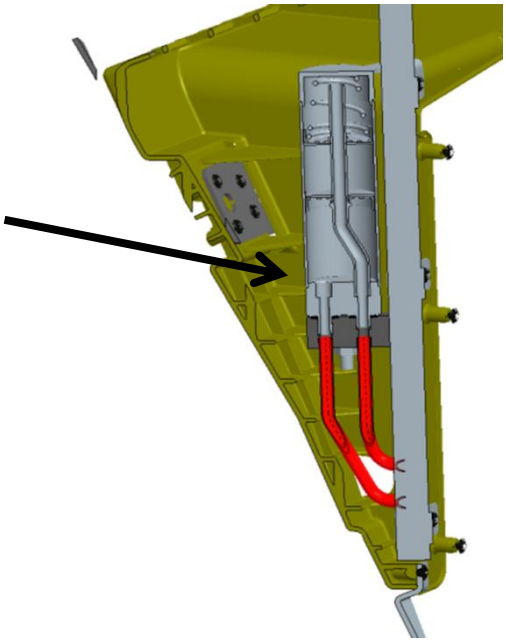
H: Evaporator inlet filter:

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.

I: Receiver Drier / is serviceable

Beginning in 10- 2015, Parksmart steel condenser assembly was changed to a plastic model which contains a serviceable receiver dryer. Drier connections use slim line seals. System also contains refrigerant dye.

Caution: Steel condenser and plastic condenser have unique line sets and WILL NOT INTERCHANGE!



ParkSmart System Diagnostic Table

TRUCK MUST BE IN PARKED MODE TO PERFORM DIAGNOSTIC TESTS!

For additional wiring diagrams and J1939 fault codes see Freightliner doc # C02.03

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

Removing fuse f2 for 5-10 seconds will reset the main system controller to factory default settings.

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION / SEE APPENDIX
Unit Will Not Run or Turn On	1. Loose connection 2. No power is available at the unit. 3. Blown fuse or fuses 4. Defective AUX Control panel. 5. Lost signal to Aux Control Panel - WAKE UP 6. Control PCB Assembly defective. 7. Park Switch defective or wrong logics. 8. No 12 volts to pin C3 battery sense. 9. Broken wire or defective wire harness 10. Parked button illuminates for a couple of seconds but unit does not run.	1. Confirm all connections are tight, including ground lugs, and terminals crimped on wires and battery cables. 2. Check **AUX** batteries for voltage. Low voltage cut out 11.3 3. Check F2 fuse for continuity and/or voltage and 12 volt input at pin C1 on Control PCB Assembly. See appendix F. 4. Check for 12 volts and ground at AUX control panel. See appendix C 5. Check Wake up signal pin D6 on Control PCB Assembly. See appendix C and /or I. 6. Test Control PCB Assembly. See appendix I 7. Truck parked 0 volts to pin C4. Brakes released 12 volt to pin C4. Check for input. See Pin Out Chart 8. Check fuse F8 12V power signal from Aux batteries to pin C3 on PCB assembly. See appendix I 9. Inspect all wiring and harness connections. 10. Check for loss of communication on Can Bus J1939. Check for loss of wake up signal (switched to ground) from control to pin D6 on Control PCB Assembly. See appendix C 11. Incorrect park brake switch will prevent unit from operating. Check signal on system controller C4. See pin out chart.
Unit runs in parked mode but not engine running mode.	1.Broken wire to relay to LS1 and/or LS2 relays 2. LS1 and / or LS2 relay defective 3. Fuse F2 blown 4. Lost output (ground) from Control PCB Assembly pin D10 and/ or D11 going to LS1 and LS2 relays.	1. Inspect all wiring and harness connections. 2. Check connections and test both relays. See appendix D 3. Check fuse. See appendix F 4. Determine if ground from Control PCB Assembly has failed. See appendix I
Unit runs in ***Engine On*** mode, but not ***Engine Off***	1. Low Aux Batteries 2. Park Brake Signal 3. Wake Up Signal 4. Relays LS3/LS4 5. Wiring Harness 6. Aux Battery Voltage	1. Check Aux batteries and battery separator. See Appendix A & B 2. Park brake switch defective, wiring harness issue or wrong switch logics 3. Loss of wake up signal. Check Aux control panel and control PCB Assy. See Appendix C & I. 4. Check relays and wiring. See Appendix D 5. Check wiring harness connectors and physical condition. 6. Check for Aux battery voltage (12V) at the control PCB Assy pin C3.

TRUCK MUST BE IN PARKED MODE TO PERFORM DIAGNOSTIC TESTS!

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

Unit Runs - But Does Not Blow Cold Air CHECK SERVICE LINK Also see C02.03 section-7 Cooling Performance	Check Service Link for faults (Examples) • Ambient outside air temperature • Evaporator temperature / freeze sw. • Sleeper Temperature • Refrigerant pressure binary switch 1. Evaporator airflow blockage. 2. Check Sensors 3. Thermal Expansion Valve 4. Overcharged refrigerant system 5. Condenser fan or coil blocked 6. Compressor Fuse or Relay. 7. Blend door position. 8. Evaporator blower. 9. Compressor controller & phase harness connections. 10. Compressor thermal switch. 11. High side pressure switch 12. Loss of charge. (refrigerant system is serviceable) 13. Defective compressor	See fault code list for complete listing 1. Clear any blockage from recirculation filter, grill and louvers. 2. Check evaporator / sleeper / ambient air sensors. See appendix G, N, and O 3. Thermal expansion valve – refrigerant flow - see appendix G 4. Overcharged system – see appendix E 5. Check condenser fan, inlet and outlet for restriction (outside behind sleeper). See appendix J & W and pages 30-33. 6. Check F1 fuse and PARKED MODE LS3 relay. See appendix F and D. Confirm all wire harness plugs are connected. 7. Check blend door operation. See appendix M 8. Check Evaporator blower. See appendix K. 9. Check Control PCB Assembly and power to compressor. See appendix I and pages 34-40 10. Check thermal switch. See appendix H 11. Check pressure switch (Normally Closed). Switch open low at 29-35 psi and opens high at 420-430 psi. See appendix E 12. If all tests check OK a loss of charge may have occurred. Check for pressure switch fault. Follow Freightliner service instructions. 13. If all above items are ok and power is detected at the compressor but it does not operate, the system refrigeration loop must be replaced. See Freightliner service instructions.
Unit Cycles On And Off	1. Poor electrical connection. 2. Condenser fan inoperative. 3. Air flow blockage causing high pressure or freeze condition. 4. Condenser coil blocked or fan not operating	1. Check all electrical connections. 2. Check condenser fan. See appendix J & W 3. Check for restricted airflow under truck at condenser inlet and outlet and at louvers and recirculation grill. Check pressure switch and/or freeze switch. See appendix E and G 4. Check fan and/or clean coil. See appendix J & W & pages 30-33.
Unit Blows Cold Air, But Low Airflow	1. Check all duct work connections. 2. Evaporator coil or filter blocked 3. Evaporator blower motor	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 K
Unit Runs Correctly, But Less Than Expected Run Time	1. Ground terminal(s). 2. **AUX** batteries weak or not charged correctly. 3. Separator not functioning correctly. 4. Trucks main batteries poor condition 5. High amperage draw 6. Defective Outside air temperature sensor. 7. Improper PCB Assembly (Opt-Idle) used	1. Inspect and tighten ALL connections. 2. Check battery condition / state of charge. See appendix A 3. Check separator connections and operation. See appendix B 4. Check Main truck batteries for condition and state of charge. See appendix A 5. 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 6. Energy management stops/ amp usage will increase. See appendix O. 7. Could affect run time and starting batteries.
Unit is Noisy or Vibrates	1. Evaporator Blower motor. 2. Condenser fan motor. 3. Compressor mounting.	1. Check evaporator blower. See appendix K 2. Check condenser fan. See appendix J & W & pages 30-33 3. Check rubber compressor mounts. See appendix L
Unit runs but does not blow hot air	1. Heater power and ground 2. Heater fuse 3. Wiring harness 4. Heater enable signal 5. Blend Door 6. Park Brake switch	1. Check for power at the heater pins 1 & 2 2. Check heater fuse F3. See page 5 3. Check wiring harness connectors and physical condition 4. Check heater enable 12V at heater pin 7 from PCB pin C15 5. See appendix M 6. Incorrect park brake switch will prevent heater from operating.

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

Appendix

A. Battery Condition and Performance:

Battery Voltage is critical for system operation. Special attention should be given to both sets of batteries.

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

Standard alternator 270 Amp.

Load test and maintain batteries as required by the manufacturer.

B. Separator

Check the voltage of the trucks main batteries on the separator (main) battery terminal.

With the truck not running the truck battery Voltage should be under 13 Volts. Anytime the truck main battery voltage is **below 12.5** the separator contacts will be open.

Start the truck. When a Voltage of 13.2 on the truck batteries is reached, the separator contacts will close, and allow power to begin charging the **AUX** batteries. You should see a voltage increase going into the **AUX** batteries. Using a clamp on DC ammeter you will see the rate of charge going to the batteries.

When this occurs, the separator is working correctly.

If the separator does not close or closes and does not allow charging to the AUX batteries, replace the separator.

***Please note**: It is normal for the separator to change back and forth between charging the truck bank of batteries and the **AUX** system bank of batteries, especially in the first two hours. As the truck batteries regain charge the separator will stay engaged for longer periods of time.*

START Interrupt: Rev 5 only: Battery separator will open automatically anytime the engine start is engaged. This separator will not interchange with Rev3 and Rev 4B.

