Revisions to this document are noted by a stripe in the left-hand margin

SUBJECT: Replacing SKiM® Module and GATE Drive Card Inside the Dual Power Inverter Module 2 (DPIM2)

MODELS AFFECTED: H 40/50 EP™ System Equipped With DPIM2

Tools Required

- J-51586 Tab Bending Tool
- J-46708 (or equivalent) Multimeter
- J-51673 DPIM Leak Tester
- Stop Watch
- Electrostatic Discharge Wrist Strap (Refer to Figure 2)
- Pick or Small Flat Blade Screwdriver
- Torx-Plus® T8 Bit
- Torx-Plus® T10 Bit
- Torx-Plus® T20 Bit
- Torx-Plus® T25 Bit
- Torx-Plus® T25 6in Bit
- 4mm Hex Key
- 6mm Hex Key
- 8mm Hex Socket
- Loctite® 242
- Loctite® 425

Introduction:

This Service Information Letter (SIL) announces the availability of the SKiM® Module and GATE Drive Card Service Kit (Electronic Service Kit P/N 29556119), GATE Drive Card Phase A-C Harness Service Kit (Harness Phase A-C Service Kit P/N 29556137), and GATE Drive Card Phase B Harness Service Kit (Harness Phase B Service Kit P/N 29556136) and includes the procedure to replace the SKiM® Module and GATE Drive Card located inside the DPIM2. The availability of these kits eliminates the need for a complete DPIM2 replacement under certain failure conditions.

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Please Note: Allison Transmission Service Information Letters are intended for use by professional, trained technicians, not for the "do-it-yourselfer." They are written to inform those technicians of conditions that may occur on some transmission models (or serial numbers ranges) or to provide information that could assist in the proper servicing of a specific Allison transmission. Properly trained technicians have the equipment, tools, safety instructions, and know-how to do a job properly and safely. If a condition is described, do not assume that the Service Information Letter applies to your transmission, or that your transmission has the condition described. Product evolution and information updates are inevitable. Please see your authorized Allison Transmission service dealer or distributor to understand if your particular transmission may benefit from the information contained within the Service Information Letter.

Phase A or C Replacement: Electronic Service Kit P/N 29556119 and Harness Phase A-C Service Kit P/N 29556137 are required to perform the replacement of the Phase A or C SKiM® Module and GATE Drive Card.

Phase B Replacement: Electronic Service Kit P/N 29556119 and Harness Phase B Service Kit P/N 29556136 are required to perform the replacement of the Phase B SKiM® Module and GATE Drive Card.

NOTE: Components and replacement procedures are the same for Inverter A and Inverter B. Refer to Figure 25 for GATE Drive Card locations.

Refer to Table 1, Table 2, and Table 3 for Electronic Service Kit contents.

Table 1. SKiM® Module and GATE Drive Card Electronic Service Kit

Part Name	Part Number	Quantity
Electronic Service Kit	29556119	1
Module-SKiM® 5	29540527	1
GATE Drive Card	29546784	1
Busbar-GND, GATE Drive	29546790	2
SKiM® Module O-Ring	29540585	1
Cover Gasket	29540714	1
SKiM® Module Capacitor	29546783	3
Alignment Tool	29558018	1
Tie Wrap	*	1

Table 2. GATE Drive Card Phase A-C Harness Electronic Service Kit

Part Name	Part Number	Quantity
Harness Phase A-C Service Kit	29556137	1
Cable Assembly	29546811	1
Strain Relief	29549697	2
Tie Wrap	*	1
*Tie Wrap material to be nylon 6/6 or approved equivalent.		

Table 3. GATE Drive Card Phase B Harness Electronic Service Kit

Part Name	Part Number	Quantity
Harness Phase B Service Kit	29556136	1
Cable Assembly	29546810	1
Strain Relief	29549697	2
Tie Wrap	*	1
* Tie Wrap material to be nylon 6/6 or approved equivalent.		

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NOTE: Perform the necessary diagnosis prior to ordering Electronic Service Kit P/N 29556119, P/N 29556137, and P/N 29556136. Contact Allison TAC at (800) 252-5283 to confirm the SKiM® Module or GATE Drive Card failure.

Warranty Claim Information:

1. When a SKiM® Module and Gate Drive Card Kit, P/N 29556119, is utilized to repair a failed DPIM under warranty, use SKiM® Module and Gate Drive Card Kit part number 29556119 as the PFP and claim the kit part number in the Service Parts subsection of the AWAARE claim.
2. The replacement of SKiM® Modules and Gate Drive Cards on a DPIM2 under Allison supplied warranty, must be approved my Allison H 40/50 EP™ Service Engineering prior to removing the DPIM Main Cover.

Diagnosis:

Scenario 1: The SKiM® Module and Gate Drive Card may need to be replaced if any of the following Diagnostic Trouble Codes are logged and any of the red highlighted checks in Table 4 and Table 5 are out of specification.

- DTC 77-30
- DTC 80-01

Scenario 2: The SKiM® Module and Gate Drive Card may need to be replaced if any of the following Saturation Fault codes are logged and/or any of the red highlighted checks in Table 4 and Table 5 are out of specification.

- DTC 73-27
- DTC 74-27
- DTC 73-28
- DTC 74-28
- DTC 73-29
- DTC 74-29

NOTE: The saturation codes listed under Scenario 2 and the out of specification measurements in Table 4 and Table 5 will identify which SKiM® Module and IGBT need to be replaced.

If any of the DTCs listed in Scenario 1 and Scenario 2 are logged, troubleshoot them per H 40/50 EP™ System Troubleshooting Manual TS5812EN. In addition to troubleshooting the aforementioned DTCs, a DPIM Check List should be completed. Refer to the DPIM Check List appendix of the troubleshooting manual.

WARNING: DO NOT rely on the High Voltage Interlock Loop (HVIL) or control systems to de-energize the system. Always perform the Electrical Disconnect Verification Procedure to be sure the system is discharged before servicing components.

DO NOT attempt to bypass any High Voltage Interlock for any reason. Tampering with the HVIL may result in injury. Failure to follow proper safety procedures may result in serious personal injury or death.

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NOTE: Allison Transmission, Inc. requires that the DPIM be removed from the vehicle prior to component replacement. Prior to removal of the DPIM, refer to the H 40/50 EP™ System Troubleshooting Manual (TS5812EN) and perform the Electrical Disconnect Verification Procedure.

NOTE: The SKiM® Module and GATE Drive Card replacement should NOT be performed if smoke and/or water damage are present.

NOTE: All cables (AC and DC) must be removed from the DPIM prior to taking measurements shown on the DPIM Check List. For additional information, refer to H 40/50 EP System™ Troubleshooting Manual (TS5812EN).

Table 4. Inverter Circuit Test – IGBT Check (DPIM1 and DPIM2)

DPIM Checklist V2.0								
NOTE: To take these measurements, all cables (AC and DC) must be removed from the DPIM.								
NOTE: The specifications listed below are merely guidelines. All DPIM replacements must be approved by the Technical Assistance Center.								
Inverter Circuit Test – IGBT Check (DPIM1 and DPIM2)								
			A-Side			B-Side		
	DC(+)	DC(-)	Phase A	Phase B	Phase C	Phase A	Phase B	Phase C
Place **Negative** multimeter lead on DPIM Chassis	>400K Ohms	>400K Ohms	>200K Ohms	>200K Ohms	>200K Ohms	>200K Ohms	>200K Ohms	>200K Ohms
Results								
Place **Positive** multimeter lead on DC(+)	N/A	>7K Ohms	>5K Ohms	>5K Ohms	>5K Ohms	>5K Ohms	>5K Ohms	>5K Ohms
Results	—							
Place **Negative** multimeter lead on DC(-)	N/A	N/A	>5K Ohms	>5K Ohms	>5K Ohms	>5K Ohms	>5K Ohms	>5K Ohms
Results	—	—						
Set your multimeter to **Resistance** mode (Ohms). Make sure multimeter lead polarity is correct during Resistance Check. Resistance values will vary at first. Hold leads in position until the resistance value stabilizes and then record it.								

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Table 5. Inverter Circuit Test – Diode Test (DPIM1 and DPIM2)

Inverter Circuit Test – Diode Test (DPIM1 and DPIM2)						
	A-Side			B-Side		
	Phase A	Phase B	Phase C	Phase A	Phase B	Phase C
Place **Positive** multimeter lead on DC(-)	0.3V±0.1	0.3V±0.1	0.3V±0.1	0.3V±0.1	0.3V±0.1	0.3V±0.1
Results						
Place **Negative** multimeter lead on DC(+)	0.3V±0.1	0.3V±0.1	0.3V±0.1	0.3V±0.1	0.3V±0.1	0.3V±0.1
Results						
Set multimeter to **Diode Check** mode. Make sure multimeter lead polarity is correct during Diode Check. This test uses a small current that is applied to the diode and the voltage drop is the reading determined above.						

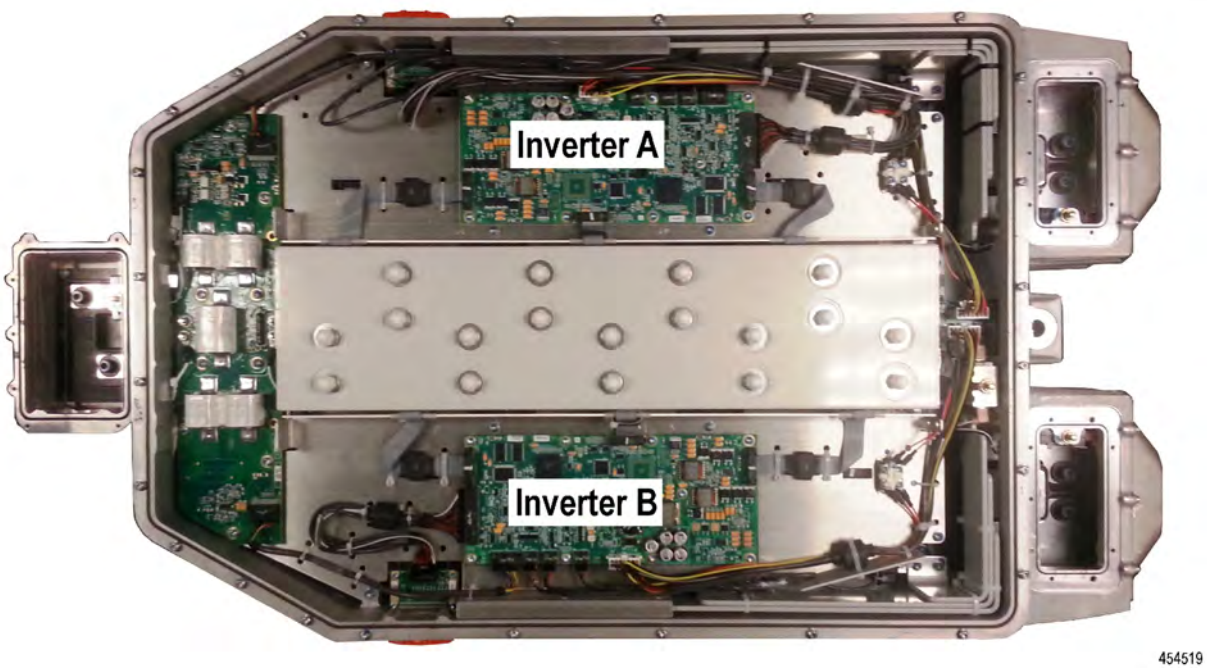

Figure 1. DPIM2 (Main Cover and Lug Box Covers Removed)

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NOTE: Refer to the attachment at the end of this SIL for information regarding the name and location of components within the DPIM2.

The procedures contained in this SIL are organized into the following sections:

Section 1: Removal of Main Cover and HVIL Circuit Card
Section 2: Removal of BCA Card Mounting Shelf
Section 3: Removal of the AC Busbar Assembly
Section 4: Removal of GATE Drive Card
Section 5: Measure Baseline DPIM Cooler Circuit Leak Rate
Section 6: Removal of SKiM® Module
Section 7: Installation of SKiM® Module
Section 8: Measure DPIM Cooler Circuit Leak Rate After SKiM® Module Installation
Section 9: Inspection of the AC Busbar Supports for Corrosion and Debris
Section 10: Installation of GATE Drive Card
Section 11: Installation of the AC Busbar Assembly
Section 12: Installation of BCA Card Mounting Shelf
Section 13: Installation of HVIL Circuit Card and Main Cover

Section 1: Removal of Main Cover and HVIL Circuit Card

NOTE: All circuit cards in the DPIM2 are sensitive to electrostatic discharge (ESD). ESD damage can be caused by voltage levels that cannot be felt by humans. When working on the DPIM2, ALWAYS wear an ESD wrist strap to ground any possible electrostatic charge. The strap should be worn around the wrist with the alligator clip securely attached to the DPIM chassis. Refer to Figure 2.

Figure 2. Electrostatic Discharge Wrist Strap (Typical)

1. Using a Torx-Plus® T25 bit, remove twenty-six (26) M5x18mm machine screws that secure the Main Cover to the DPIM Housing (refer to Figure 3). Set the screws aside for reassembly. Remove the Main Cover. Discard the cover gasket.

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Figure 3. DPIM Main Cover

2. Exercising care, cut one (1) wire tie at location shown in Figure 4. Do NOT remove any wire ties that pass through the HVIL Circuit Card. Leaving the severed wire ties in place will provide a visual aid for wire tie locations during installation of the replacement circuit card.

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Figure 4. HVIL Circuit Card – Wire Tie Location

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3. Cut the two (2) wire ties at locations shown in Figure 5 and remove them from the mounts. The wire tie mounts do NOT have to be removed from the DPIM Housing unless they interfere with the removal or installation of the HVIL circuit card.

Figure 5. HVIL Circuit Card – Two (2) Wire Tie Locations

CAUTION: Do NOT pull on the wires when removing connectors; doing so may pull the pins out of the connector.

4. When removing connectors, push down on the tab at Location 1 and push the harness out of the connector at Location 2 (refer to Figure 6).

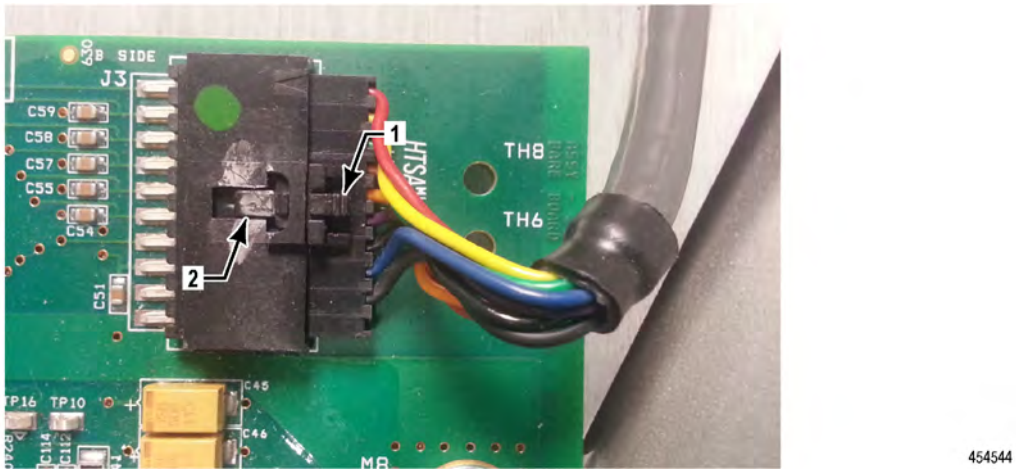

Figure 6. HVIL Circuit Card Connector Removal

5. Remove three (3) wire harness connectors from HVIL Circuit Card surface mount connectors by gently depressing the retaining tab with a pick or small flat blade screwdriver. Refer to Figure 7.

NOTE: Use care to avoid bending or damaging the circuit card connectors.

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Figure 7. HVIL Circuit Card – Three (3) Harness Connector Locations

WARNING: Any conductive material (i.e. screws, bolts, nuts, etc.) can cause a short inside the DPIM that will result in permanent and irreversible DPIM damage. All hardware must be accounted for throughout the service procedure.

6. Using an 8mm socket, remove the four (4) M5 nut/washer assemblies as shown in Figure 8. Disconnect the two (2) wire ring terminals from the studs.

Figure 8. HVIL Circuit Card – Four (4) Mounting Nut/Washer Locations (M5)

7. Using a Torx-Plus® T25 bit, remove the four (4) M5x30mm screws securing the HVIL Circuit Card as shown in Figure 9.

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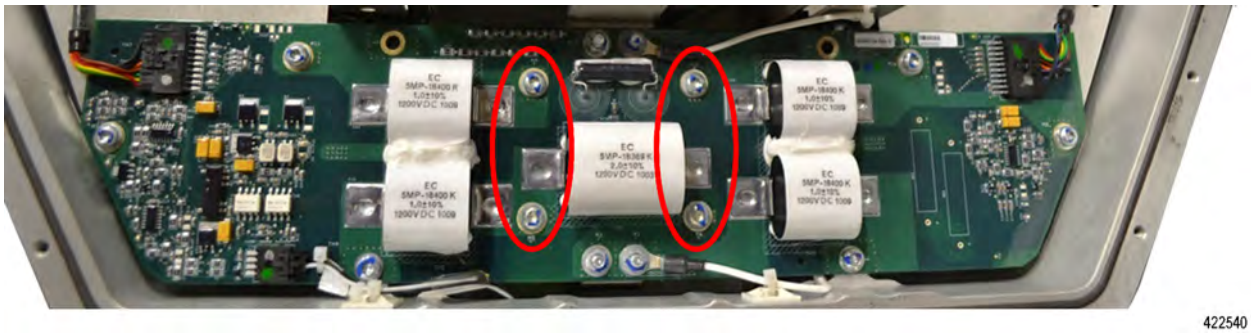

Figure 9. HVIL Circuit Card – Four (4) Mounting Screw Locations (M5x30mm)

8. Using a Torx-Plus® T25 bit, remove the two (2) M5x14mm screws securing the HVIL Circuit Card as shown in Figure 10.

Figure 10. HVIL Circuit Card – Two (2) Mounting Screw Locations (M5x14mm)

9. Using a Torx-Plus® T25 bit, remove the four (4) M5x22mm screws securing the HVIL Circuit Card as shown in Figure 11.

Figure 11. HVIL Circuit Card – Four (4) Mounting Screw Locations (M5x22mm)

10. Lift the HVIL Circuit Card straight up and remove it from the DPIM Housing.
11. Verify that the choke is in place as shown in Figure 12.

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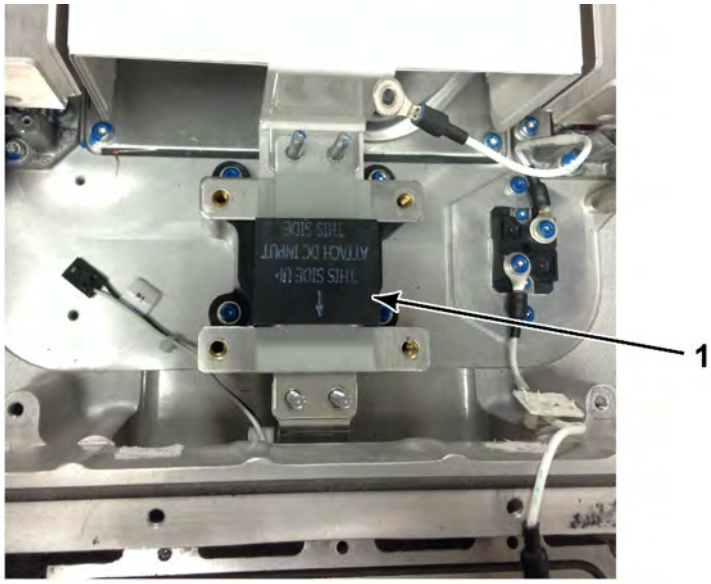
NOTE: The choke may have adhered to the underside of the HVIL Circuit Card when it was removed. If this has occurred, reinstall choke to its proper location as shown in Figure 12. The choke must be installed with the arrow pointing toward the DC lug box.



(1) – Choke

Figure 12. Verification of Choke Installation

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Section 2: Removal of BCA Card Mounting Shelf

1. Carefully cut and remove the wire ties retaining the wire harnesses (refer to Figure 13).

Figure 13. Wire Tie Locations

NOTE: Label the wires on connectors 2, 3, and 4 (refer to Figure 14) with the corresponding phase (A, B, C) as indicated by the circuit card connector labels (CURR A, CURR B or CURR C) for reinstallation.

CAUTION: Failure to properly label the current sensor harnesses may lead to improper reinstallation and cause the DPIM to not operate.

2. Remove five (5) wire harness connectors from circuit card surface mount connectors by gently depressing the retaining tab with a pick or small flat blade screwdriver (refer to Figure 14 and Figure 15).

NOTE: Use care to avoid bending or damaging the circuit card connectors.

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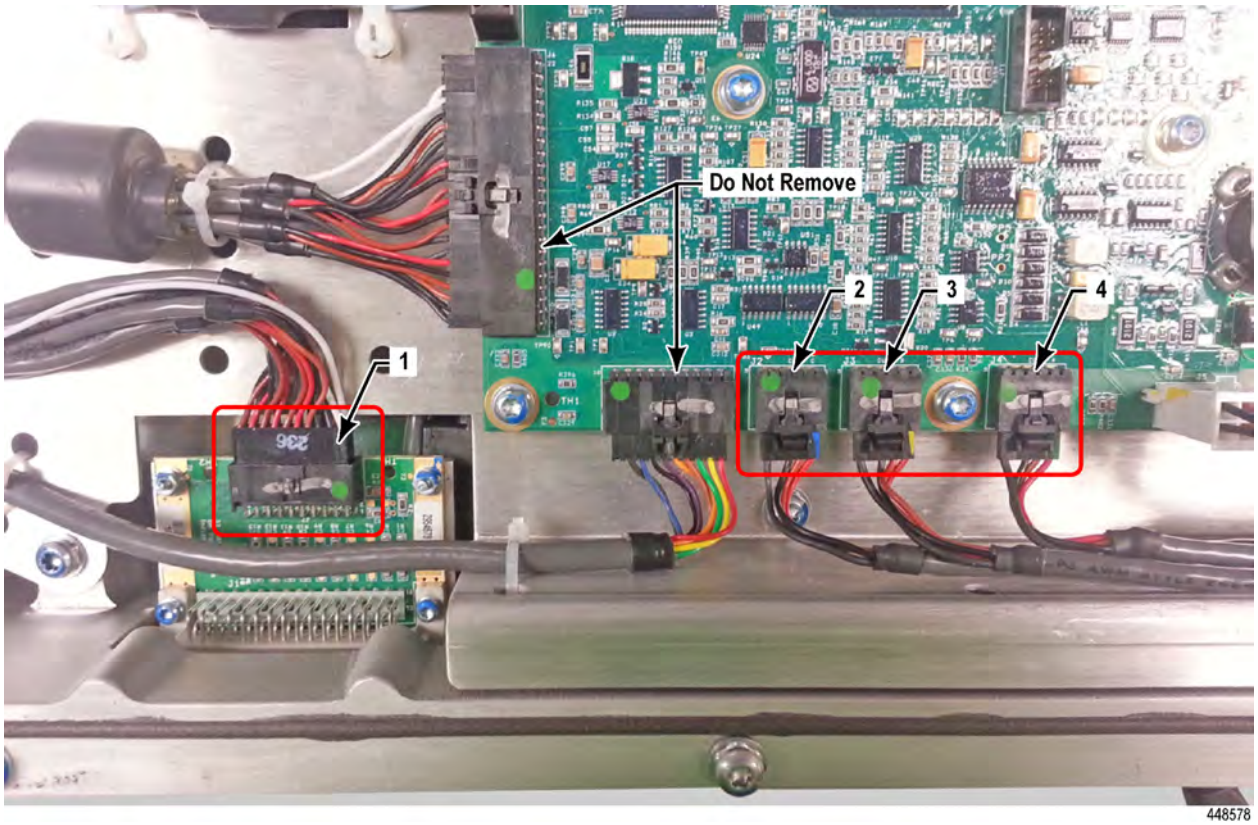

Figure 14. Wire Harness Connector Removal (4 Locations)

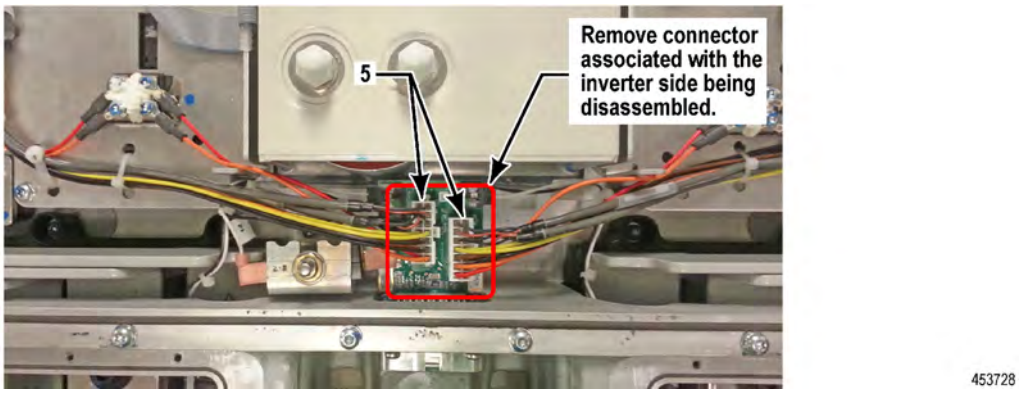

Figure 15. Wire Harness Connector Removal

3. Using a Torx-Plus® T25 bit, remove the seven (7) M5x14mm screws securing the BCA Mounting Shelf (refer to Figure 16).

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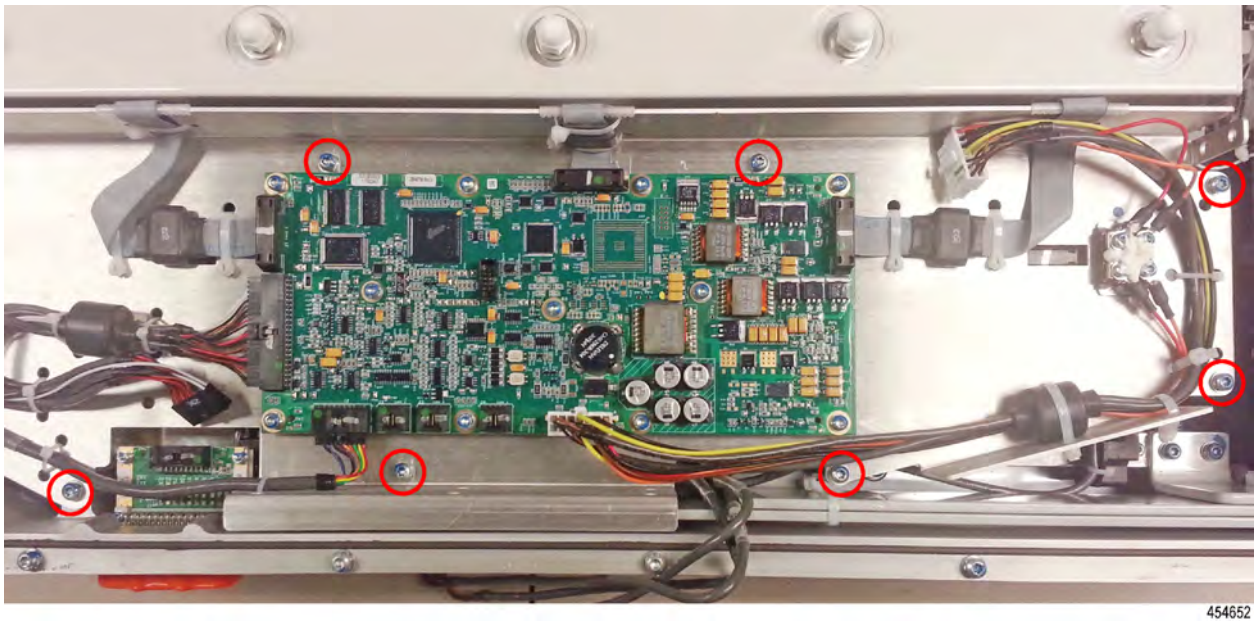

Figure 16. BCA Mounting Shelf Fastener Locations

4. Carefully lift the BCA Mounting Shelf and set in on the side of the chassis as shown in Figure 17.

NOTE: Three (3) harnesses are still connecting the BCA Card to the GATE Drive Cards. Do NOT relocate the BCA Mounting Shelf any farther than as shown in Figure 17.

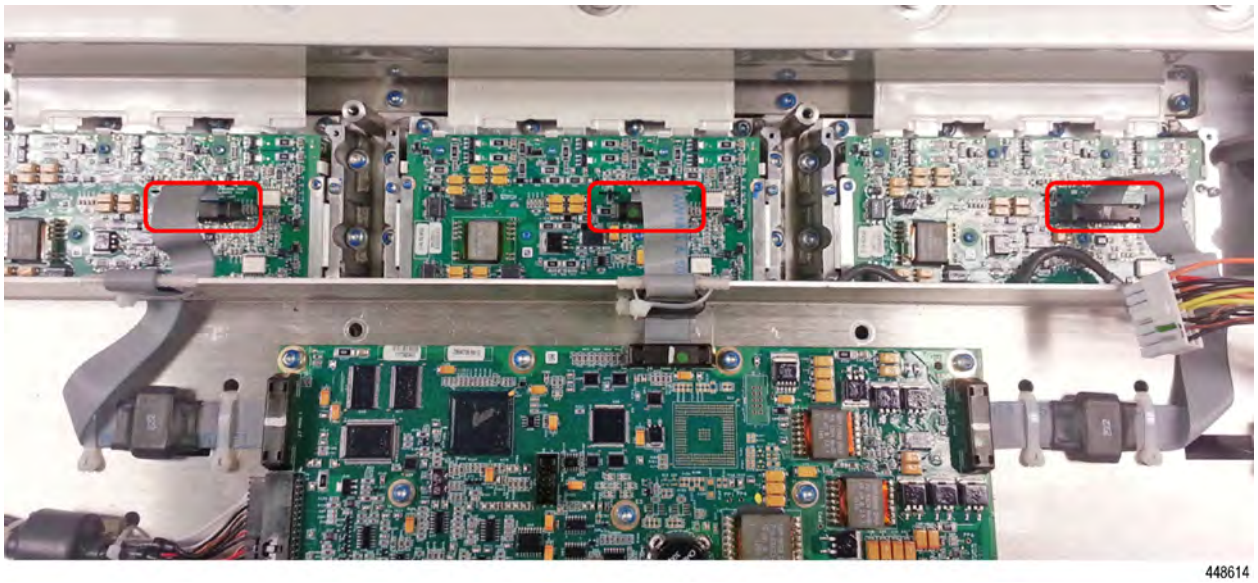

Figure 17. BCA Mounting Shelf Relocation

5. Remove three (3) ribbon cable connectors from the GATE Drive Cards (refer to Figure 17) as follows:
   a. Use the handle of Tab Bending Tool J-51586 to disengage and remove the cable strain relief cap (refer to Figure 18).

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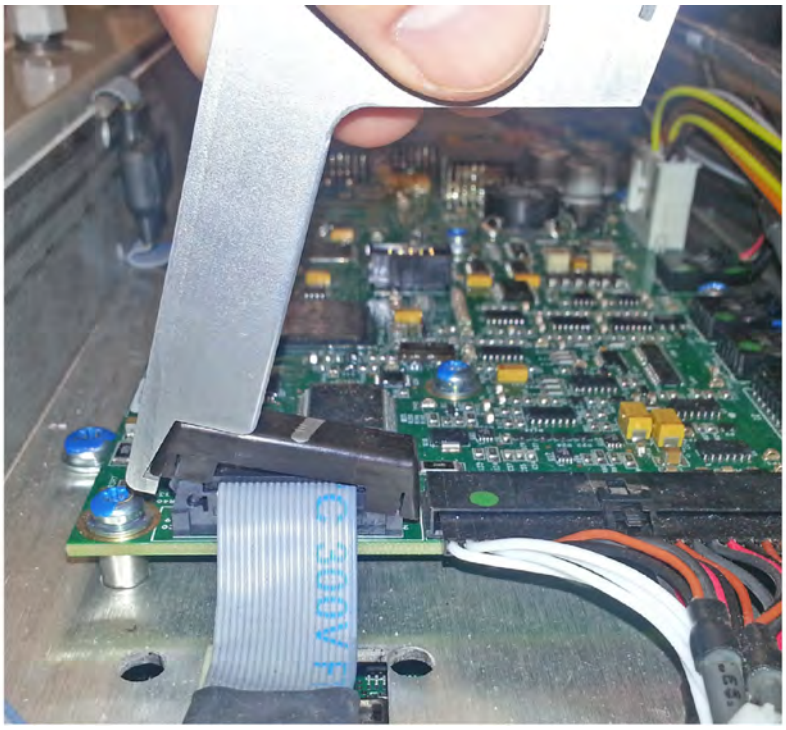

Figure 18. Cable Strain Relief Cap Removal (BCA Cable Card Connector Shown for Clarity)

b. Press the tabs down on both sides of the GATE Drive Card Connector to release the ribbon cable connector (refer to Figure 19).

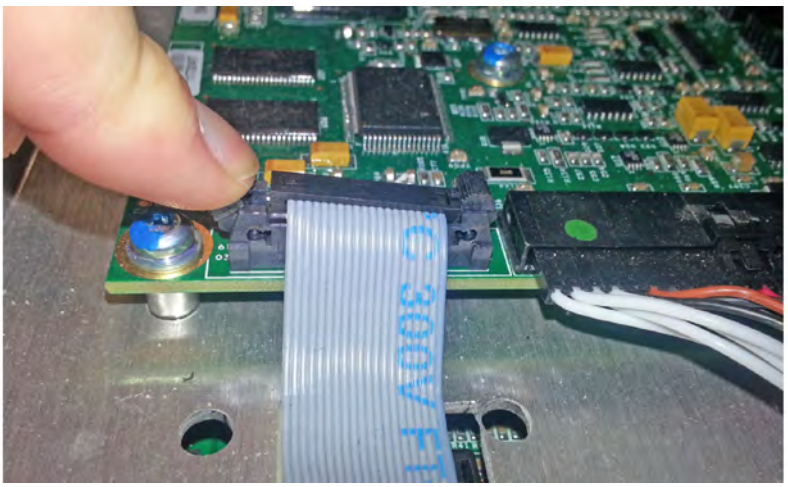

Figure 19. Releasing the Ribbon Cable Connector (BCA Cable Card Connector Shown for Clarity)

6. Remove the BCA Mounting Shelf from the DPIM to gain access to the three (3) Gate Drive Cards.

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Section 3: Removal of the AC Busbar Assembly

NOTE: Refer to Figure 20 for DPIM2 Phase Locations.