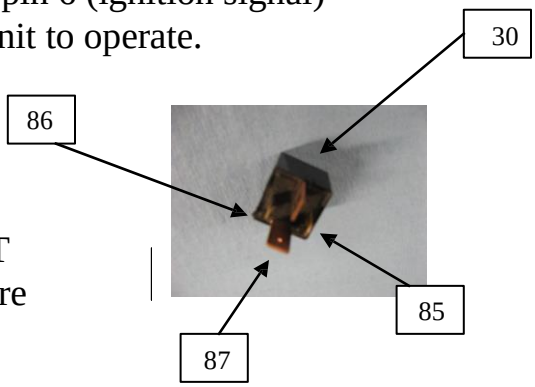
C. AUX Control Panel Testing: <u>Attention! Conduct this test with ENGINE OFF/ KEY OFF AND BRAKES SET!!!</u>

First, check for proper voltage and signal at the 6 pin connector. You should have 12 volts across pins 4 (pos) and 5 (neg). You should also have 12 volts at pin 24 (wake up signal). Pushing the parked button switches the 12 volts at pin 24 to ground, signaling the ParkSmart unit to operate.

During this test, you should not have 12 volts to pin 6 (ignition signal) and you must have Can Bus connection for the unit to operate.

D. Relay Testing

With relay unplugged, confirm there is 12 VOLT on the sockets where 85 and 30 relay terminals are connected.



If you do not have 12 VOLT here check fuses, wiring and battery connections.

<u>Now, with relay unplugged</u>, check across terminals 85 and 86 of the relay, using a continuity tester or an OHM meter. You should have continuity or an ohms value through the relay coil. If you do not, replace relay.

In Parked mode, as soon as you turn the **AUX Control Panel** blower switch on and set the temperature control to cold and push the parked button, terminals 86 on LS3 and LS4 relays become connected to ground internally on the Control PCB Assembly pins D12 and D13. When this happens the relays will pull in the contacts and allow voltage through the relays. You should now have 12 VOLT passing through the relay on spade terminal 87 of the relay. This provides power through fuses F1, F4 and F5, to the evaporator blower, condenser fan and the compressor controlling section of the Control PCB Assembly.

With relay plugged in: TURN THE UNIT ON IN PARKED MODE. If you do not have 12 VOLT on terminal 87, check across terminals 85 (+) an 86 (-). You should have 12 VOLT. If you have 12 VOLT here and do not have 12 VOLT on terminal 87 your relay is defective. The internal coil of the relay is energized but the contacts are not closing. (continued on next page)

Replace the relay.

If you have 12 VOLT on terminal 87 and the compressor does not run you could have a defective Control PCB Assembly or compressor. See testing Control PCB Assembly Appendix I.

E. Pressure Switch Testing: You must remove the top section of the ParkSmart unit to access the switch. Check J1939 for any fault codes. **The brazed switch is not serviceable**. This switch is normally closed and opens only on high pressure.

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 29.

The Schrader mounted switch (units after 3-22-2012) is serviceable. It opens on low or high – high side pressure. If pressure switch is open or service link shows a fault, you must connect to the loop and check system pressure. Switch opens between 27-35 psig low or 426-483 high.

When the unit is off for a few minutes, unplug the 32 pin connector on the PCB assembly and check across terminals D2 and D5, you should always have continuity. If you do not, you may have a broken wire, bad connection, pressure situation or defective switch. If the pressure, harness and connections are ok, the unit or switch will have to be replaced. Call Freightliner Dealer

F. Check continuity across fuse body (fuse does not look blown)

Remove fuse from fuse holder. Using a meter, check for continuity across the fuse. You can check for voltage across the fuse using a dc volt meter.

G. Evaporator Sensor/Freeze Switch Testing: Location: Top of unit, behind the evaporator coil, just inside the Cabinet base.

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

The freeze switch is a temperature sensor. To verify the condition you will need a Volt/OHM meter. If a freeze condition occurs, the unit will stop the compressor. If the freeze condition leaves, the compressor will restart and the **ParkSmart** unit will continue to run. See Evaporator Sensor/Freeze switch Resistance Chart 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 next to return air filter. A broken capillary tube will also cause the same condition. TXV / cap tube are not serviceable.

H. Compressor Thermal Limit Switch: You must remove the compressor cover of the ParkSmart 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.

I. Control PCB Assembly:
Do not attempt to test the controller or compressor until you have completely eliminated all other possibilities.

PCB assemblies after 3-6-2012 have removable harness and cluster block.

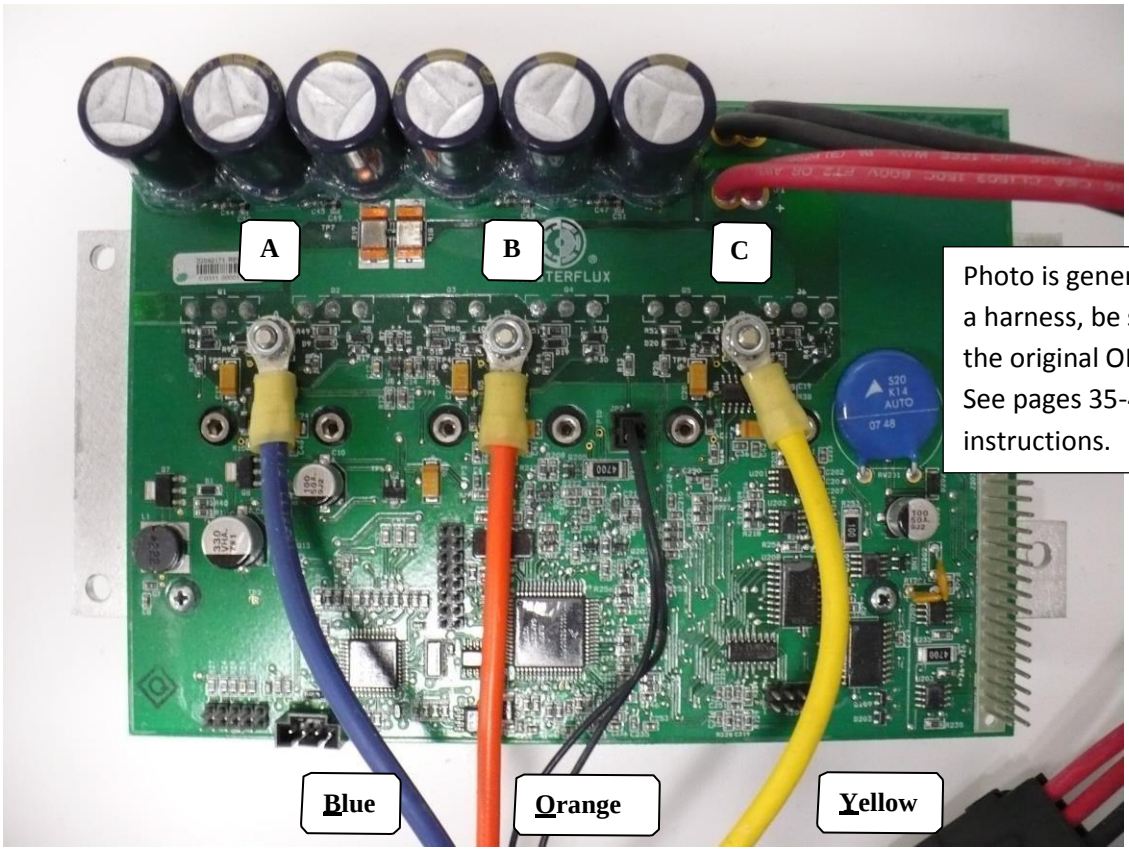


Photo is generic. If replacing a harness, be sure to follow the original OE routing path. See pages 35-40 for routing instructions.

Wires must always be connected in this order and torqued to 12-14 inch LBS (+or- .89 inlb)

In parked mode, when you turn the **ParkSmart** unit on, the compressor relay LS 3 and blower/fan relay LS 4 will close. LS 3 will send 12 VOLT main power from terminal 87, through the F 1 fuse, to the compressor controller section of the control PCB assembly. LS 4 will send main power through its terminal 87, through F 4 and F 5 fuses to the blower and fan. If all other conditions are ok, such as the high pressure switch, freeze switch and the compressor thermal limit switch, the compressor controller will then send voltage out to the compressor.

Check for 12 VOLT from the F2 fuse going to the PCB controller pin C1. Also check fuse F8, 12 volts, to pin C3 (Aux Battery Sense). If Aux battery voltage is below 11.3 the ParkSmart unit will not operate in parked mode. Before condemning an internal component or unit, try operating the unit with engine running.

!!! Cluster Block units – see instructions page 34-36!!!
Ring Terminal Units – Follow steps below - also see pages 37 – 40.

If you have the correct voltage in you should have voltage out on the three phase wires connected to the compressor. Remove controller cover. Disconnect the three phase wires from the controller.

NOTE: See warning on page 34 for testing controller with phase wires disconnected!

Using a volt meter 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 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.

Wiring diagrams located after appendix
Controller pin-out table located after appendix

J. Condenser Fan Motor Testing: First do a visual inspection of all fan parts. See Appendix pages 30/33. Condenser is located outside the truck on rear sleeper wall.

Reconnect any wires or plugs you might have disconnected when removing the cover. Turn the Parked Unit on, if you do not have 12 volt at the fan, check fuse F5 And relay LS4. If you have 12 VOLT main power, check for the signal voltage from pin C 7 (white wire). You should have zero voltage with unit off and 1.6 to 3.9 volts unit on. If all voltages are correct, reconnect the plug. If the fan does not run, see additional tests on pages 30-33.

Using a DC ammeter you can check the amperage draw of the blower. Normal amps approx. **9.5** max.

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

NOTE: 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.

K. Evaporator Blower Motor Testing: First do a visual inspection of all blower parts.

Check J1939 for any fault codes. For evaporator fan location see Freightliner instructions.

Reconnect any wires or plugs you might have disconnected when removing the cover. Turn the **Parked Unit on** and check for 12 VOLT at the unit side of the wiring harness. If you do not have 12 volt, check fuse F4 and relay LS4. If you have 12 VOLT main power, check for the signal voltage from pin C 13 (tan wire). You should have 10 volts on low speed and approx. 6 volts at high speed. If all voltages are correct, reconnect the plug. If fan does not run, it is defective, and needs to be replaced.

Using a DC ammeter you can check the amperage draw of the blower. Normal amps approx. **10** on high

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

Blower motor change 4-2015. Installing a new style motor in an older unit will require a jumper harness.

L. Compressor Rubber Mounts:

Visual inspection of the compressor rubber mounts may be necessary if excessive vibration is present. Check for loose mounting nuts. If mounting nuts and captive studs are ok, vibration could be from the internal part of the compressor. If so call your Freightliner dealer.

M. Blend Door Actuator: For blend door location see Freightliner ParkSmart documents. Check J1939 for any fault codes.

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

This actuator motor drives the blend door. Each time the unit is powered up the door sets to full cold. Removing the F2 fuse will reset the unit and the blend door.

When in the heat mode the blend door will direct recycled 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 2 on the actuator, this is power for pin C8 on the Control PCB Assembly. Use a common ground to check 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.

N. Sleeper Temperature Sensor: Location see Freightliners instructions
This sensor monitors sleeper internal temperature. See chart 2 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.

O. Ambient Outside Air Temperature Sensor:
This sensor monitors the Ambient air temperature. See chart 3 for testing data.

If this sensor fails, the power management system stops and although the unit will still operate, the total run time of the battery pack will be reduced. It is located in the condenser unit outside the truck on rear sleeper wall.

Evaporator Sensor/ Freeze switch Resistance Chart

	A	B	C	D
1	Evaporator Sensor			
2				
3	Temp(ºF)	Temp (ºC)	Resistance (nominal)	Voltage (nominal)
4	-40.0	-40.0	92757.0	4.554
5	-31.0	-35.0	66870.0	4.402
6	-22.0	-30.0	48790.0	4.215
7	-13.0	-25.0	35937.0	3.991
8	-4.0	-20.0	26757.0	3.732
9	5.0	-15.0	20103.0	3.443
10	14.0	-10.0	15252.0	3.133
11	23.0	-5.0	11664.0	2.81
12	32.0	0.0	9000.0	2.488
13	41.0	5.0	6998.0	2.175
14	50.0	10.0	5485.0	1.882
15	59.0	15.0	4330.0	1.613
16	68.0	20.0	3443.0	1.374
17	77.0	25.0	2757.0	1.164
18	86.0	30.0	2221.0	0.982
19	95.0	35.0	1800.0	0.826
20	104.0	40.0	1468.0	0.695
21	113.0	45.0	1204.0	0.585
22	122.0	50.0	993.2	0.493
23	131.0	55.0	823.2	0.415
24	140.0	60.0	685.8	0.351
25	149.0	65.0	574.2	0.297
26	158.0	70.0	482.9	0.252
27	167.0	75.0	408.3	0.215
28	176.0	80.0	346.8	0.184
29	185.0	85.0	295.6	0.157

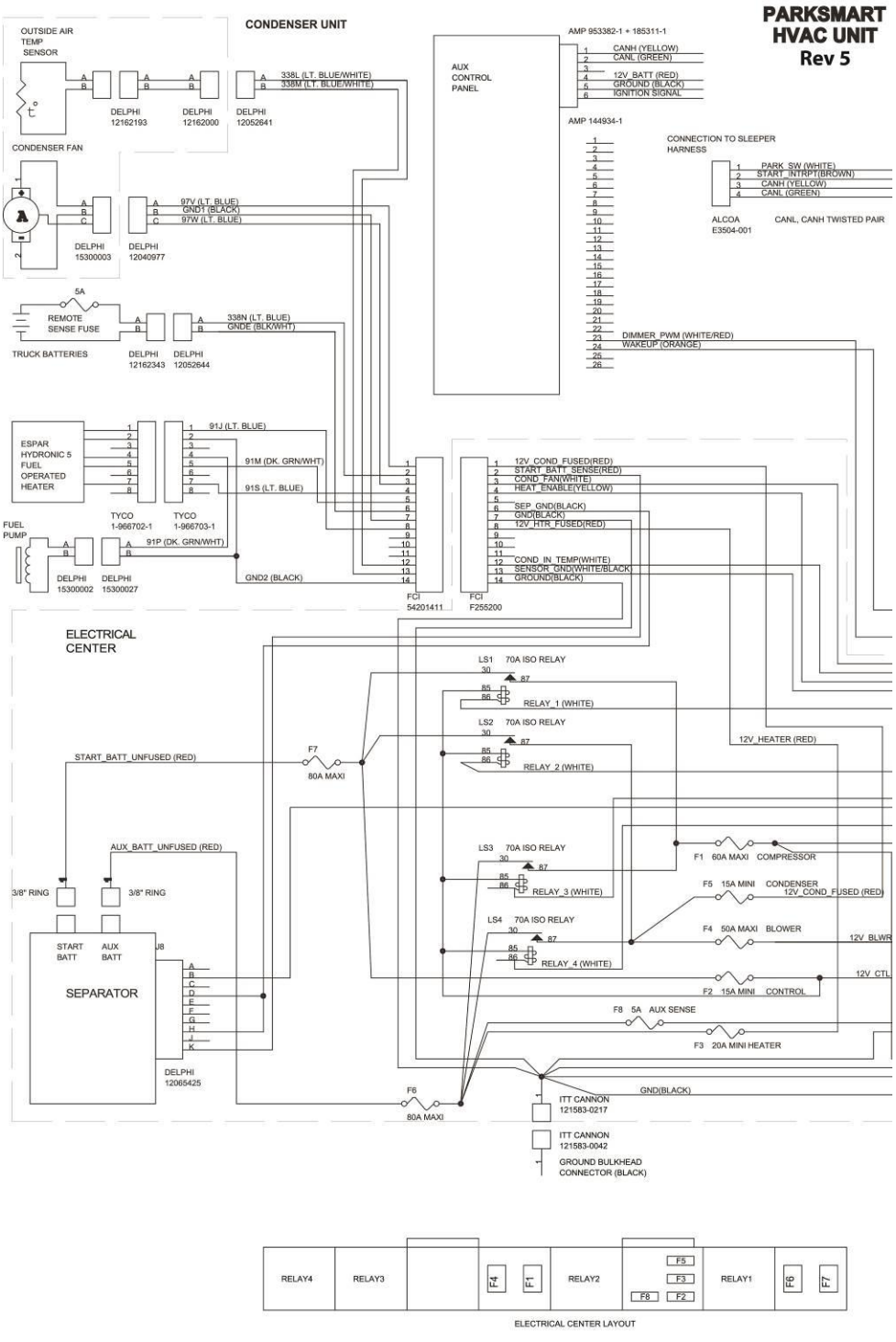
Sleeper Air Sensor Resistance Chart

	A	B	C	D
1	Sleeper, Air Temperature Sensor			
2				
				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