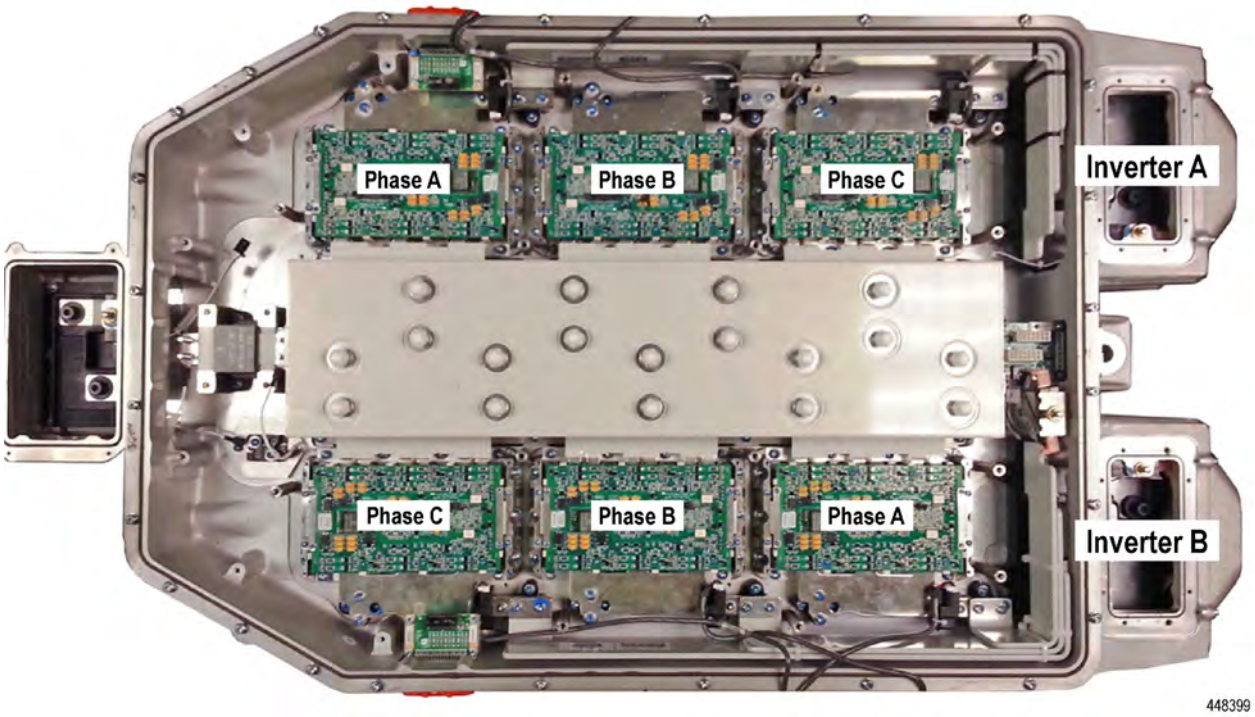

Figure 20. DPIM2 Phase Locations

1. Using a Torx-Plus® T25 bit, remove the six (6) M5x22mm screws (refer to Figure 21).

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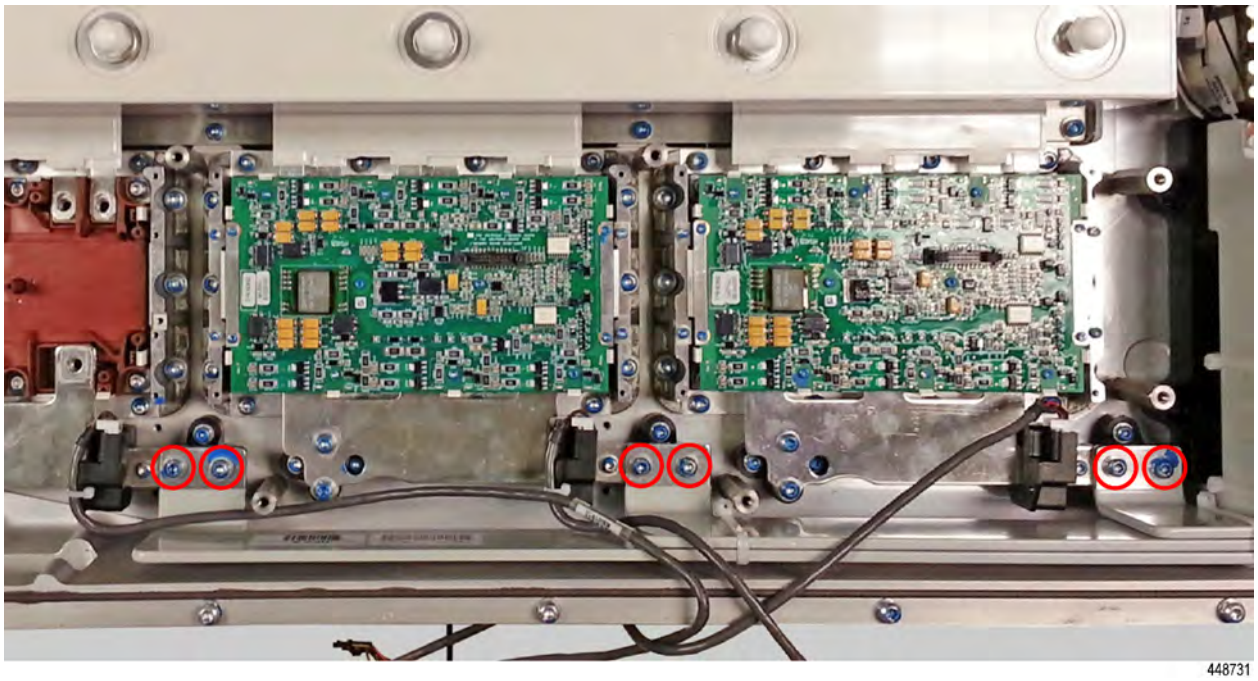

Figure 21. Mounting Screw Locations

2. Using a 6mm hex key, remove the three (3) M8 AC lug bolts (refer to Figure 22).

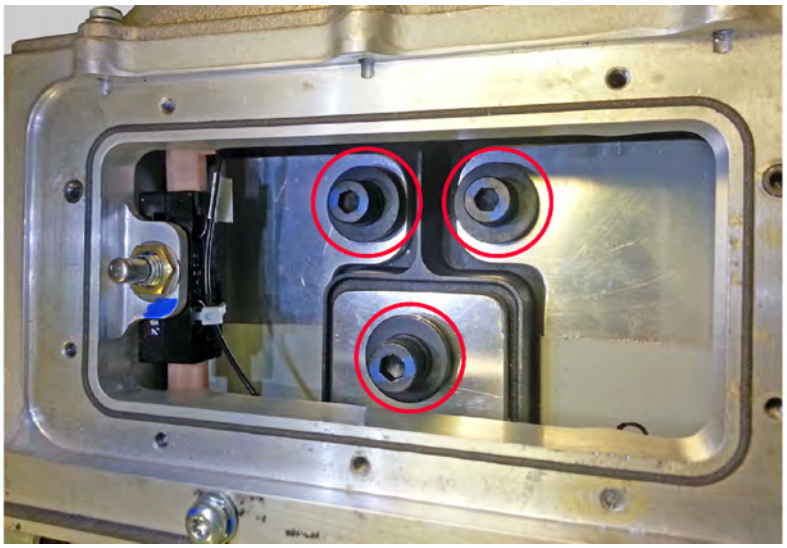

Figure 22. AC Lug Bolts

3. Remove the HVIL switch connector (refer to Figure 23).

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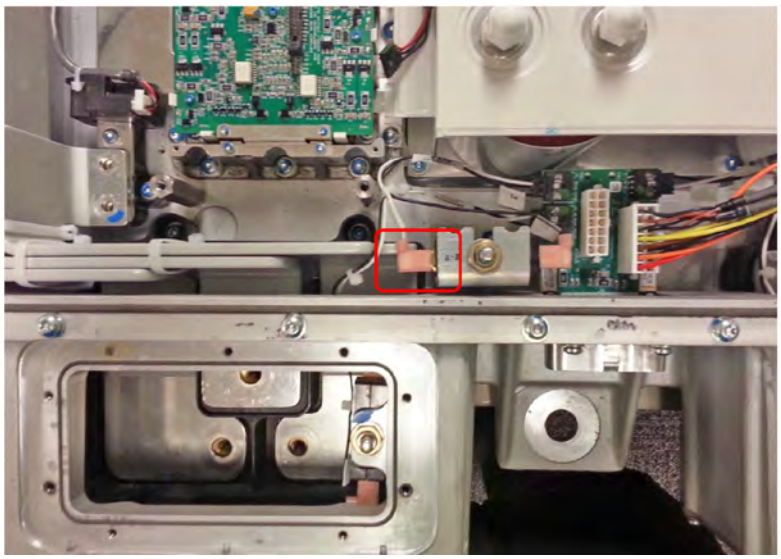

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Figure 23. HVIL Switch Location

4. Carefully remove the AC Busbar Assembly by slightly lifting upward then outward from the AC Lug Box (refer to Figure 24).

CAUTION: Do not allow the AC Busbar Assembly to strike the HVIL Switch during the removal process.

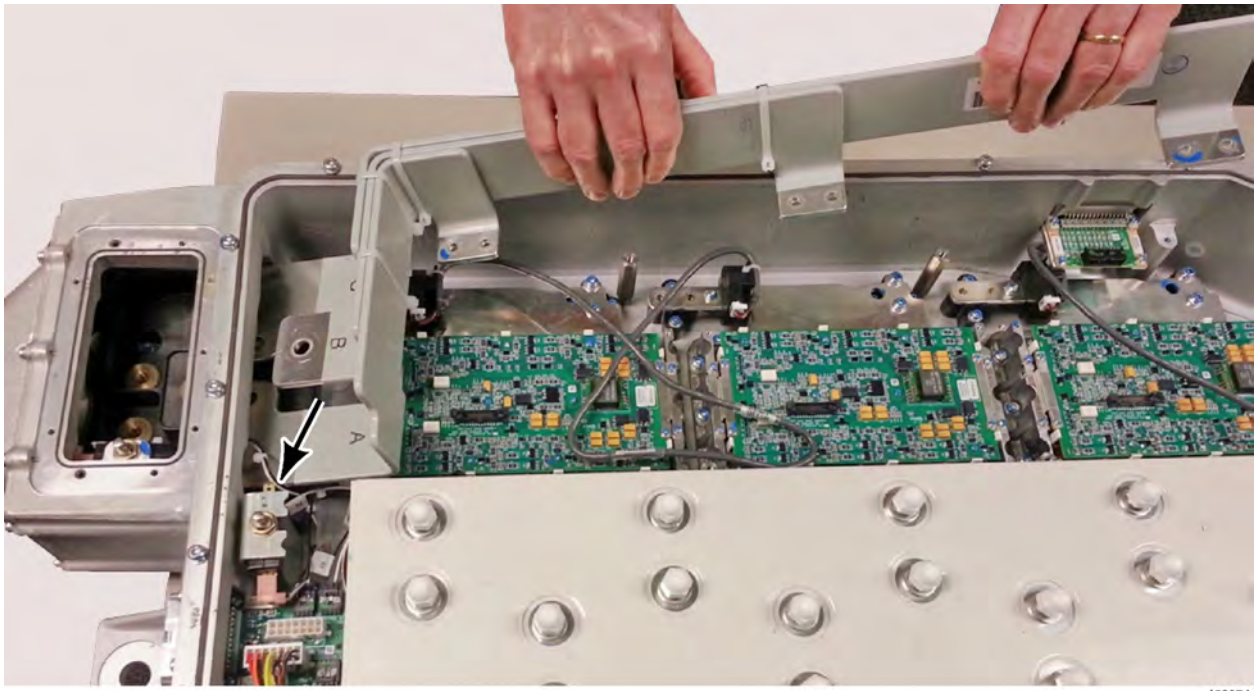

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Figure 24. Removal of AC Busbar Assembly

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Section 4: Removal of GATE Drive Card

NOTE: Refer to Figure 25 for DPIM2 Phase Locations.

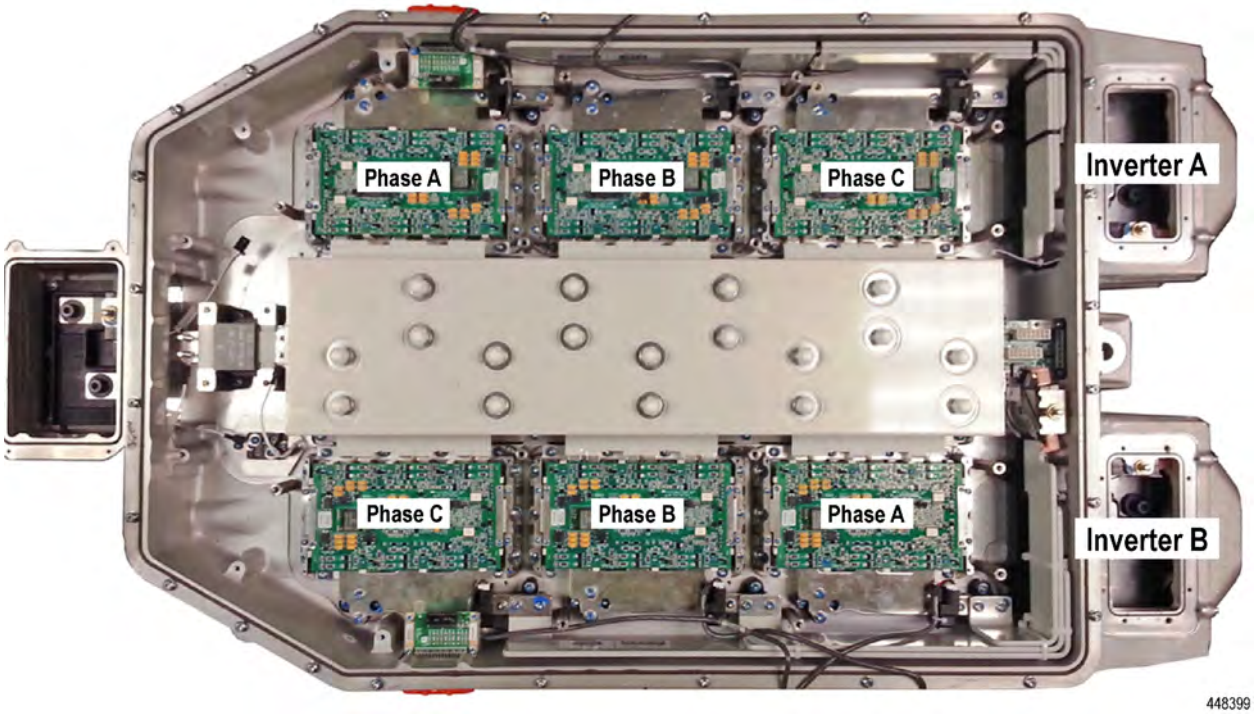

Figure 25. DPIM2 Phase Locations

1. Using a Torx-Plus® T8 bit, remove the twelve (12) M3x8mm (coarse thread) screws from the GATE Drive Card (refer to Figure 26).

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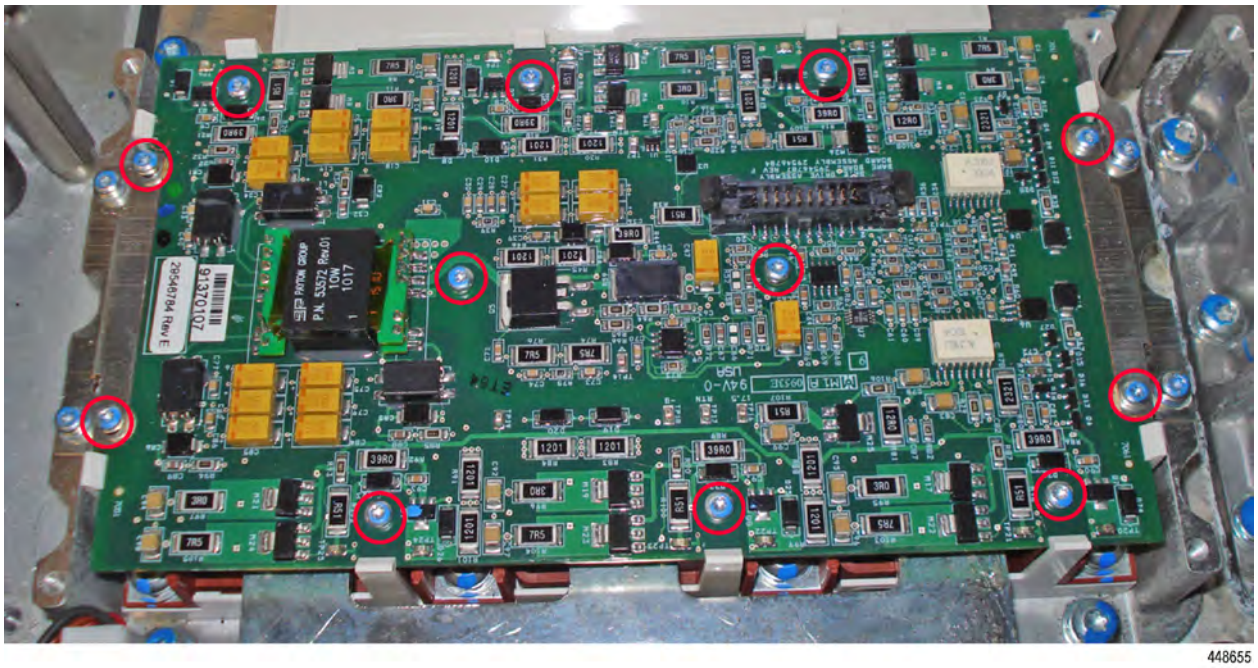

Figure 26. GATE Drive Card Fastener Locations (M3x8mm Coarse Thread – Quantity 12)

2. Using a Torx-Plus® T10 bit, remove the four (4) M3x8mm (fine thread) screws from the GATE Drive Card (refer to Figure 27). Set the two (2) grounding brackets aside.