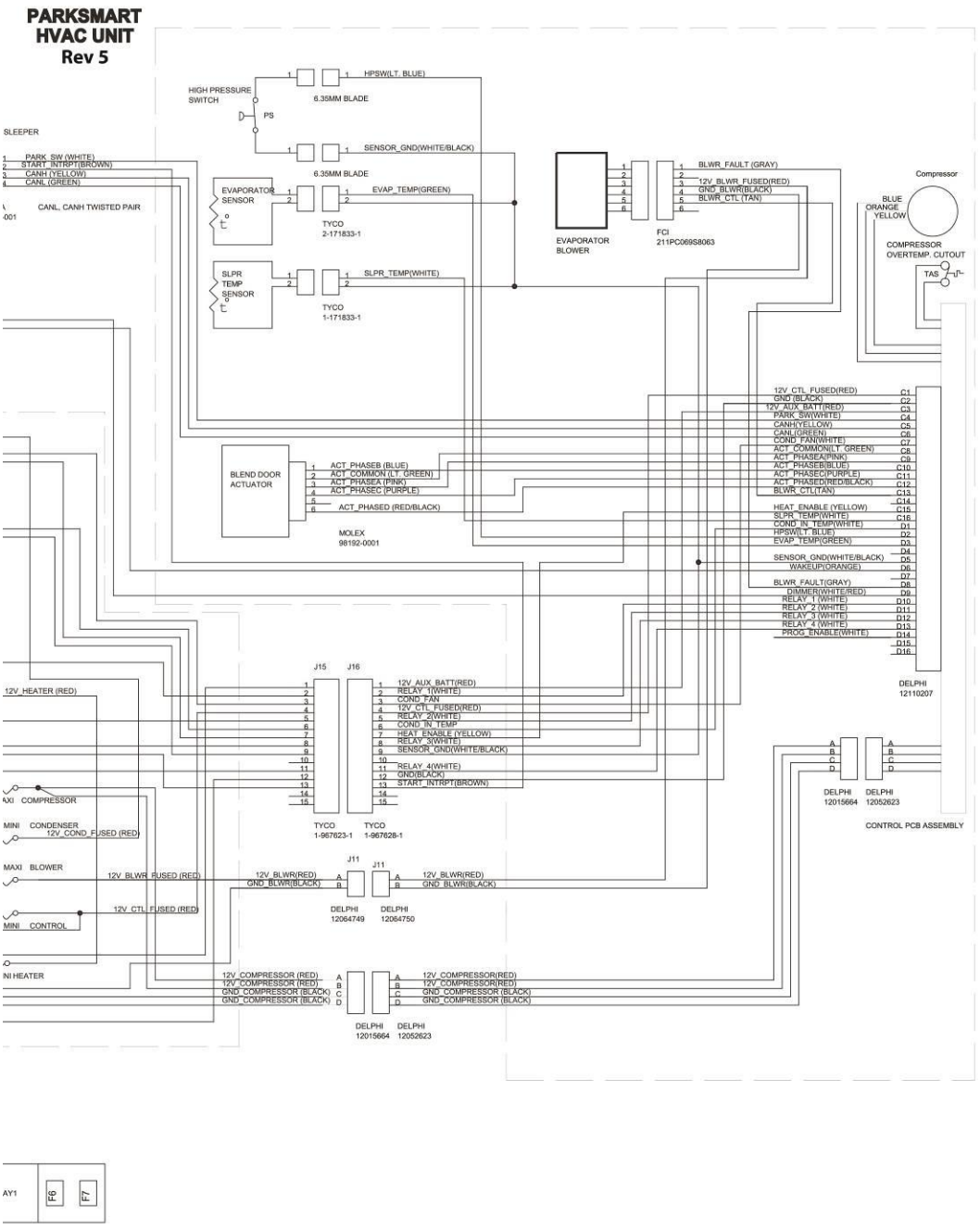
Ambient Outside Air Sensor Resistance Chart

	A	B	C	D	E
1	Ambient, Air Temperature Sensor				
2			**Resistance (KOHM)**		
3	Temp(ºF)	Temp (ºC)	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

For REV 5 Split Units built before 4/14 2015

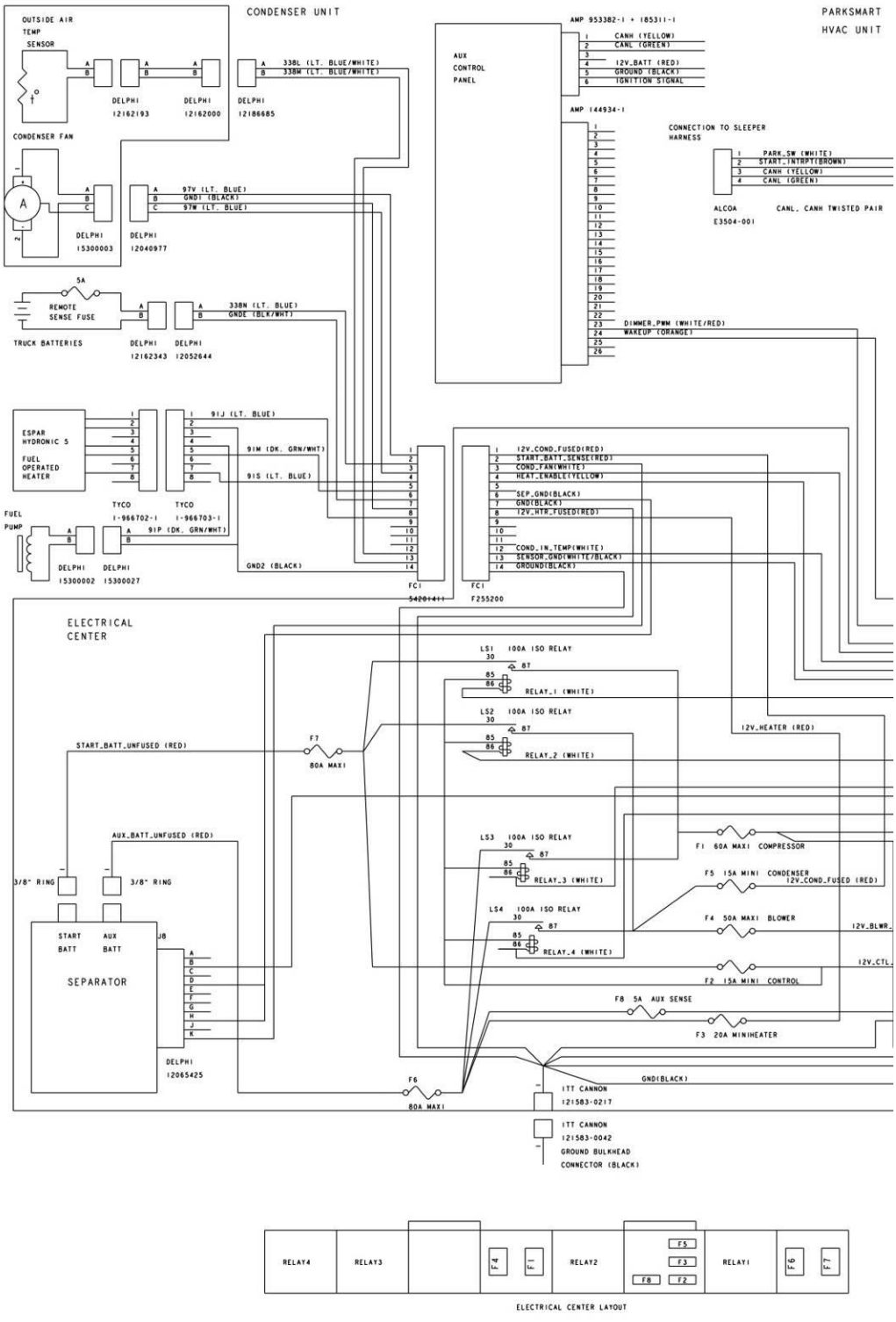


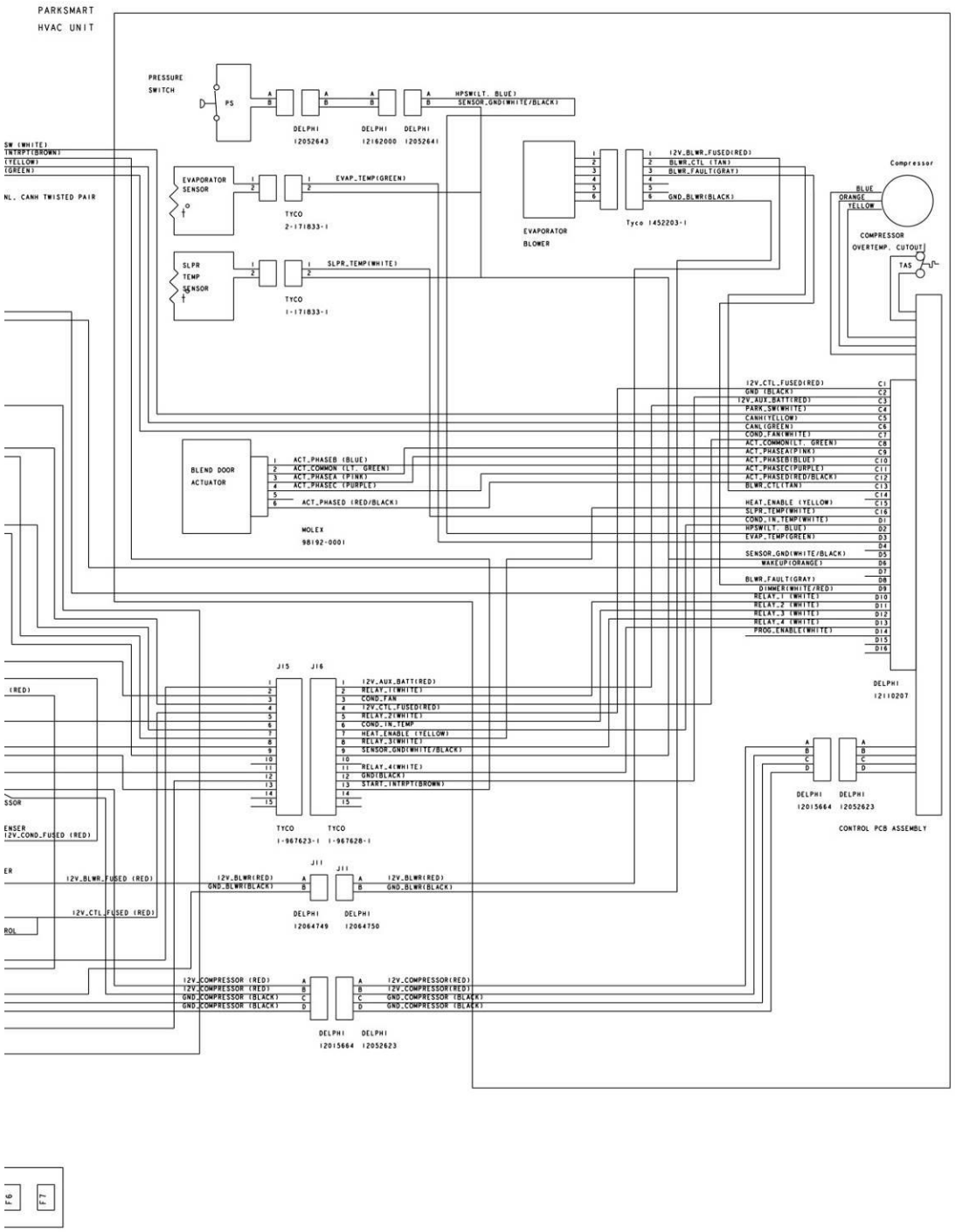
Blower motor change 4-2015. Installing a new style motor in an older unit will require a jumper harness.



For REV 5 Split Units built before 4/14 2015

For REV 5 Split Units built after 4/14 2015





For REV 5 Split Units built after 4/14 2015

Control module pinout with functional information

Pin	Circuit ID	Wire Color	Function	Typical Voltage	Other End of Circuit
C1	12V_CTL_FUSED	Red	12V power from main batteries for controls	12-14V	Control fuse F2
C2	GND	Black	Ground for controls	0V	Black bulkhead connector
C3	12V_AUX_BATT	Red	Sense wire for aux. battery voltage	Must be above 11.3V	Blue bulkhead connector
C4	PARK_SW	White	Input from parking brake switch	11.5-14V - parking brake released, <0.5V - parking brake engaged	4 way connector near electrical cneter
C5	CANH	Yellow	J1939 Can bus HI	2.5V bus idle, 3.5V active	4 way connector near electrical cneter
C6	CANL	Green	J1939 Can bus LO	2.5V bus idle, 3.5V active	4 way connector near electrical cneter
C7	COND_FAN	White	PVM ground switched output to control condenser fan speed	0V fan off, 1.6-3.9V cooling mode	Condenser fan (3 way connector)
C8	ACT_COMMON	Lt. Green	12V power for blend door actuator	11-14V	Blend door actuator (top of unit)
C9	ACT_PHASEA	Pink	Ground switched output to blend door motor phase	11-14VG, pulses to <0.5V when motor running	Blend door actuator (top of unit)
C10	ACT_PHASEB	Blue	Ground switched output to blend door motor phase	11-14VG, pulses to <0.5V when motor running	Blend door actuator (top of unit)
C11	ACT_PHASEC	Purple	Ground switched output to blend door motor phase	11-14VG, pulses to <0.5V when motor running	Blend door actuator (top of unit)
C12	ACT_PHASED	Red/Black	Ground switched output to blend door motor phase	11-14VG, pulses to <0.5V when motor running	Blend door actuator (top of unit)
C13	BLWR_CTL	Tan	PWM ground switched output to control blower speed	10V low speed, 6V high speed	Blower motor
C14	N/C		Not connected		
C15	HTR_ENABLE	Yellow	12V output enable FOH operation	11-14V in heat mode and parking brake engaged	4 way bulkhead connector
C16	SLPR_TEMP	White	0.5V input from sleeper temperature sensor	5V with sensor open or uplugged, 2V-3.3V with sensor plugged in	Sleeper temp sensor - near ACU on cabinet
D1	COND_IN_TEMP	White	0.5V input from outside air temperature sensor	5V with sensor open or uplugged, 2V-3.3V with sensor plugged in	Outside air temperature sensor - under control module cover
D2	PRESS_SW	Lt. Blue	Pressure switch input	11-14V If open and unit on. <1V if switch closed or unit off	High pressure switch
D3	EVAP_TEMP	Lt. Green	0.5V Input from evaporator temperature sensor	5V with sensor open or unplugged 1V-2.5V with sensor plugged in	Evaporator temperature sensor - top of unit just inside cabinet base
D4	N/C		Not conntected		
D5	SENSOR_GND	White/ Black	Ground from control module for sensor pressure switch	Ground	Temperature sensors, high pressure switch
D6	WAKEUP	Orange	Switch to Ground Input from ACU - turns on Parked unit	11-14V with control off, <1V when unit on (PARK button pressed or key on)	Yellow 26 way connector on back of ACU
D7	N/A				
D8	BLWR_FAULT	Gray	Fault input from blower - switched to ground	N/A	Blower motor
D9	DIMMER	White/Red	PVM power output to dimmer when control changed	2-3V for 8-10 seconds after changing setting	Yellow 26 way connector on back of ACU
D10	RELAY1	White	Switch to Ground ouptut to relay 1 - Compressor power from Main Batteries	<0.5V in Engine On mode, otherwise 11-14V	Relay in electrical center
D11	RELAY2	White	Switch to Ground ouptut to relay 2 - Blower/Fan power from Main Batteries	<0.5V in Engine On mode, otherwise 11-14V	Relay in electrical center
D12	RELAY3	White	Switch to Ground ouptut to relay 3 - Compressor power from AUX Batteries	<0.5V in Parked, Engine Off mode, otherwise 11-14V	Relay in electrical center
D13	RELAY4	White	Switch to Ground output to relay 4 - Blowe/Fan power from Aux Batteries	<0.5V in Parked, Engine Off mode, otherwise 11-14V	Relay in electrical center
D14	PROG_ENABLE	White	Ground input to go into reprogramming mode	Not normally used	Loose blade connector or unused fuse in electrical center
D15	N/C		Not connected		
D16	N/C		Not connected		

ParkSmart Fault Codes

Name	Description	SPN	FMI	Transmitting Module	Limitations
Evaporator Sensor	Shorted to ground	1547	4	FCU/ACU	—
Evaporator Sensor	Shorted to battery or open circuit	1547	5	FCU/ACU	—
Sleeper Sensor	Shorted to ground	1548	4	FCU/ACU/ACU	—
Sleeper Sensor	Shorted to battery or open circuit	1548	5	FCU/ACU/ACU	—
Ambient Air Sensor	Shorted to ground	171	4	FCU/ACU/ACU	—
Ambient Air Sensor	Shorted to battery or open circuit	171	5	FCU/ACU/ACU	—
Blend Door Actuator	Voltage above normal or shorted to high source	523330	3	FCU/ACU/ACU	—
Blend Door Actuator	Voltage below normal, shorted to low source or open circuit	523330	4	FCU/ACU/ACU	—
Blower Motor	Protection Mode: Voltage out of range	523318	2	FCU/ACU/ACU	Diagnostic feedback PWM signal is 10Hzzx50zxx duty cycle
Blower Motor	Protection Mode: Overcurrent or thermal protection	523318	6	FCU/ACU/ACU	Diagnostic feedback PWM signal is 10Hzzx25zxx duty cycle
Blower Motor	Protection Mode: Speed mismatch or blocked rotor	523318	7	FCU/ACU/ACU	Diagnostic feedback PWM signal is 10Hzzx75zxx duty cycle. Use of this FMI assumes a mechanical problem
Over Pressure	Refrigerant pressure open circuit	605	5	FCU/ACU/ACU	Outside temperature must be above 40ºF, sleeper temperature must be over 60ºF, and cooling must be requested. (Check at full cold temp settings)

701 — Approved Leak Detection Methods

The ParkSmart 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 ParkSmart 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.

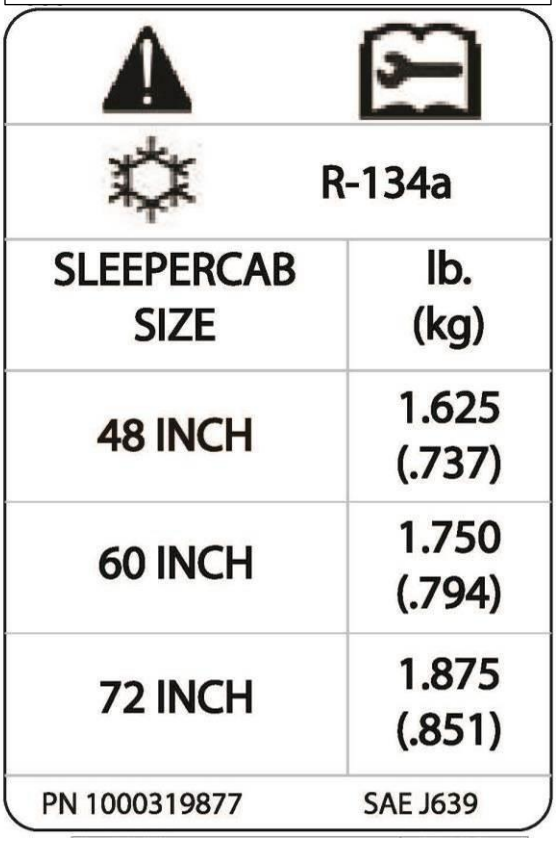
In units built from start of production through June of 2011, the ParkSmart refrigerant loop is not serviceable. When a performance complaint is coupled with evidence of a refrigerant leak, standard leak detecting methods may be employed to confirm the unit is losing refrigerant. The refrigerant type is R-134a. Follow the manufactures' operating instructions and use the leak detectors from the approved tool list to confirm suspected leaks. If a leak is confirmed on an underperforming unit, the refrigerant loop will need to be replaced with a new one.
Beginning in July of 2011 an R-134 A/C service port has been added to the high pressure side of the ParkSmart system for charging and recovery of refrigerant. Charging and recovery of this system should not be done until after the other troubleshooting methods have pointed to low or no refrigerant in the system.

CHARGE LEVELS

Refrigerant levels changed with the new Plastic condenser

Prior to 10-2015

Steel Condenser



After 10-2015

Plastic Condenser

Refrigerant level is the same for all models

See exploded view on page 33.