Figure 27. GATE Drive Card Fastener Locations (M3x8mm Fine Thread) – Quantity 4

3. Carefully pry back the ten (10) white locking tabs (refer to Figure 28) to release the GATE Drive Card from its mounting location and gently lift the card straight up. Take care to not drop the spring pins (refer to Figure 29) that may stick to the solder pads on the underside of the card.

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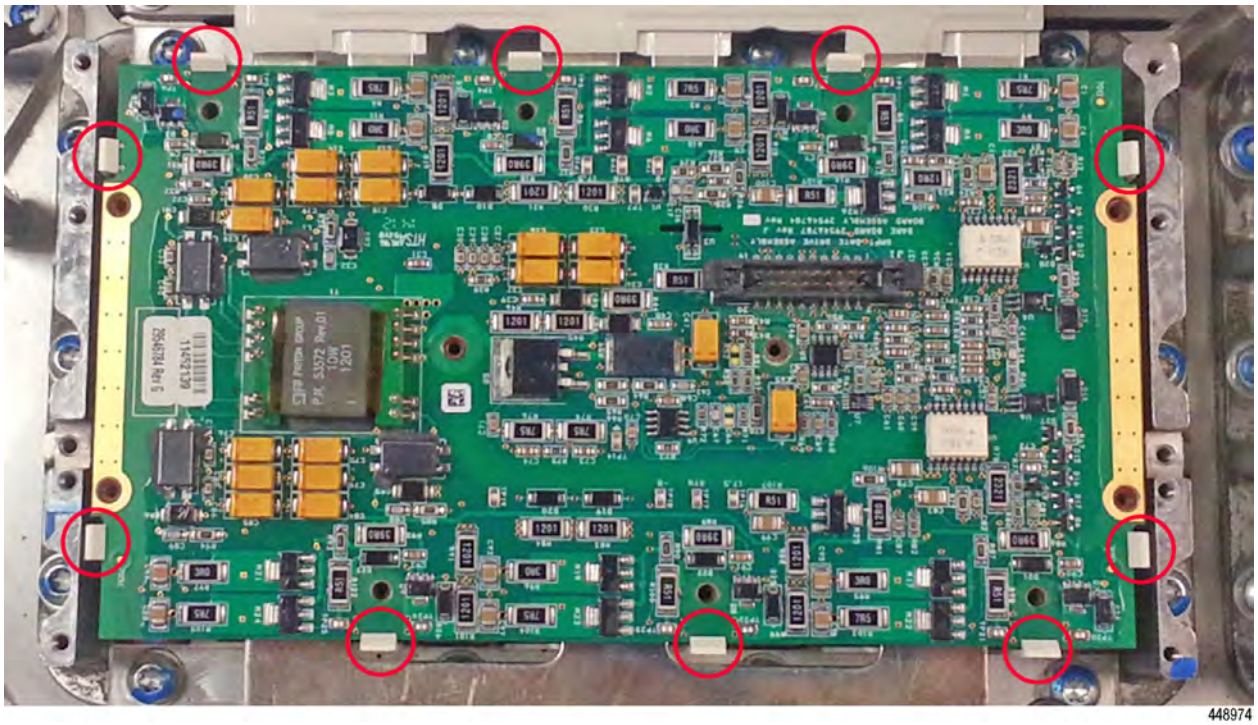

Figure 28. GATE Drive Card Locking Tab Locations

NOTE: If the spring pin sticks to the underside of the card, do not attempt to dislodge the spring from the card until the card has been completely removed. No loose pins should be left in the DPIM during disassembly.

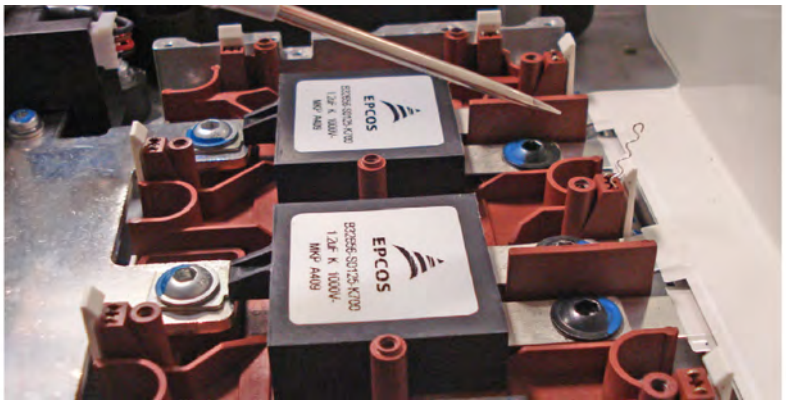

Figure 29. Spring Pins

4. Using a 4mm hex key, remove the six (6) M6x10mm screws from the SKiM Module (refer to Figure 30).

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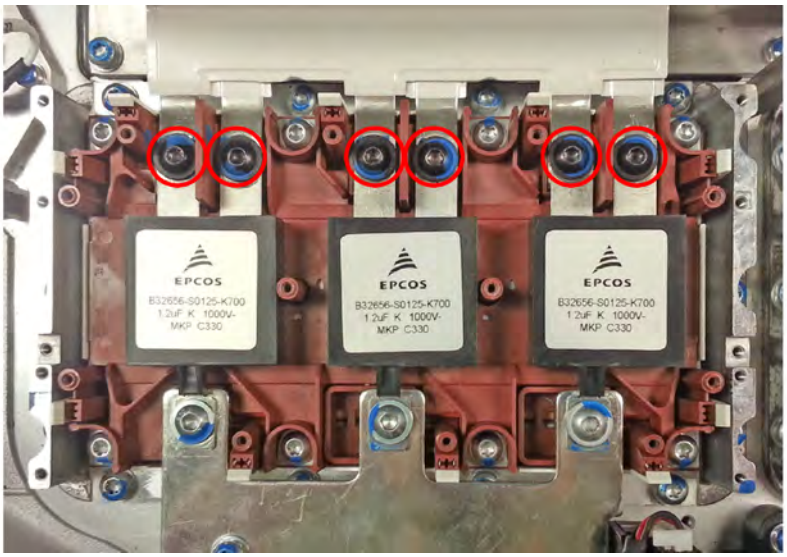

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Figure 30. SKiM Module Fastener Locations

5. Using a 4mm hex key, remove the three (3) M6x12mm screws from the SKiM Module (refer to Figure 31) and remove the three capacitors.

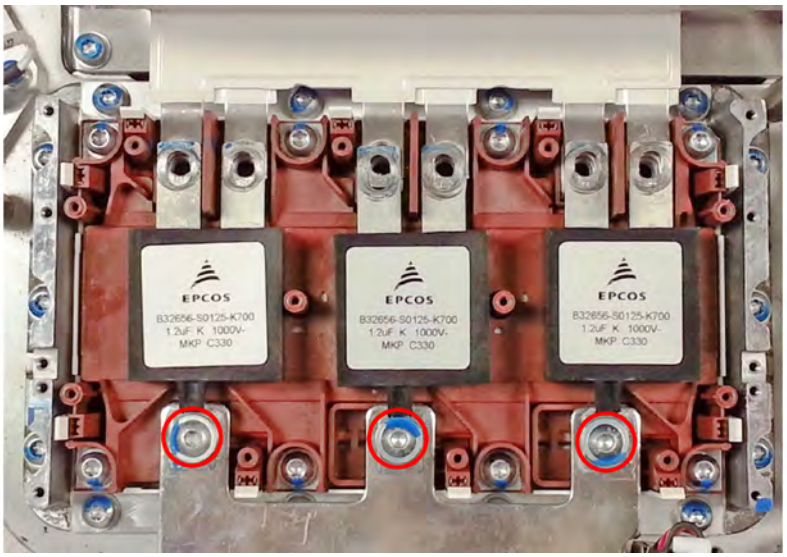

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Figure 31. SKiM Module Capacitor Removal

6. Using a Torx-Plus® T20 bit, remove the four (4) M4x14mm screws retaining the Encoder Module (refer to Figure 32) and carefully remove the Encoder Module.

NOTE: Removal of the Encoder Module is required ONLY if Inverter A Phase A SKiM® Module or Inverter B Phase C SKiM® Module and GATE Drive Cards are being replaced (refer to Figure 25).

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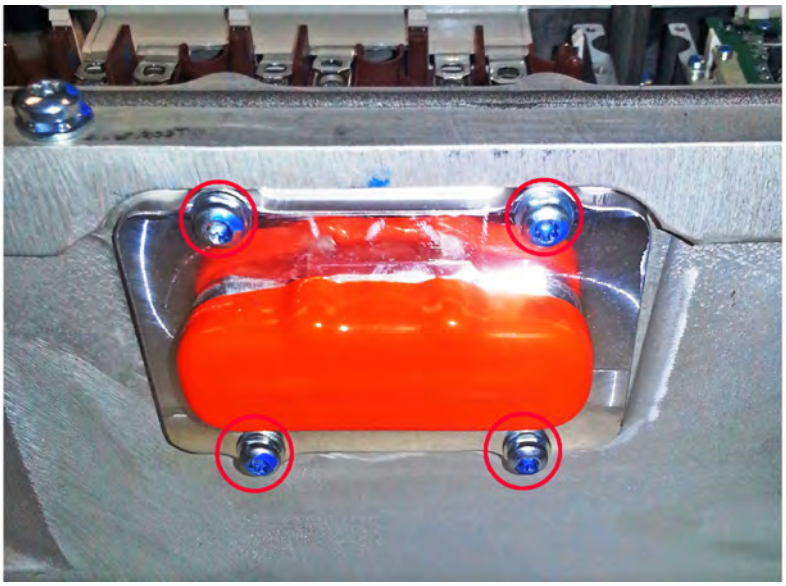

448722

Figure 32. Encoder Module Removal

7. Using a Torx-Plus® T25 bit, remove the two (2) M5x18mm mounting screws from the AC Busbar. If the DPIM has busbar-mounted current sensors installed, remove the AC Busbar and Current Sensor Assembly together (refer to Figure 33). If the DPIM has chassis-mounted current sensors installed, perform Step 8 below prior to removing the AC Busbar and Current Sensors Assembly.

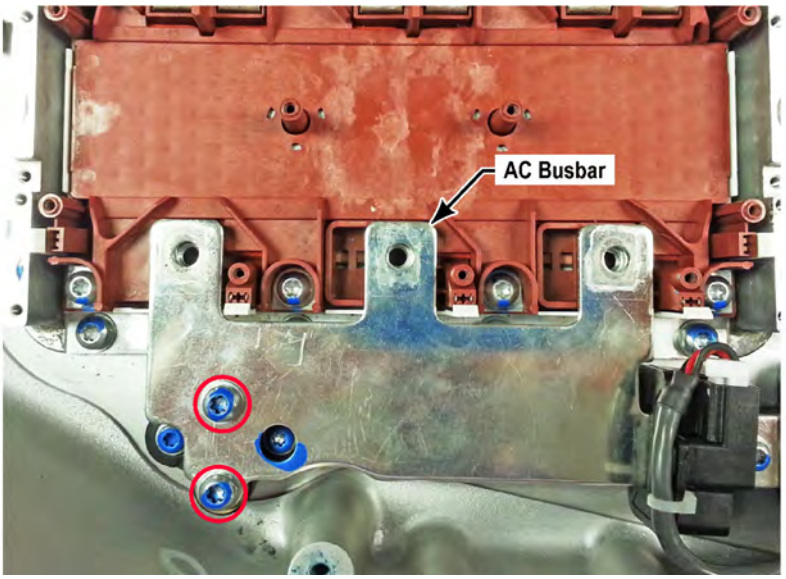

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Figure 33. AC Busbar Mounting Screw Locations

8. If the DPIM has chassis-mounted current sensors installed, use a Torx-Plus® T20 bit to remove the two (2) M4x16mm mounting screws from the current sensor mounting bracket. Remove the AC busbar and current sensor assembly together (refer to Figure 34).

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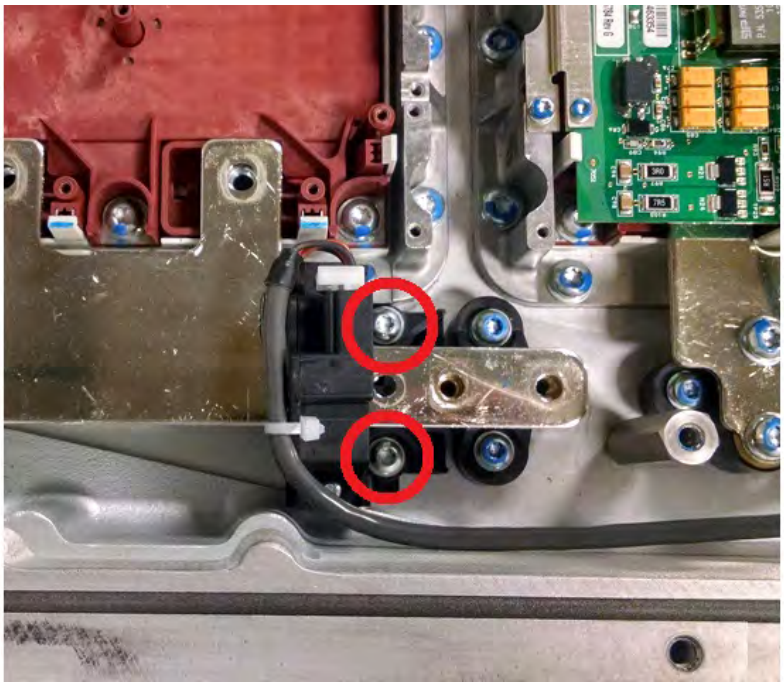

Figure 34. Chassis-Mount Current Sensor Screw Location

Section 5: Measure Baseline DPIM Cooler Circuit Leak Rate

NOTE: The DPIM Leak Tester (J-51673) is used to verify that the SKiM® Module O-Ring is not damaged during the installation of the SKiM® Module (refer to Section 7: Installation of SKiM® Module). Damage to this O-Ring will allow lube oil to enter the DPIM cavity, permanently damaging internal electrical components and making the DPIM inoperative. Prior to removing the original SKiM® Module, a baseline leak rate must be recorded to account for any system leaks that are not associated with the SKiM® Module and O-Ring being replaced. After the new SKiM® Module has been installed, the leak rate must be within 0.5 psi of the baseline leak rate.

1. Slightly raise the AC lug box end of the DPIM and allow the DPIM cooler circuit to fully drain through the cooler ports at the DC lug box end.
2. After the fluid has fully drained, lower the AC lug box end of the DPIM until it is level.
3. Thread the No. 8 Plug and No. 8 Quick Disconnect Fitting (provided with J-51673) into the DPIM cooler ports (refer to Figure 35). Torque the fittings to 30-36 N·m (22-27 lb ft.).

NOTE: The No. 8 Plug and No. 8 Quick Disconnect Fitting may be installed in either cooler port.

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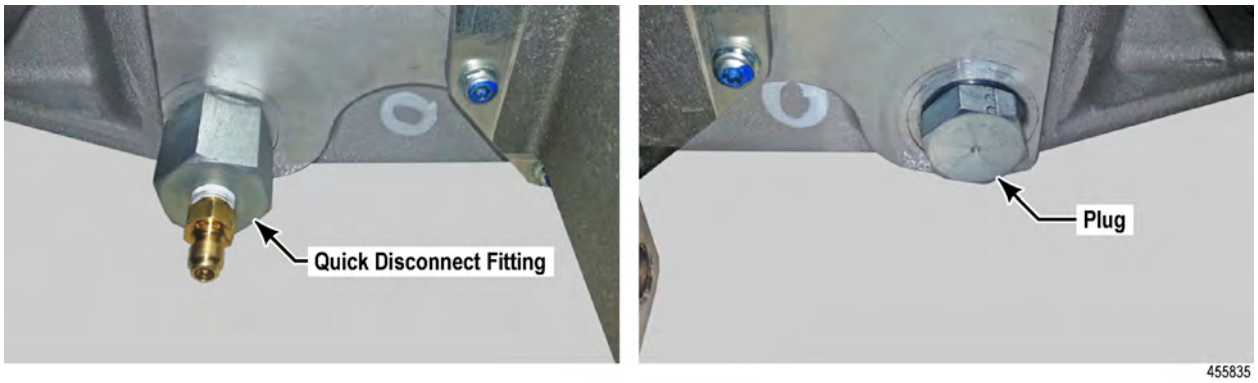

Figure 35. Installation of Cooler Port Fittings

NOTE: Ensure that the Pressure Regulator is adjusted to the lowest setting prior to connecting J-51673 to shop air.

4. Connect the hose end of J-51673 to the Quick Disconnect Fitting and connect shop air to the Pressure Regulator end of J-51673 (refer to Figure 36).

Figure 36. Connecting DPIM Leak Tester J-51673

5. Open the J-51673 Flow Valve and adjust the Pressure Regulator until the pressure stabilizes at 25 psi (refer to Figure 37).