ParkSmart Rev. 5

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

- ParkSmart 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 ParkSmart 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 carry out the service replacement procedure. (See page 31).**

   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.

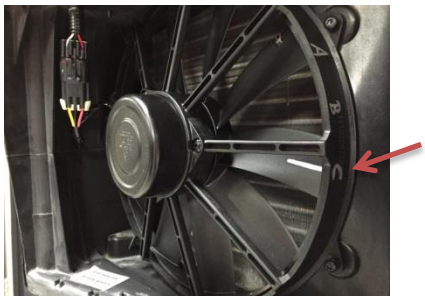
Location 1

Mark "A" as the first test location

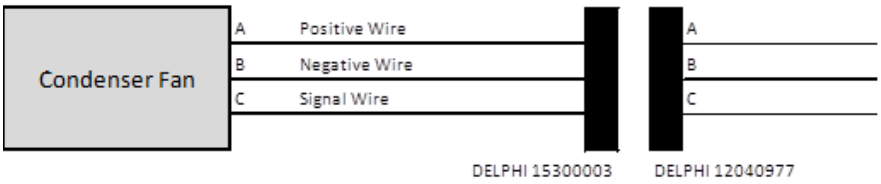
Diagnostic Procedure for Technicians (Estimated time – 10 minutes) - Continued

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”.



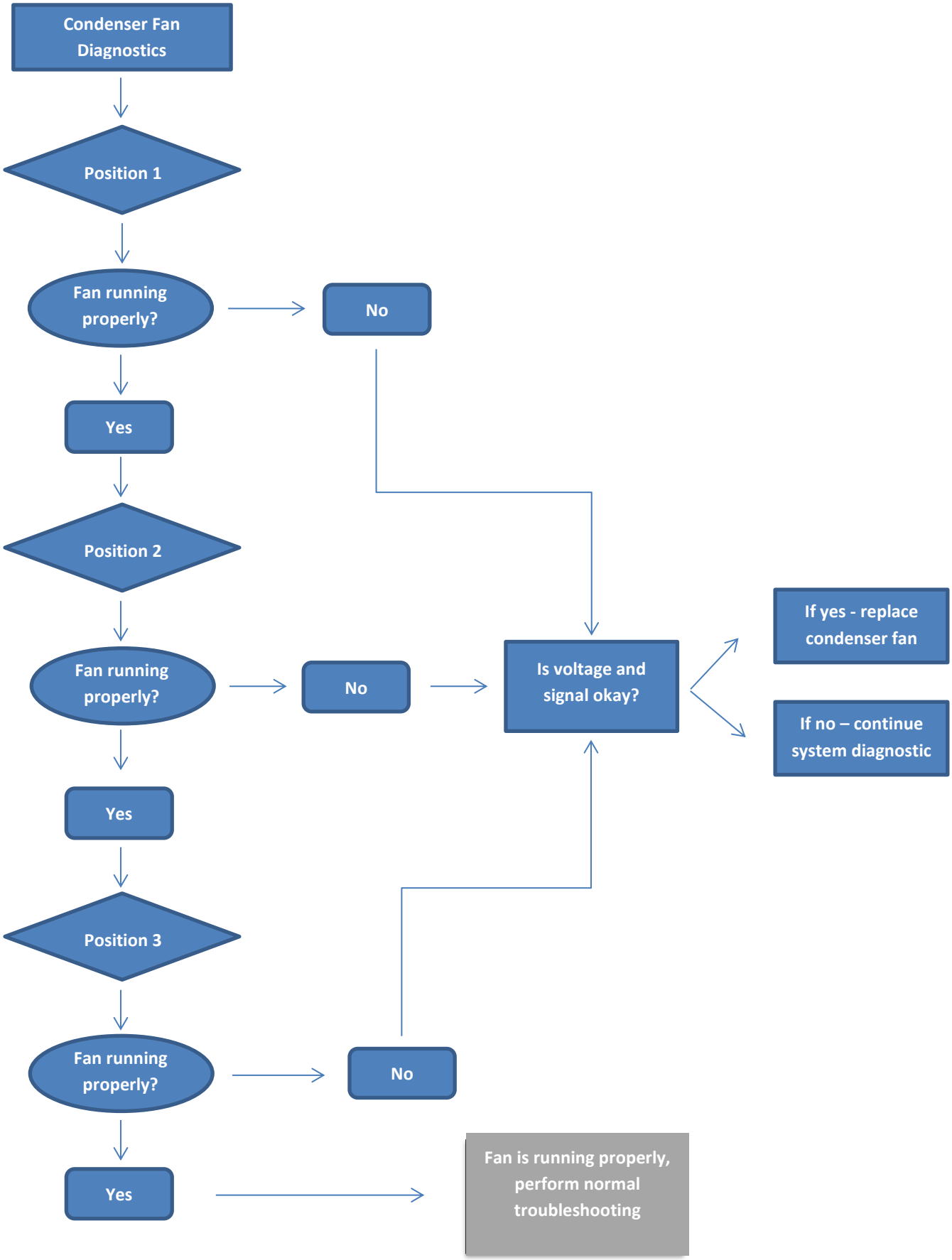
8. Return fan blade to the home location (“A”) and reconnect power to the condenser fan.
9. Start the ParkSmart no-idle system and adjust settings to full cold and high blower speed. Visually inspect condenser fan to verify proper operation. If the condenser fan is not operating, verify for 12 volts 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 ParkSmart 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.

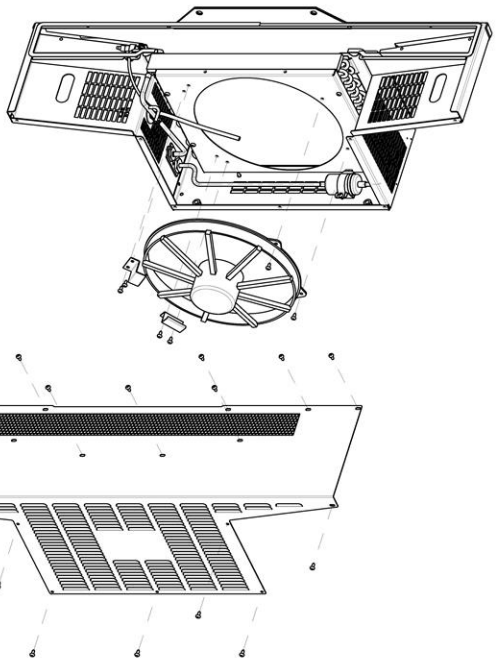
Service Replacement Procedure (Only required for confirmed failures)

1. Verify the ParkSmart 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 ParkSmart unit – follow step 9 above.


Condenser Fan Diagnostics
Position 1
Fan running properly?
No
Yes
Position 2
Fan running properly?
No
Yes
Position 3
Fan running properly?
No
Yes
Is voltage and signal okay?
If yes - replace condenser fan
If no – continue system diagnostic
Fan is running properly, perform normal troubleshooting

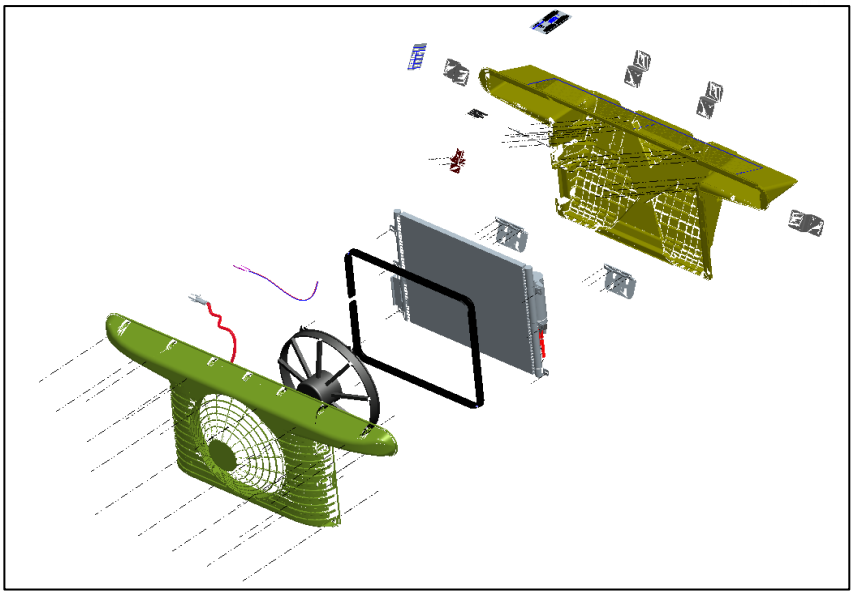
DTNA ParkSmart Rev. 5 Exploded View

Prior to 10-2015



This unit has a debris pan.
Occasional cleaning is required.

After 10-2015



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.