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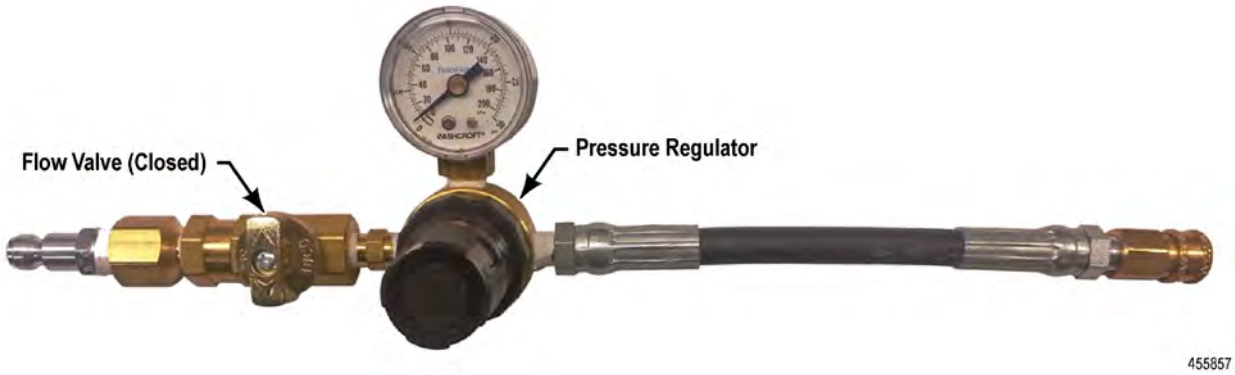

Figure 37. DPIM Leak Tester J-51673

6. Close the Flow Valve and start Stop Watch.
7. After five (5) minutes elapses, record the pressure.

NOTE: A properly sealed cooler system should have a pressure drop of no more than 1-2.5 psi over a five (5) minute period. If the pressure drop exceeds 2.5 psi, there may be a sealing problem with the port Plug, port Quick Disconnect Fitting, or DPIM Leak Tester J-51673.

8. Proceed to Step 10 if the pressure drop is no more than 1-2.5 psi over the five (5) minute period.
9. If the pressure drop exceeds 2.5 psi, check and correct the sealing integrity of all test equipment and repeat steps 5-7 until the pressure drop is less than 2.5 psi from 25 psi over a five (5) minute period.
10. Disconnect J-51673 at the Quick Disconnect Fitting on the DPIM and allow the cavity to depressurize.

NOTE: Leave all other pressure testing equipment in place while removing the old SKiM® Module (refer to Section 6: Removal of SKiM® Module) and installing the new SKiM® Module (refer to Section 7: Installation of SKiM® Module). Doing so will ensure the that only change to the sealing of the DPIM cooler circuit occurs at the SKiM® Module and O-Ring that are being replaced.

Section 6: Removal of SKiM® Module

1. Slide Tab Bending Tool J-51586 over the DC busbar terminal tab.

NOTE: The terminal tab MUST be fully inserted in the tool groove in order to control the location of the bend (refer to Figure 38).

CAUTION: Improper use or failure to use Tab Bending Tool J-51586 could result in overbending of the DC busbar tab, potentially causing unrepairable damage to the DC busbar.

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Figure 38. Inserting J-51586 Over DC Busbar Terminal Tab

2. Bend the DC busbar terminal tab up until tool J-51586 contacts the DC busbar (refer to Figure 39). The resulting bend of the tab will be approximately 45 degrees.

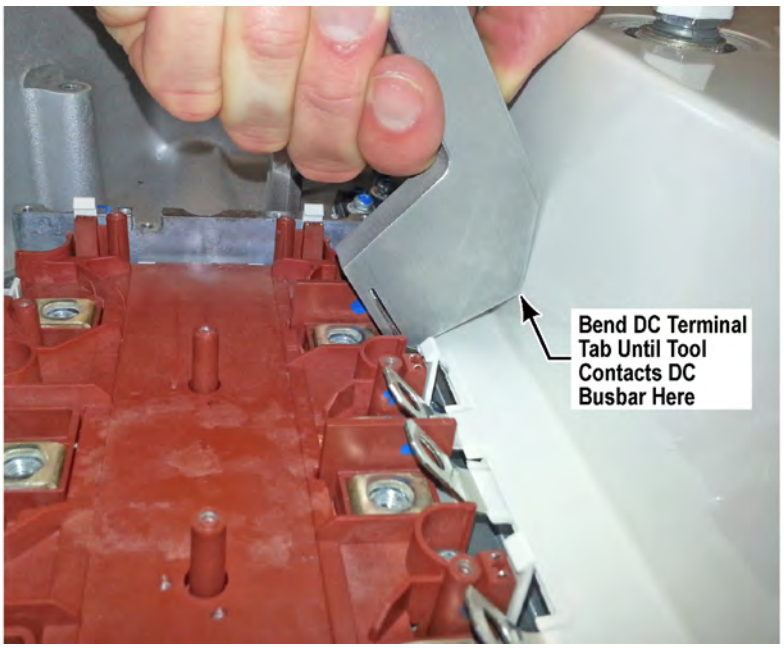

Figure 39. Bending DC Busbar Terminal Tab

3. Using a Torx-Plus® 6in T25 bit, remove the fourteen (14) M5x14mm screws (refer to Figure 40).

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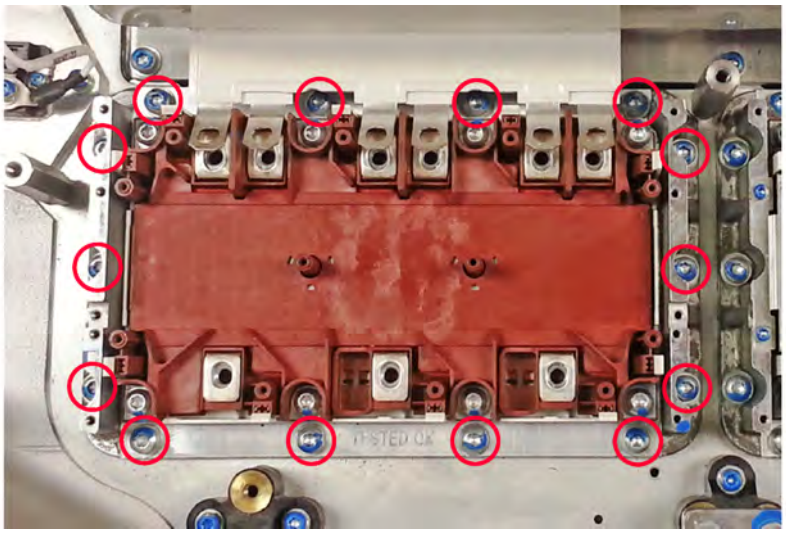
CAUTION: Do not damage the white insulation on the DC busbar while removing the screws securing the SKiM® module in place. Damage to insulation can cause permanent damage to the DPIM.



449192

Figure 40. SKiM® Module Fastener Locations

4. Lift the front of the SKiM® module to a 45 degree angle or until it is flush with the terminal tabs (refer to Figure 41). Pull the SKiM® module outward from the DPIM at a 45 degree angle.

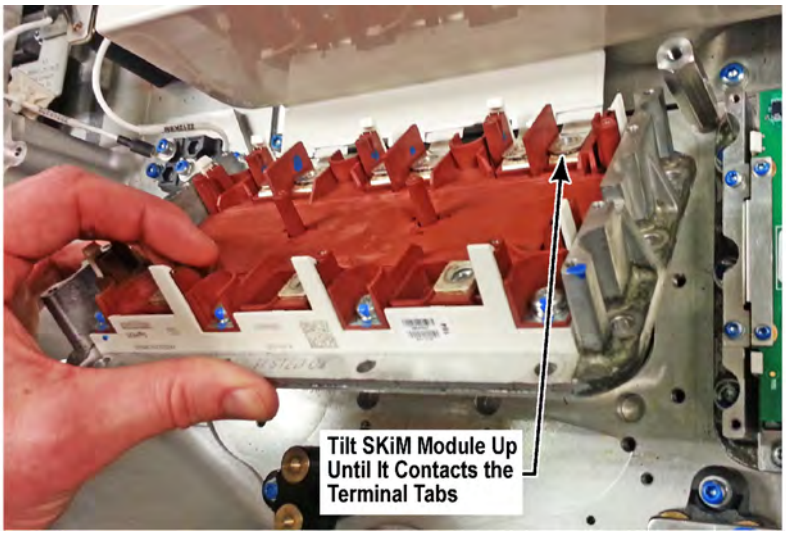


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Figure 41. SKiM® Module Removal

5. Remove the SKiM® Module O-Ring (refer to Figure 42).

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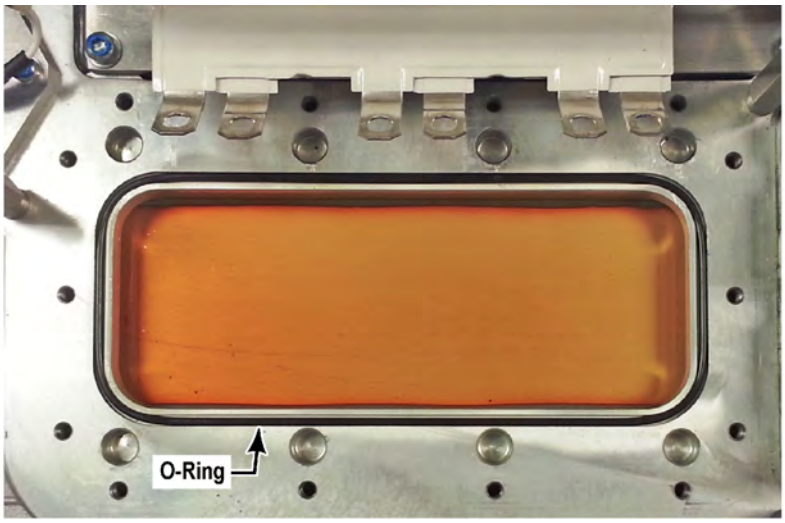

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Figure 42. SKiM® Module O-Ring

Section 7: Installation of SKiM® Module

WARNING: Inspect all reuse components for damage or corrosion, clean or replace any components as necessary. A vacuum may be used to clean any debris inside the DPIM chassis. Debris or excessive corrosion can cause isolation faults.

1. Lubricate NEW SKiM® Module O-Ring with clean transmission fluid and install in groove (refer to Figure 42).
2. Remove the plastic shipping cover from the SKiM® Module (refer to Figure 43).

456765

Figure 43. SKiM® Module Plastic Shipping Cover

3. Ensure that no spring pins have been removed along with the plastic shipping cover and that all spring pins are sitting slightly above the SKiM® Module surface (refer to Figure 44).

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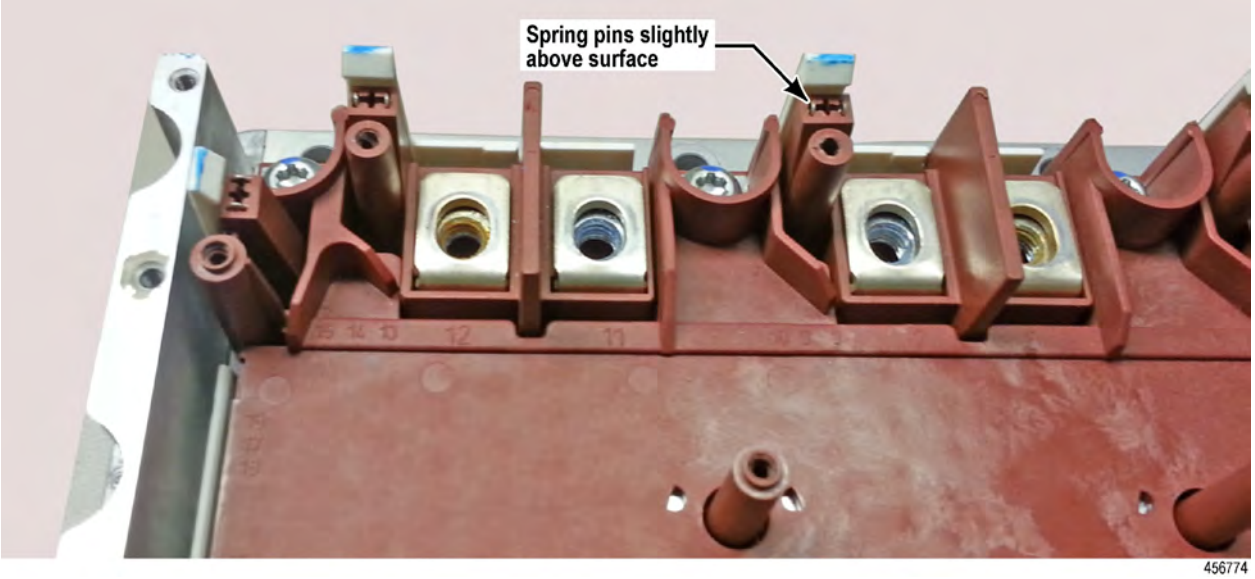

Figure 44. SKiM® Module Spring Pins

NOTE: When installing the NEW SKiM® Module, do not allow the threaded bosses (location “A”) to contact the SKiM® Module O-Ring (location “B”). The threaded bosses (location “A”) will insert into the locating holes (location “C”) after the SKiM® Module has been positioned properly (refer to Figure 45).

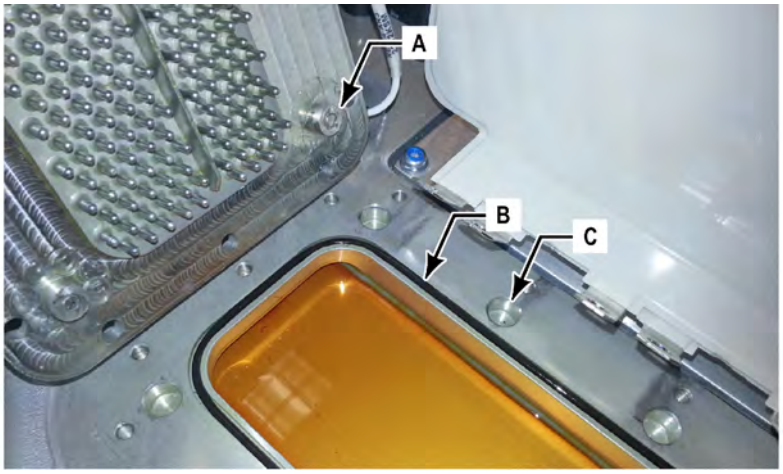

Figure 45. Installation of SKiM® Module

WARNING: Damage to the SKiM® Module O-Ring can allow a transmission fluid leak that will result in permanent and irreversible DPIM damage.

4. Position the SKiM® module at a 45 degree angle (flush with the bent terminal tabs) and apply pressure towards the DC busbar as the front of the SKiM® module is lowered into final position (refer to Figure 46).

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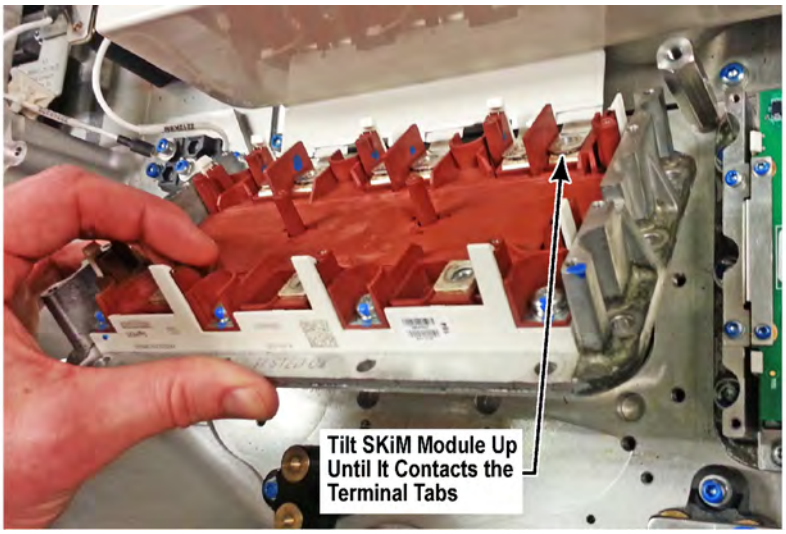

449743

Figure 46. SKiM® Module Installation

NOTE: Do NOT allow the SKiM® Module thread boss (location "A") to come in contact with the SKiM® Module O-Ring (location "B") (refer to Figure 47).

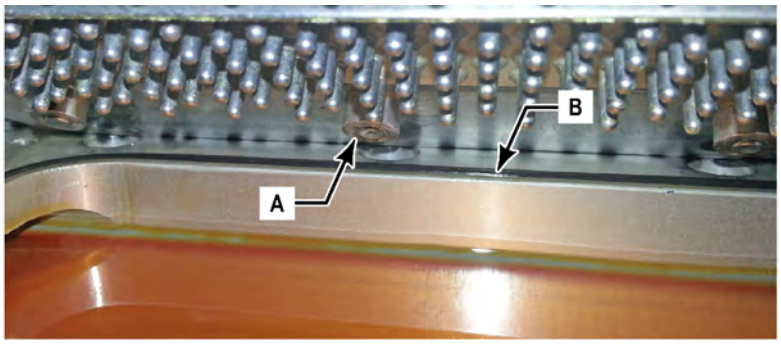

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Figure 47. SKiM® Module Thread Boss

5. Verify that all four (4) sides of the SKiM® Module are flush with the DPIM chassis to ensure that the SKiM® Module O-Ring has not been pinched.
6. Verify that all fifteen (15) spring pins are in place (refer to Figure 48).