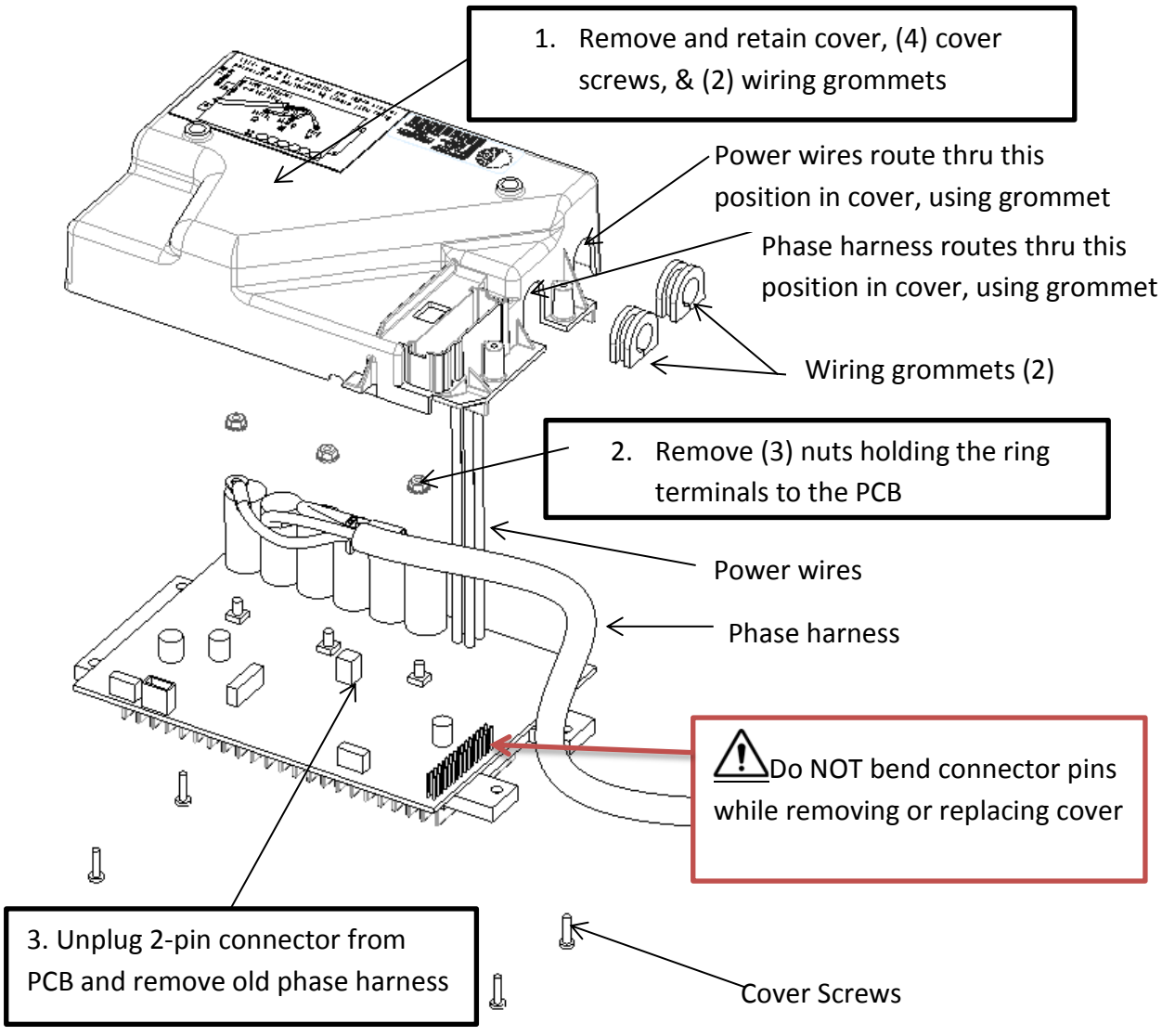
With no active fault codes, the controller should always attempt to start the compressor up to 10 times in a period of approx. 2 minutes; even when the phase harness is disconnected. If the controller does not see the compressor start after 10 attempts, it will time out and stop sending voltage to the 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 / **Cluster Block** 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.

CAUTION: Care must always be taken to install the control cover without bending the connector pins identified in **FIGURE 1**.

After the controller with phase harness has been removed from the ParkSmart unit, follow the below instructions to replace the phase harness.



Service Instructions for Phase Harness / **Cluster Block** 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.

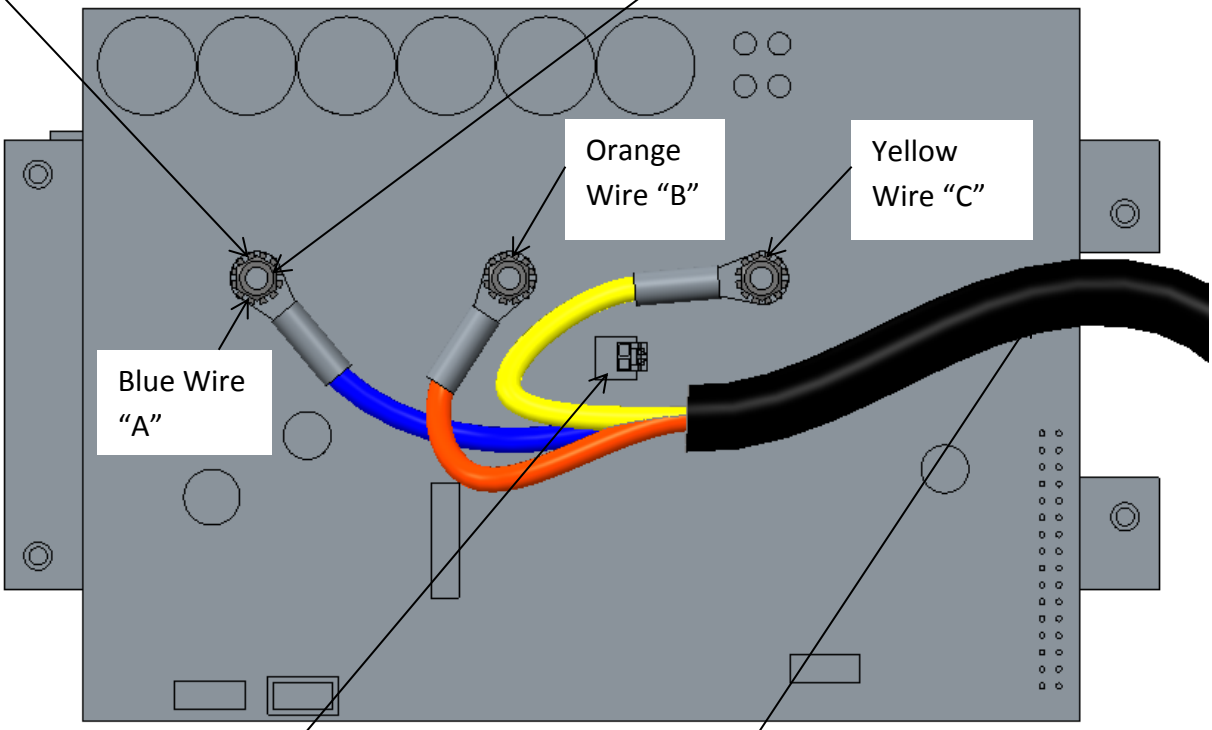
CAUTION: Care must always be taken to install the control cover without bending the connector pins identified in **FIGURE 1**.

4. Slide (3) ring terminals of new harness over threaded posts of PCB and route wires as shown

   Align each colored wire to specific threaded post identified only.

5. Secure wire terminals with (3) nuts. **Torque to 12 to 14 in-lbs**

Use the torque value specified!



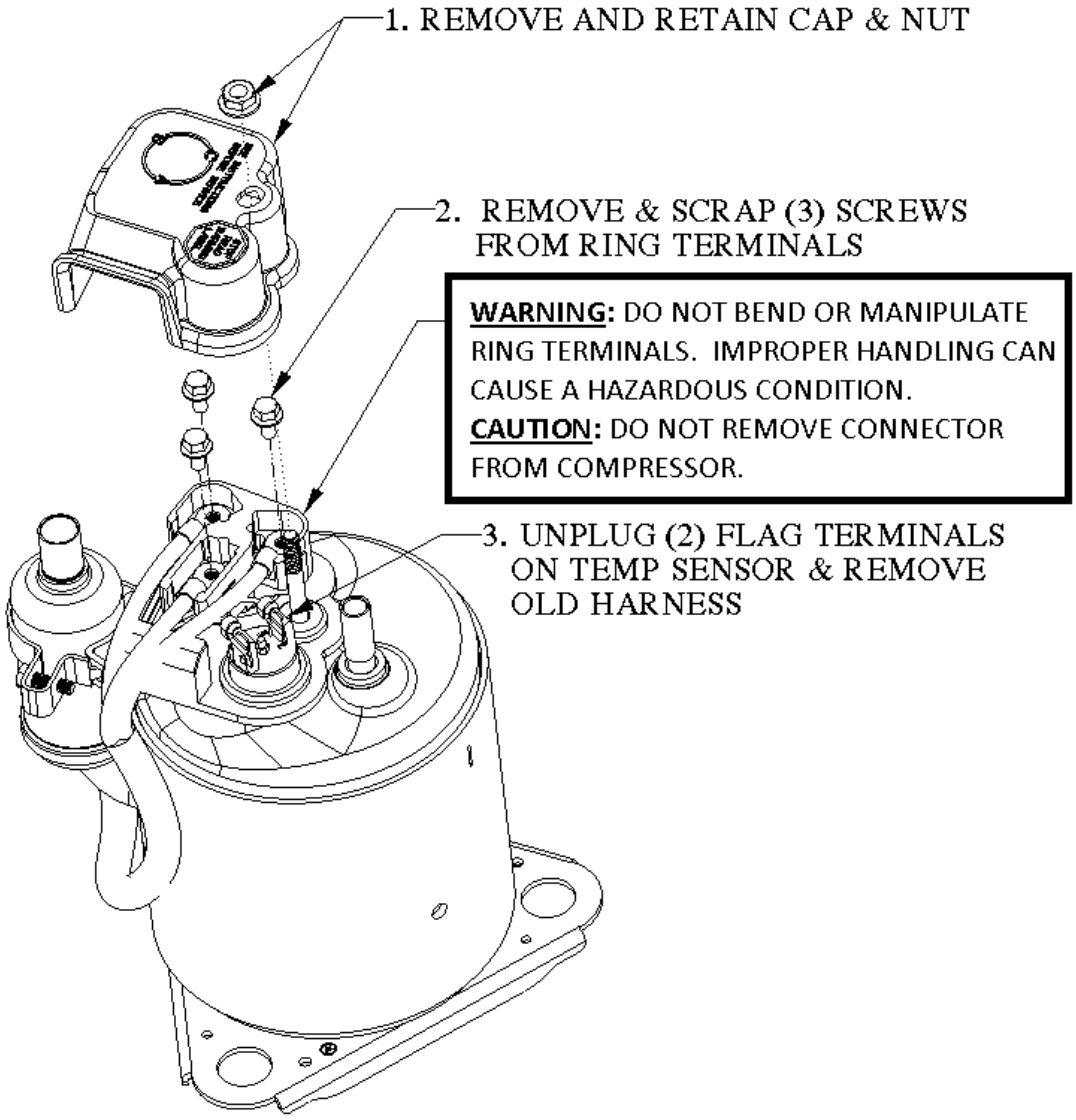
6. Plug 2-Pin connector of new harness into PCB