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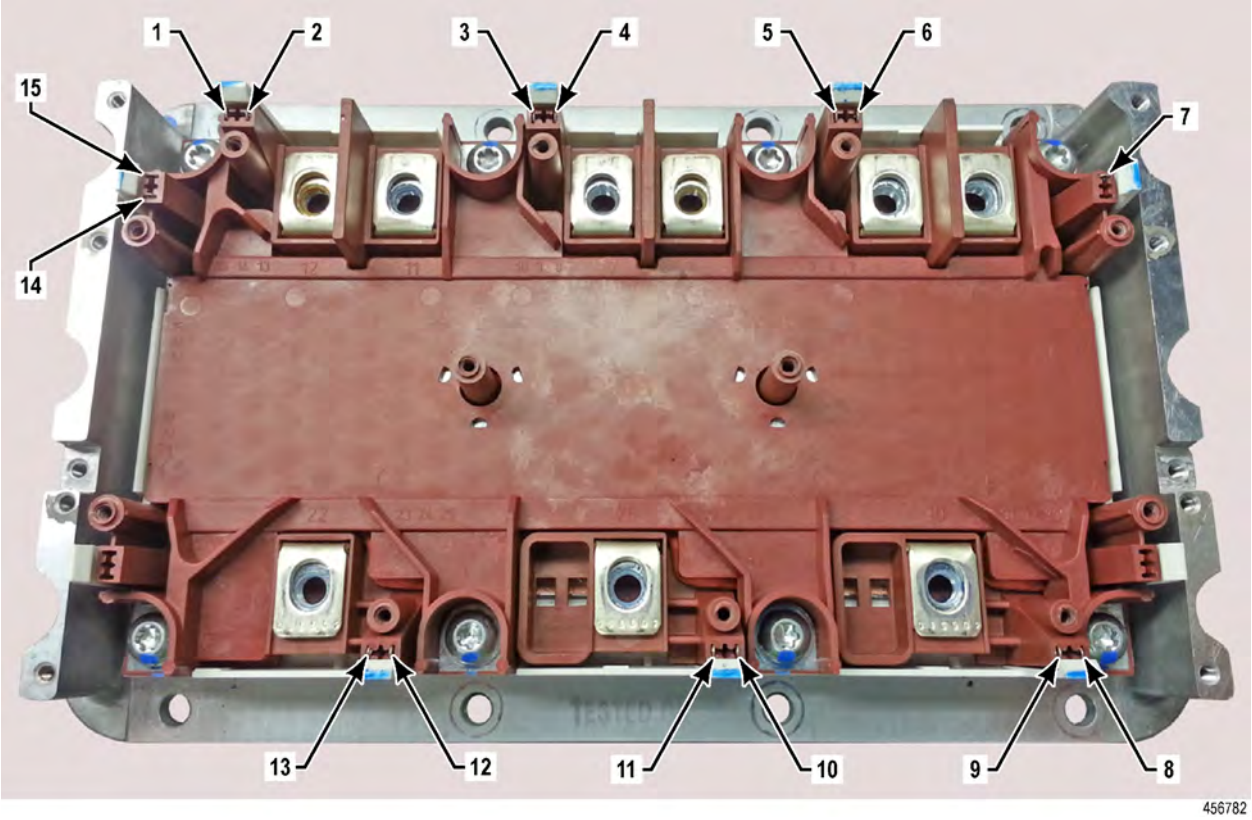

Figure 48. SKiM® Module Spring Pins (Quantity 15)

7. Using a Torx-Plus® 6in T25 bit, install the fourteen (14) M5x14mm screws (refer to Figure 49). Torque the screws to 3.1-3.5 N·m (27.4-31.0 lb in.).

CAUTION: Do not damage the white insulation on the DC busbar while installing the screws to secure the SKiM® module. Damage to insulation can cause permanent damage to the DPIM.

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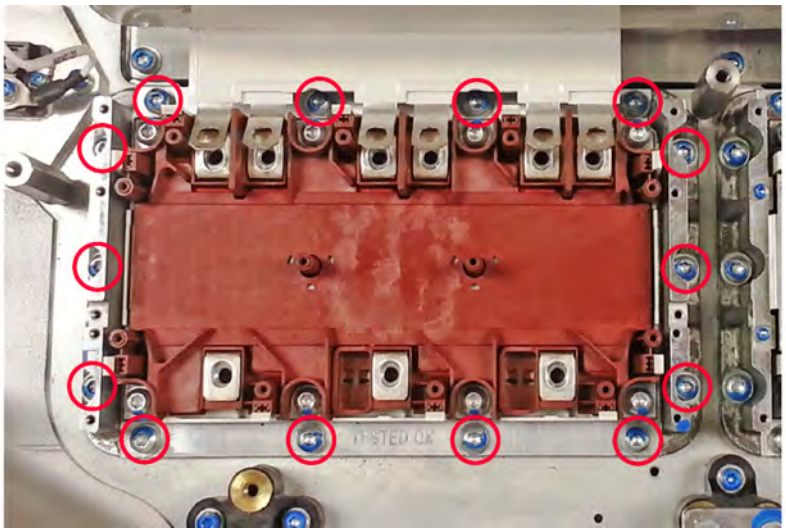

Figure 49. SKiM® Module Fastener Locations

Section 8: Measure DPIM Cooler Circuit Leak Rate After SKiM® Module Installation

NOTE: All DPIM Leak Testing equipment should still be in place (refer to Section 5: Measure Baseline DPIM Cooler Circuit Leak Rate).

1. Connect the hose end of J-51673 to the Quick Disconnect Fitting on the DPIM.
2. Open the J-51673 Flow Valve and adjust the Pressure Regulator until the pressure stabilizes at 25 psi (refer to Figure 50).

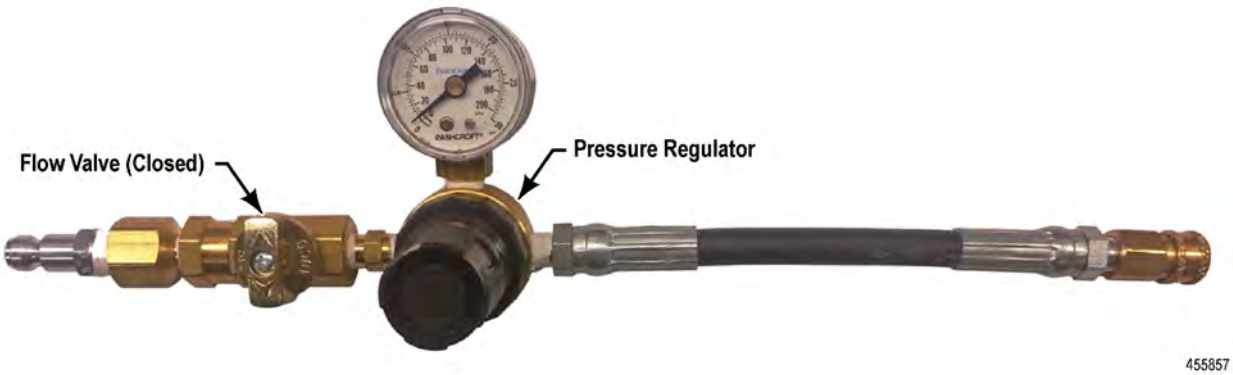

Figure 50. DPIM Leak Tester J-51673

3. Close the Flow Valve and start Stop Watch.
4. After five (5) minutes elapse, record the pressure.

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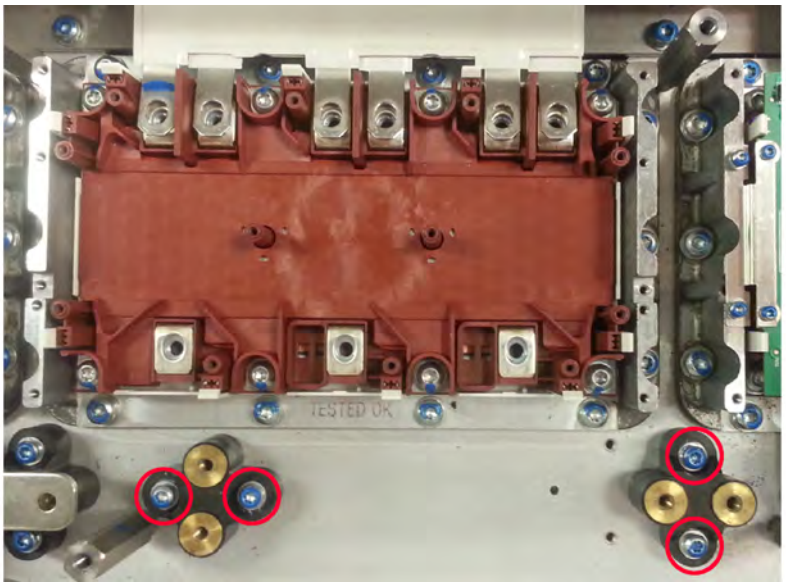
NOTE: The pressure drop should be within 0.5 psi of the baseline pressure drop obtained in Section 5: Measure Baseline DPIM Cooler Circuit Leak Rate. If the pressure drop is above 0.5 psi from the baseline, then the SKiM® Module O-Ring may have been damaged during the installation of the SKiM® Module. Remove the SKiM® Module and inspect the O-Ring and sealing surfaces for damage. Any damaged components should be replaced.

5. If the pressure drop exceeds 0.5 psi from the baseline reading pressure drop, repeat Section 7: Installation of SKiM® Module and Section 8: Measure DPIM Cooler Circuit Leak Rate After SKiM® Module Installation.
6. Remove the DPIM Leak Tester J-51673, Port Plug and Quick Disconnect Fitting from the DPIM.

Section 9: Inspection of the AC Busbar Supports for Corrosion and Debris

NOTE: Corrosion and debris that has fallen into the AC Busbar Support can create an isolation fault between the AC Busbar and DPIM Chassis

1. Using a Torx-Plus® T20 bit, remove the four (4) M4x22mm screws retaining the two (2) AC Busbar Supports (refer to Figure 51).



2295841

Figure 51. AC Busbar Supports

2. Remove the Busbar Supports and clean any debris inside the DPIM chassis or on the components. Replace components if excessive corrosion or damage is found. A vacuum may be used to remove any debris from the DPIM.
3. Install the two (2) AC Busbar Supports and use a Torx-Plus® T20 bit to install the four (4) M4x22mm screws (refer to Figure 52). Torque the four (4) M4x22mm screws to 1.2-1.5 (10.6-13.3 lb in.).

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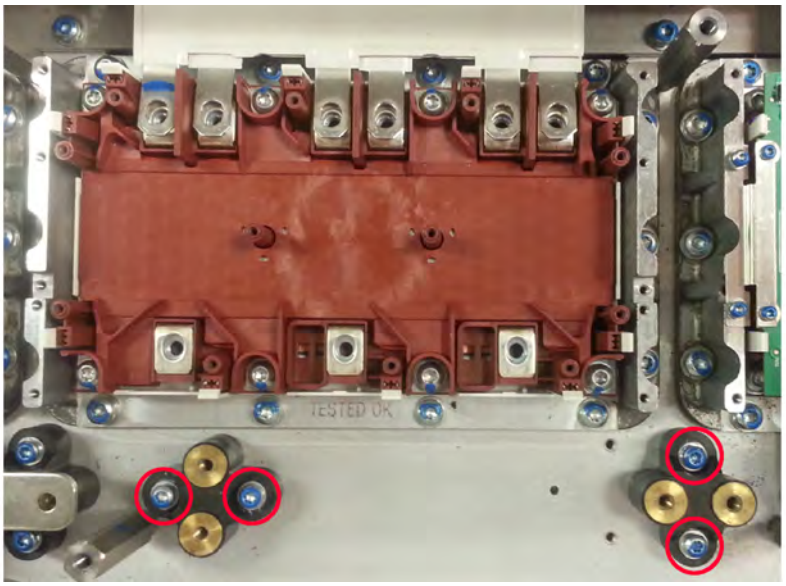

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Figure 52. AC Busbar Supports

Section 10: Installation of GATE Drive Card

1. Bend the six (6) DC Busbar Terminal Tabs back down using Tab Bending Tool J-51586.
2. If the DPIM has busbar-mounted current sensors installed, install AC Busbar and Current Sensor Assembly and apply one drop of Loctite® 425 or 242 thread locking compound to the end of the external threads of the two (2) M5x18mm mounting screws. Using a Torx-Plus® T25 bit, install the two (2) M5x18mm mounting screws to the AC Busbar (refer to Figure 53). Torque the two (2) M5x18mm screws to 3.1-3.5 N·m (27.4-31.0 lb in.).

NOTE: If the DPIM has chassis-mounted current sensors installed, perform Steps 3 through 10 below. If the DPIM has busbar-mouned current sensors, skip Steps 3 through 10 below and proceed to Step 11.

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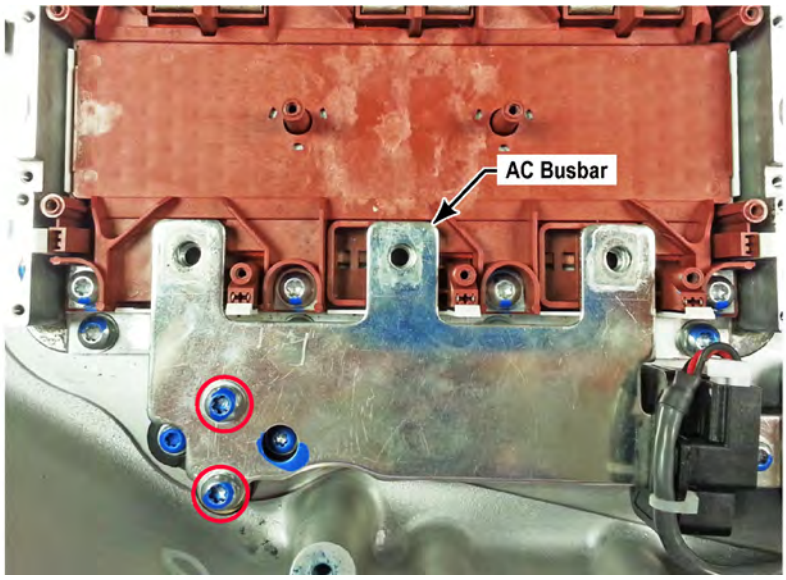

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Figure 53. AC Busbar Mounting Screw Locations

3. Carefully cut and remove the single wire tie holding the current sensor harness to the body of the current sensor (refer to Figure 54). Leave the harness connected to the sensor.

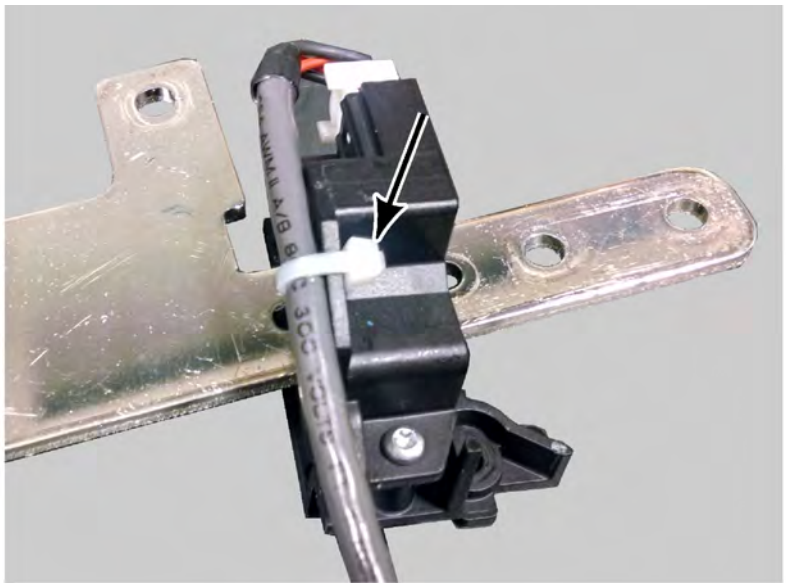

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Figure 54. Wire Tie to be Removed

4. Install the AC Busbar and Current Sensor Assembly and align the holes in the AC Busbar to the AC Busbar Supports and the SKiM® module (refer to Figure 55).

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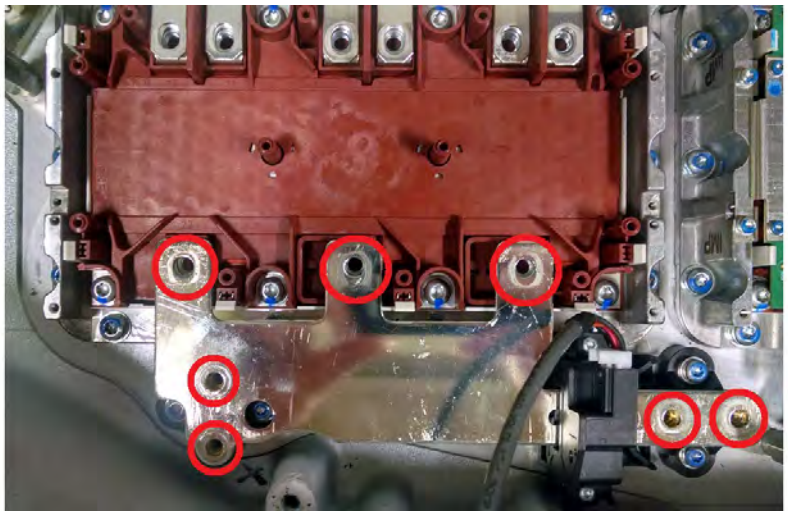

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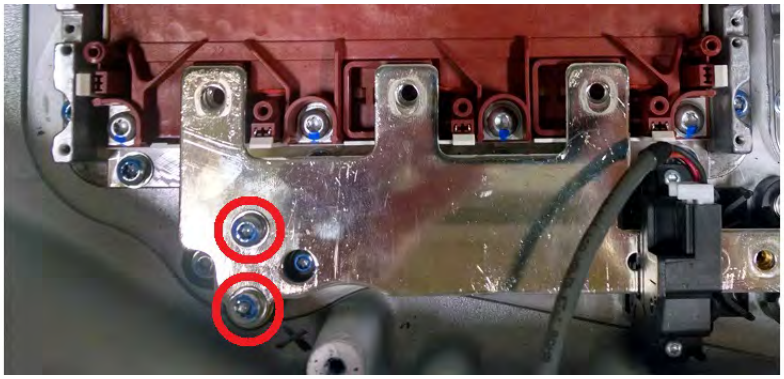
Figure 55. Align Holes During AC Busbar Installation

5. Apply one drop of Loctite® 425 or 242 thread locking compound to the end of the two (2) M5x18mm mounting screws (refer to Figure 56). Using a Torx-Plus® T25 bit, torque the two screws to 3.1-3.5 N·m (27.4-31.0 lb in).