7. Orient ring terminals and route wiring harness out of cover as shown

8. Replace (2) wiring grommets, cover, and (4) cover screws

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

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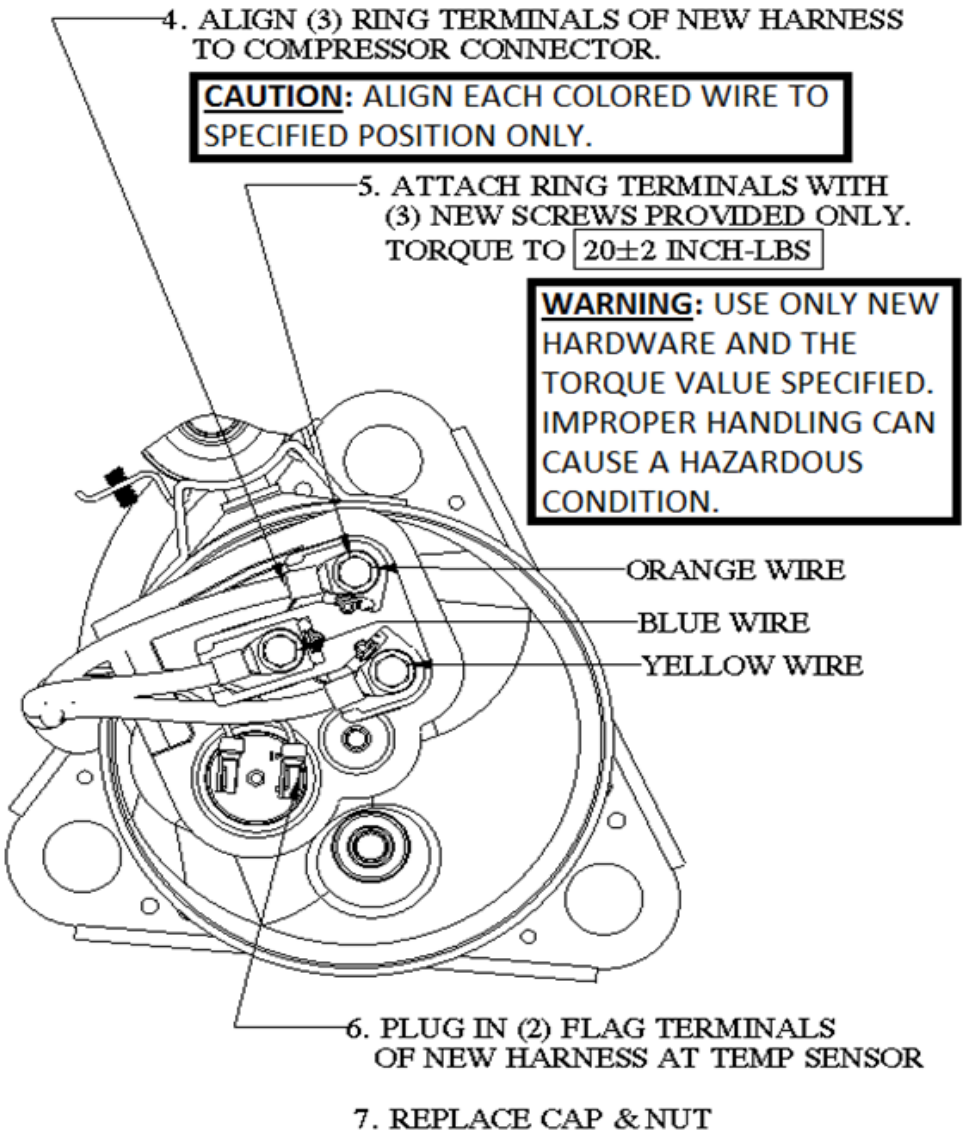

Service Instructions for Phase Harness / **Ring Terminal** Compressor Only

WARNING: To avoid potential property damage or personal injury, Read Important Safety Warnings and ALL instructions before attempting to install or service product.
CAUTION: Care must always be taken to install the control cover without bending the connector pins identified in **FIGURE 1**.

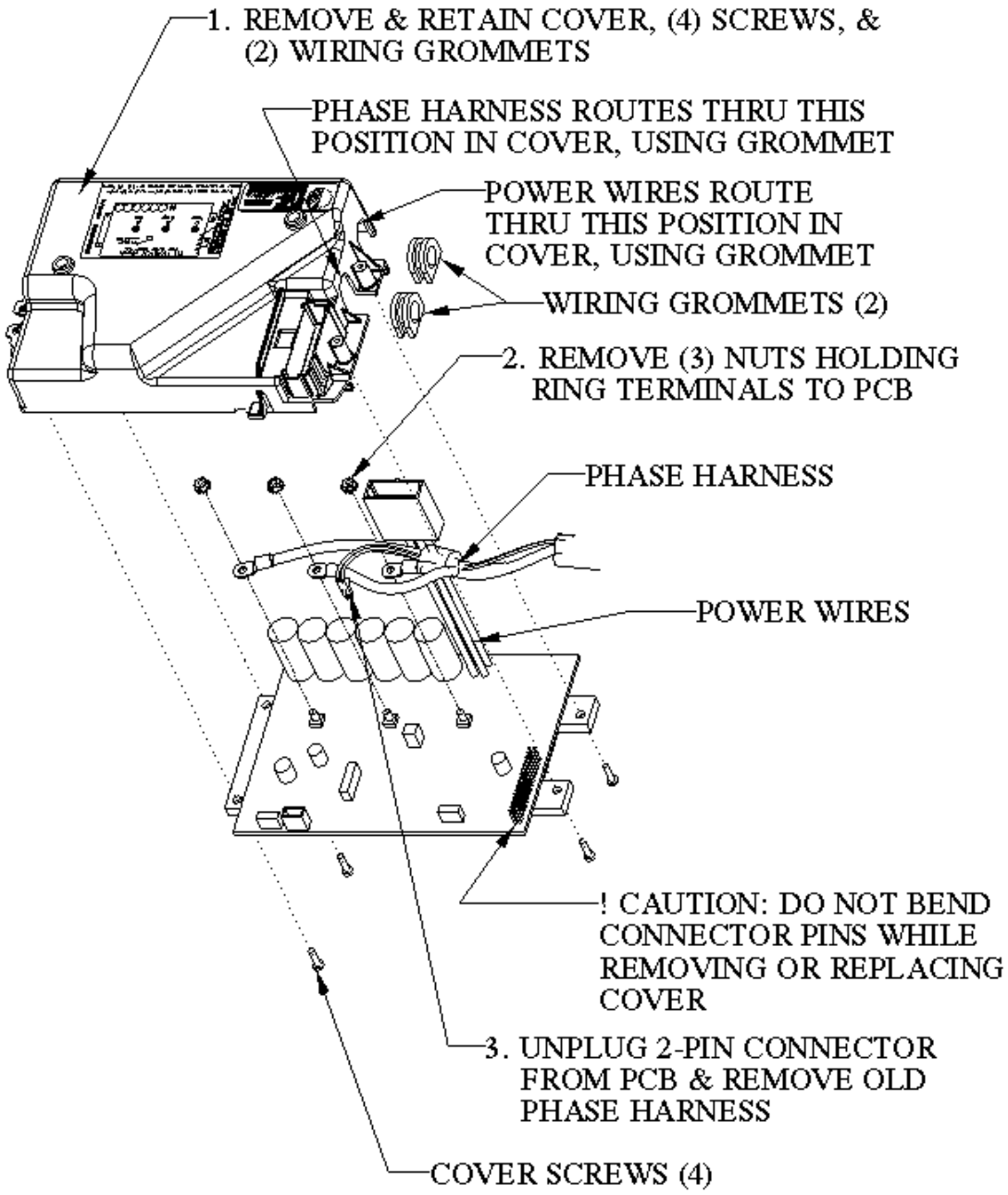

FIGURE 1

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.

CAUTION: Care must always be taken to install the control cover without bending the connector pins identified in **FIGURE 1**.

FIGURE 2