3327510

Figure 56. AC Busbar Mounting Screw Locations

6. Align the holes in the current sensor mounting bracket to the holes in the DPIM chassis and start two (2) M4x16mm screws (refer to Figure 57).

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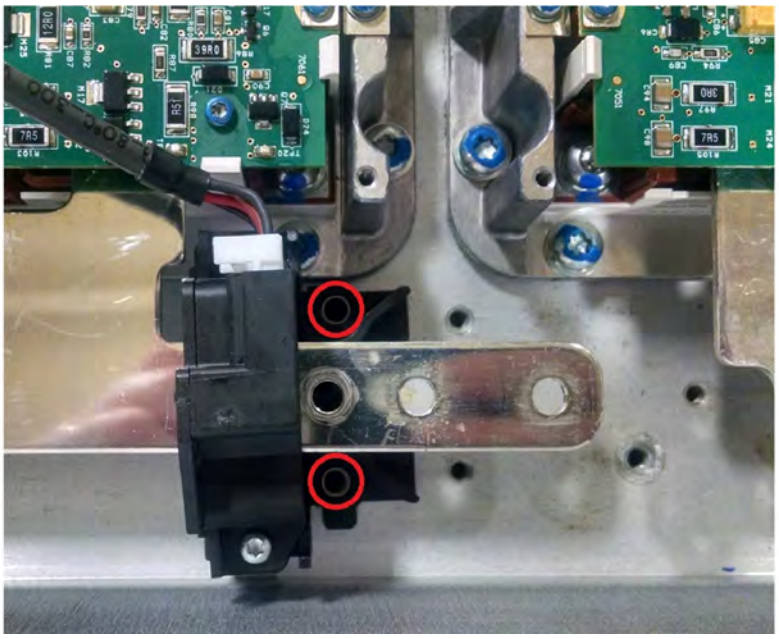

Figure 57. Location of Mounting Holes

7. Insert the alignment tool (P/N 29558018) into the plate side of the current sensor so that the tool lies against the sensor housing while sitting on top of the AC busbar (refer to Figure 58).

NOTE: The plate side of the sensor references the side of the sensor with a thin plate that completes the sensor housing.

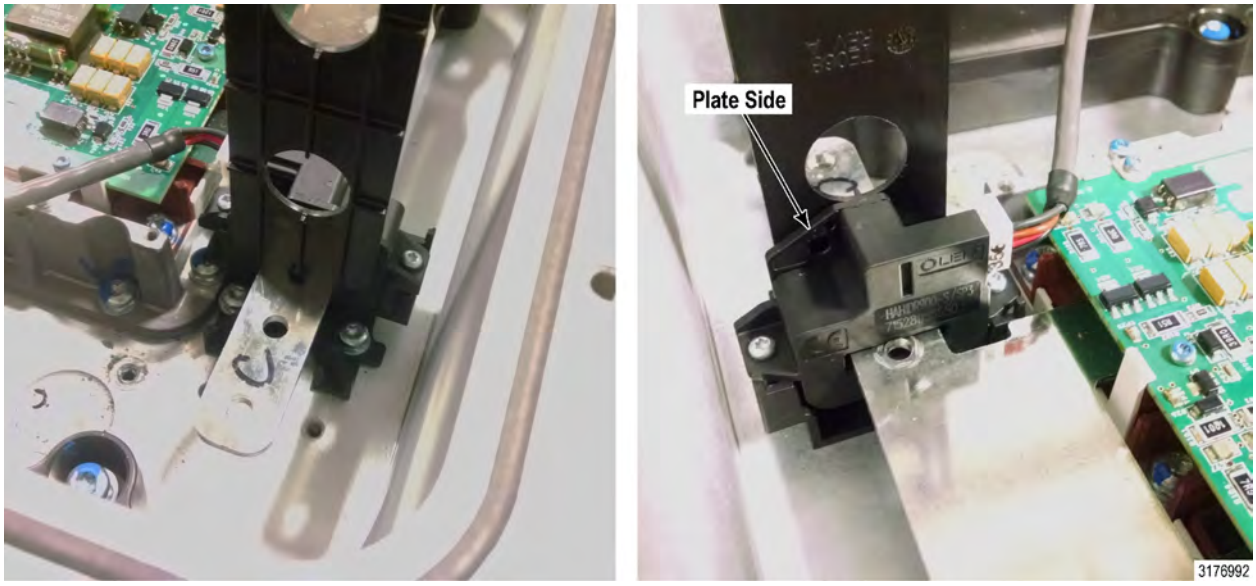

Figure 58. Alignment Tool in Plate Side of Current Sensor

8. Using a Torx-Plus® T20 bit and with the alignment tool still installed, torque the two (2) M4x16mm sensor mounting screws to 1.2-1.5 N·m (10.6-13.3 lb in.)

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9. Remove the alignment tool and verify that the AC busbar is not touching the sensor housing.
10. Route the harness assembly with adequate wire bend radius and secure it to the sensor with a new wire tie ensuring no relative movement of the harness to the sensor housing. Clip excess wire tie length as required. (refer to Figure 59).

3183994

Figure 59. Harness Routed and Tied to Sensor Housing

11. Perform the following step ONLY if removal of the Encoder Module was required:

    Carefully position the Encoder Module on the DPIM. Using a Torx-Plus® T20 bit, install the four (4) M4x14mm screws (refer to Figure 60). Torque the four (4) M4x14mm screws to 1.2-1.5 N·m (10.6-13.3 lb in.).

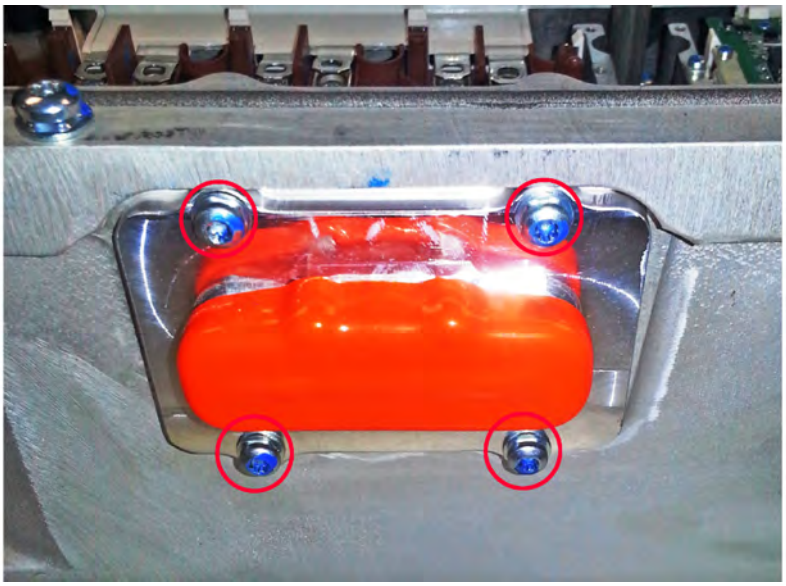

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Figure 60. Encoder Module Installation

12. Position the three (3) capacitors on the SKiM® Module. Apply one drop of Loctite® 425 or 242 thread locking compound to the ends of the external threads of the three (3) M6x12mm screws. Using a 4mm hex key,

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install the three (3) M6x12mm screws (refer to Figure 61). Torque the three (3) M6x12mm screws to 6.8-7.3 N·m (60.2-64.6 lb in.).

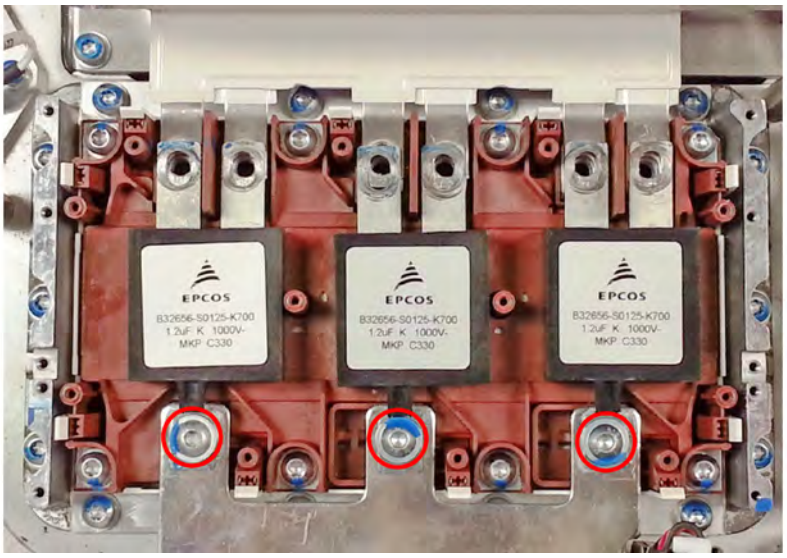

Figure 61. SKiM® Module Capacitor Installation

13. Apply one drop of Loctite® 425 or 242 thread locking compound to the ends of the external threads of the six (6) M6x10mm screws. Using a 4mm hex key, install the six (6) M6x10mm screws to the SKiM® Module (refer to Figure 62). Torque the six (6) M6x10mm screws to 6.8-7.3 N·m (60.2-64.6 lb in.).

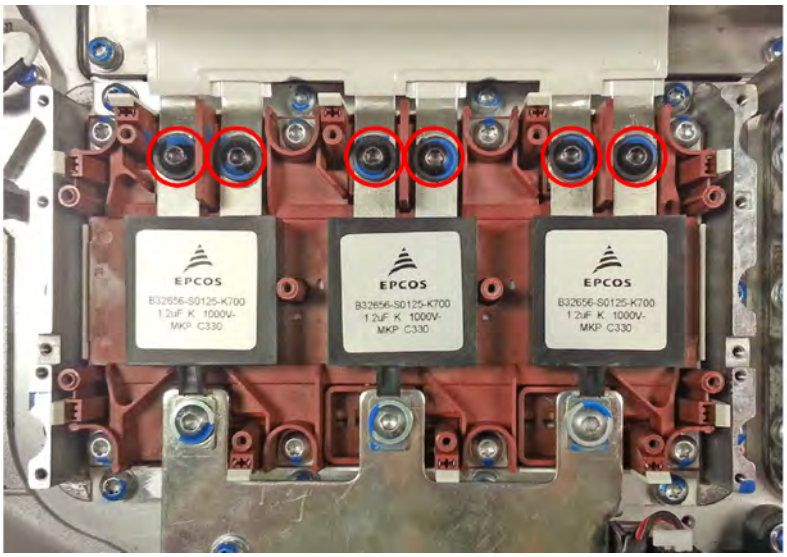

Figure 62. SKiM® Module Fastener Locations

14. Position the GATE Drive Cardholes over the locating hubs on the SKiM® module (refer to Figure 63). Carefully press the GATE Drive Card straight down over the ten (10) white locking tabs (refer to Figure 64) so the card is fully seated.

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NOTE: There are 6 locating hubs on the SKiM® module; two (2) on each end of the SKiM® module and two (2) in the center.

CAUTION: Failure to mount the card on the locating hubs correctly can prevent the card from seating completely causing the card to flex which can cause damage.

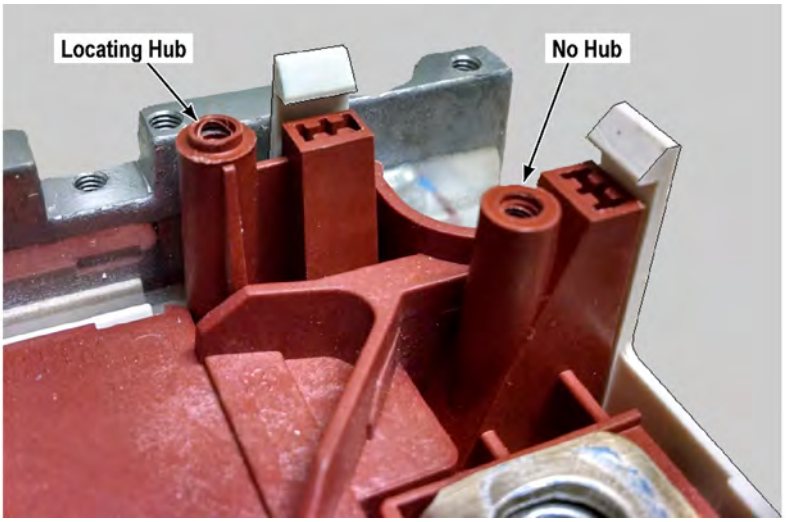

Figure 63. Locating Hub Identification on SKiM® Module

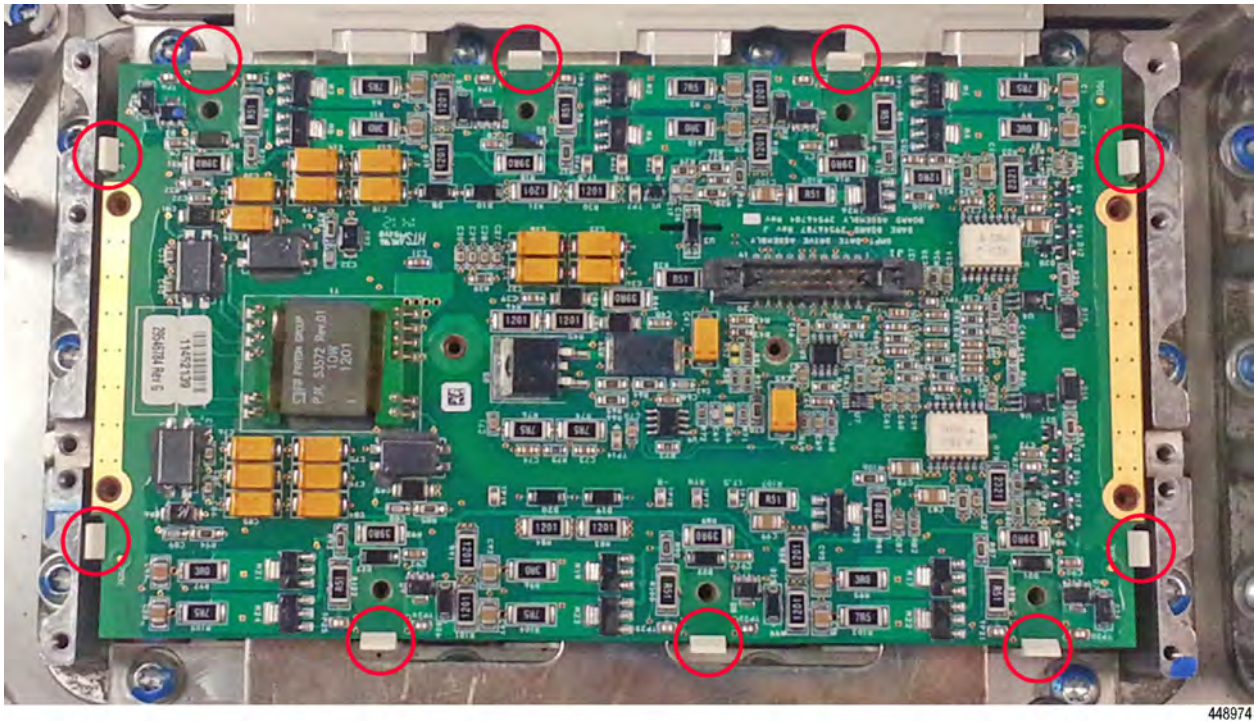

Figure 64. GATE Drive Card Locking Tab Locations

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15. Place the two (2) grounding brackets into position. Using a Torx-Plus® T10 bit, install the four (4) M3x8mm (fine thread) screws to the GATE Drive Card (refer to Figure 65). Torque the four (4) M3x8mm (fine thread) screws to 0.6-0.8 N·m (5.3-7.1 lb in.).

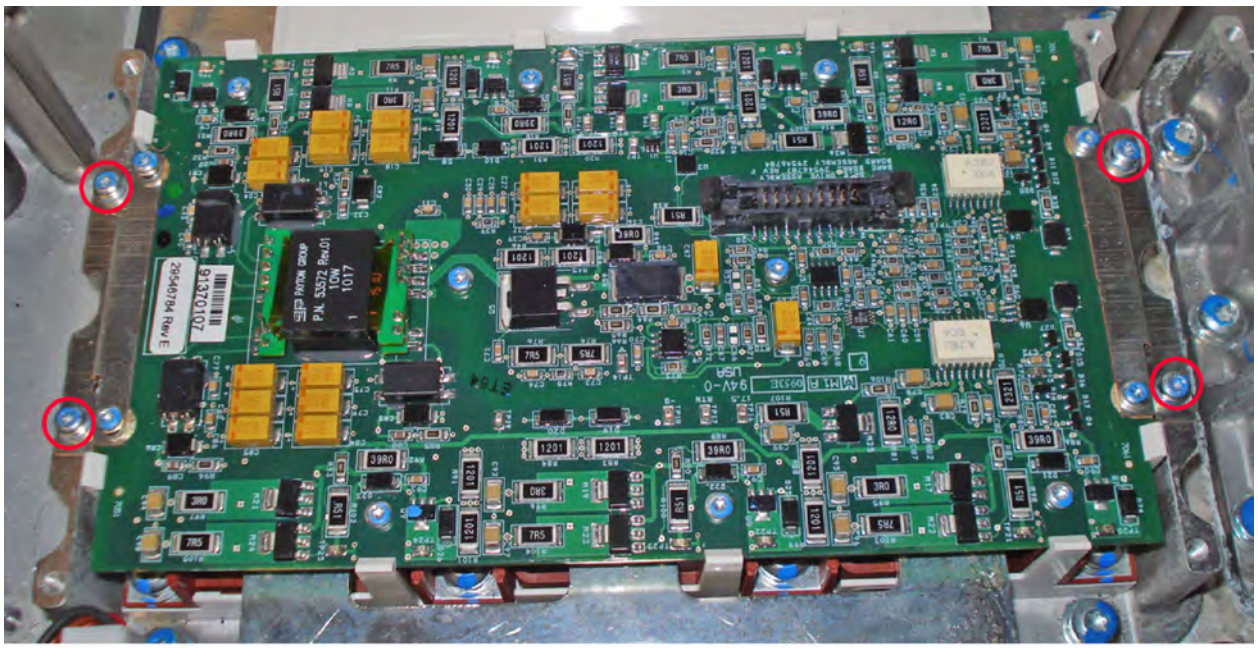

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Figure 65. GATE Drive Card Fastener Locations (M3x8mm Fine Thread) – Quantity 4

16. Using a Torx-Plus® T8 bit, install the twelve (12) M3x8mm (coarse thread) screws to the GATE Drive Card (refer to Figure 66). Torque the twelve (12) M3x8mm (coarse thread) screws to 0.3-0.6 N·m (2.7-5.3 lb in.).

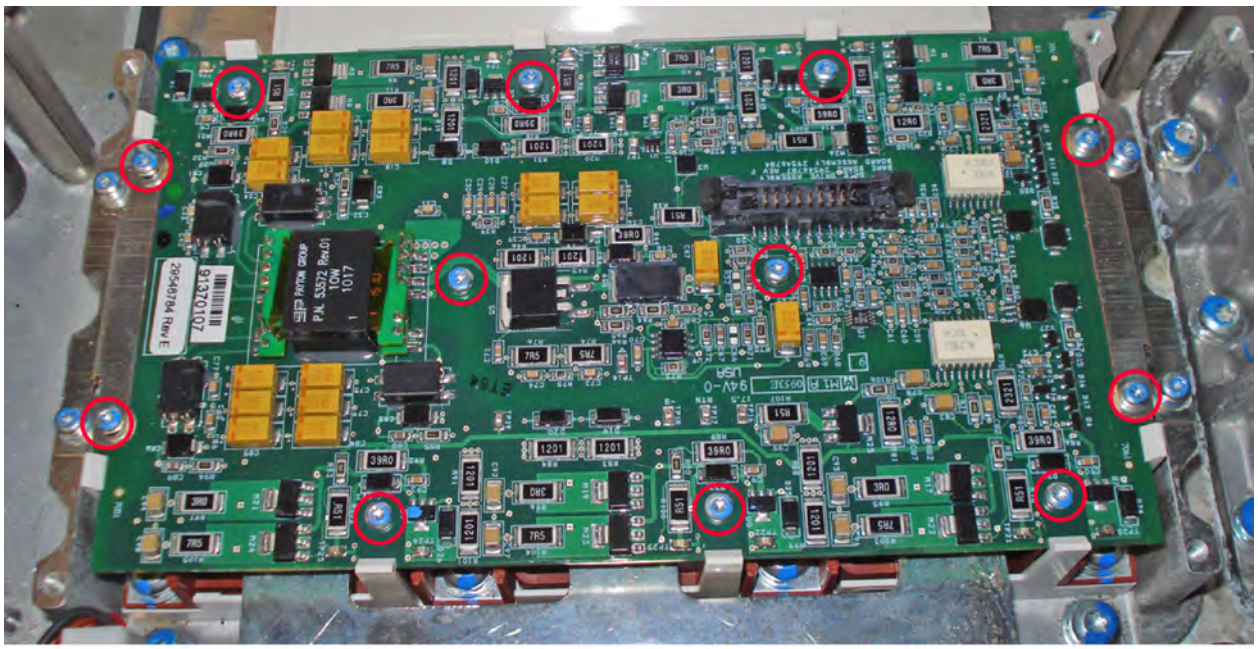

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Figure 66. GATE Drive Card Fastener Locations (M3x8mm Coarse Thread – Quantity 12)

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Section 11: Installation of the AC Busbar Assembly

1. Carefully install the AC Busbar Assembly into AC Lug Box (refer to Figure 67).

CAUTION: Do not allow the AC Busbar Assembly to strike the HVIL Switch during the installation process.

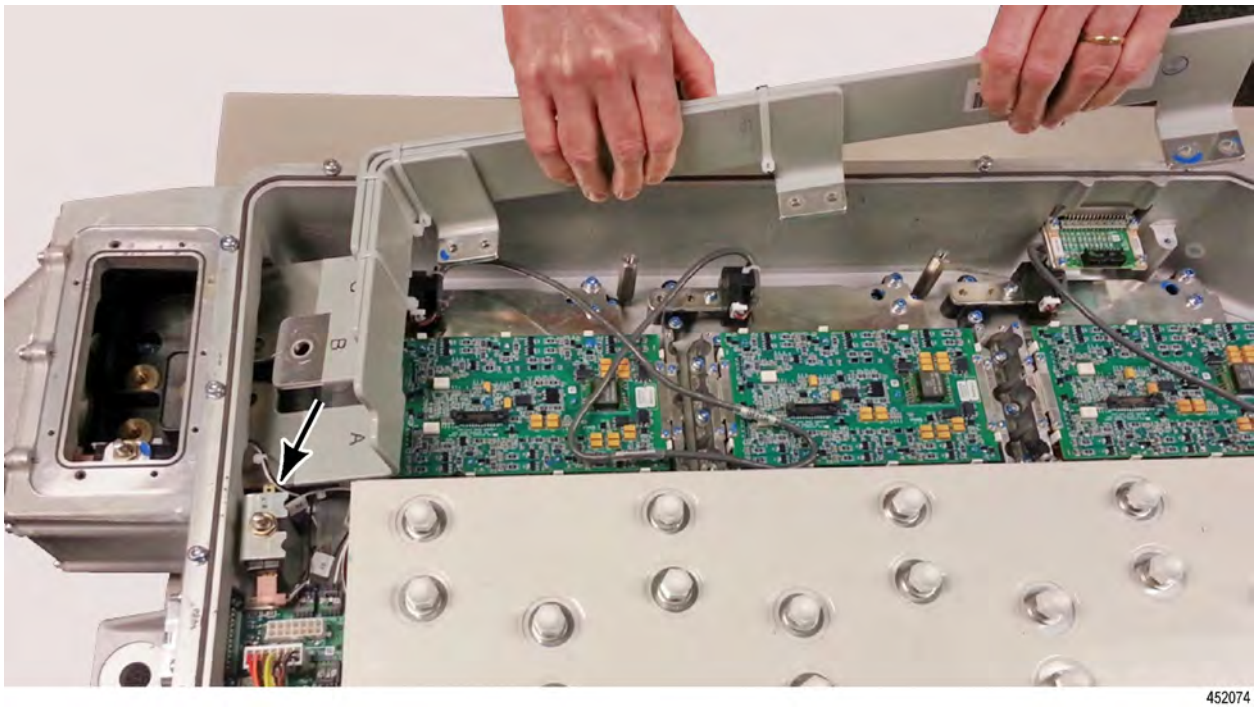

Figure 67. Installation of AC Busbar Assembly

2. Install the HVIL switch connector (refer to Figure 68).

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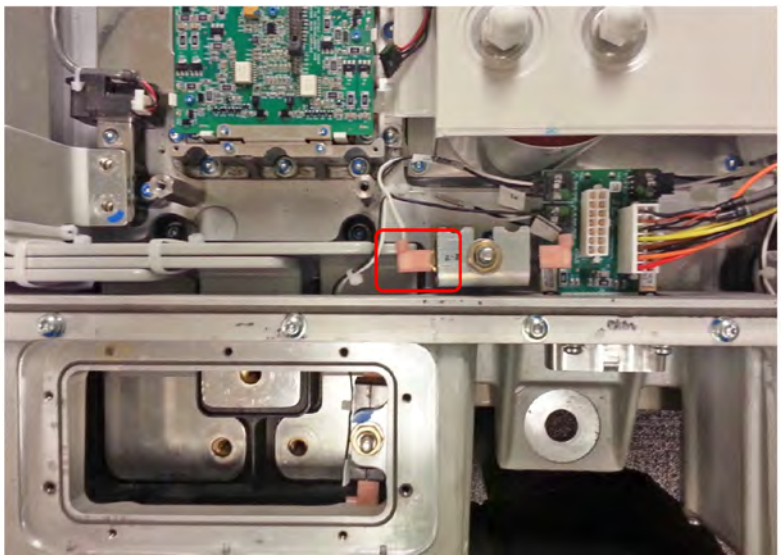

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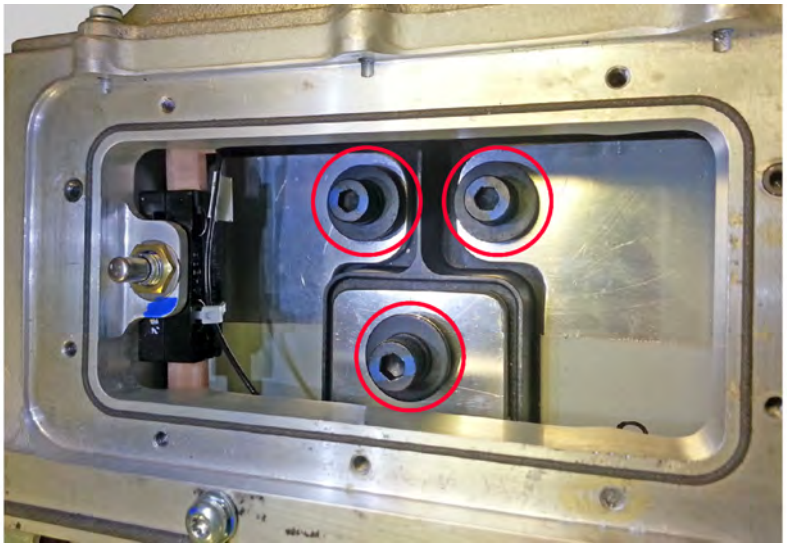
Figure 68. HVIL Switch Location

3. Install and finger tighten the three (3) M8 AC lug bolts (refer to Figure 69).



448740

Figure 69. AC Lug Bolts

4. Apply one drop of Loctite® 425 or 242 thread locking compound to the end of the external threads of the six (6) M5x22mm screws. Using a Torx-Plus® T25 bit, install the six (6) M5x22mm screws (refer to Figure 70). Torque the six (6) M5x22mm screws to 3.1-3.5 N·m (27.4-30.9 lb in.).

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NOTE: Install all screws before torquing to ensure that the holes line up.

NOTE: Exercise special care to not pinch any wires when components are installed and screws are torqued.

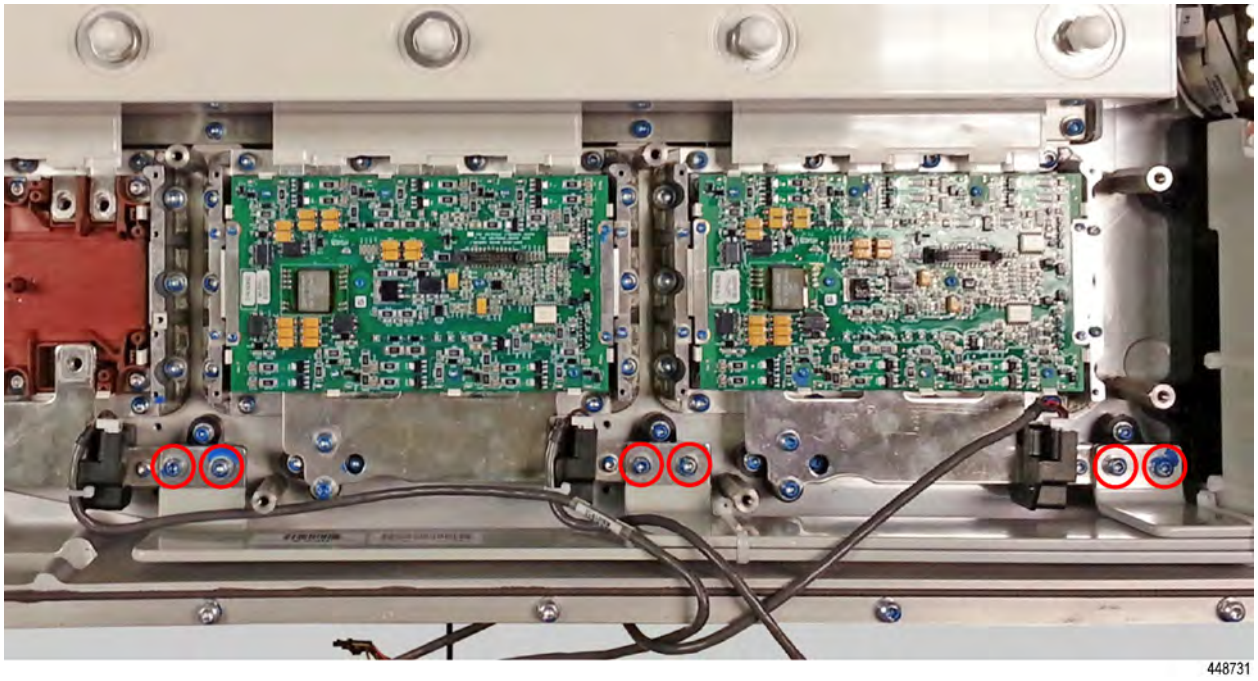

Figure 70. Mounting Screw Locations

Section 12: Installation of BCA Card Mounting Shelf

1. Feed all tie wraps through the BCA Card Mounting Shelf (refer to Figure 71).

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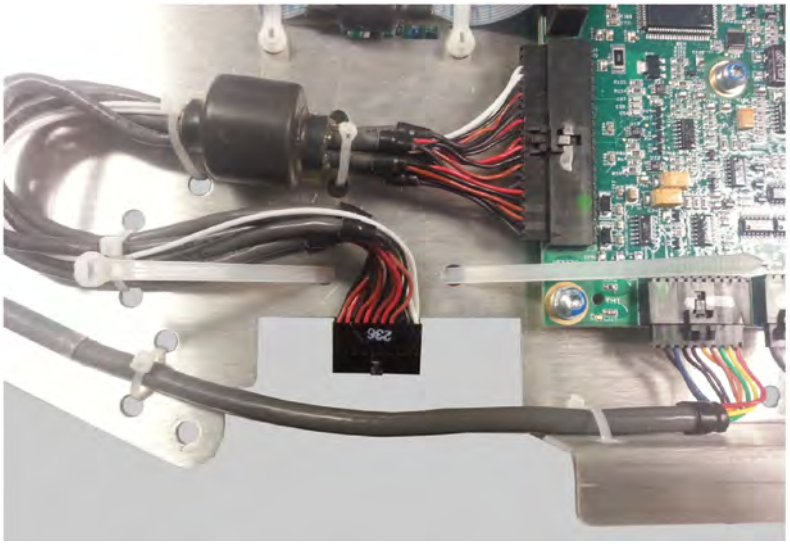

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Figure 71. BCA Card Mounting Shelf tie Wrap Location

2. Replace the ribbon harness (1, 2, or 3) that connects to the Gate Drive that was replaced.

NOTE: P/N 29546811 is used on phases A and C and P/N 29546810 is used for Phase B (refer to Figure 72).

3. Place the BCA Mounting Shelf onto the side of DPIM chassis as shown in Figure 72.

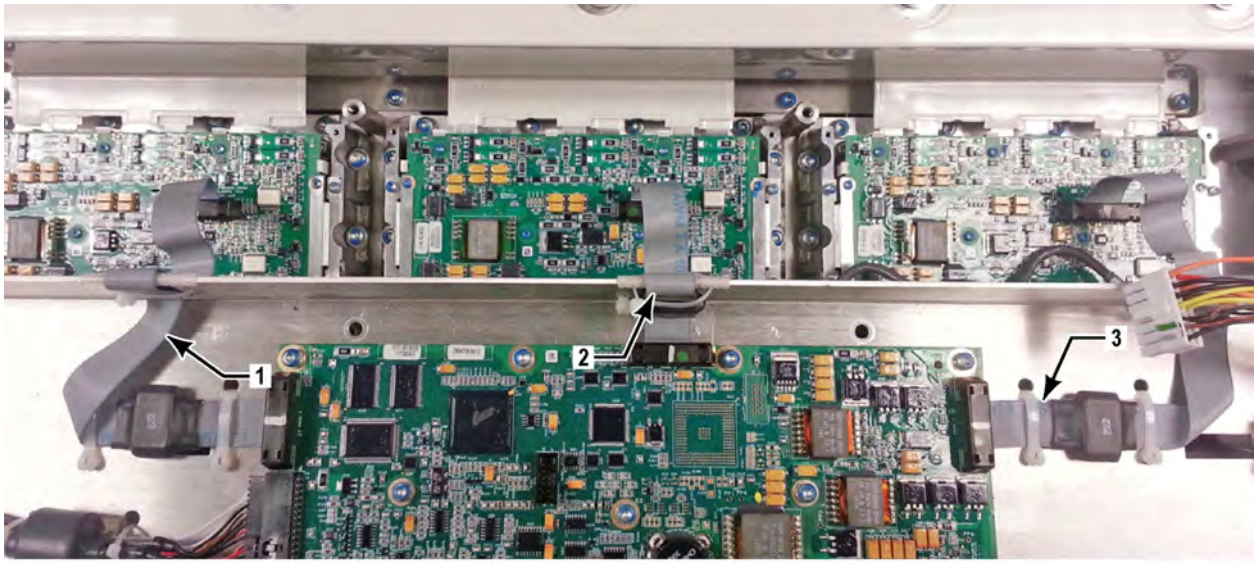

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Figure 72. BCA Mounting Shelf (GATE Drive Card Cable Connectors Shown Circled)

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4. Connect three (3) GATE Drive Card Connectors to three (3) GATE Drive Cards (refer to Figure 73) and install the cable strain relief caps.

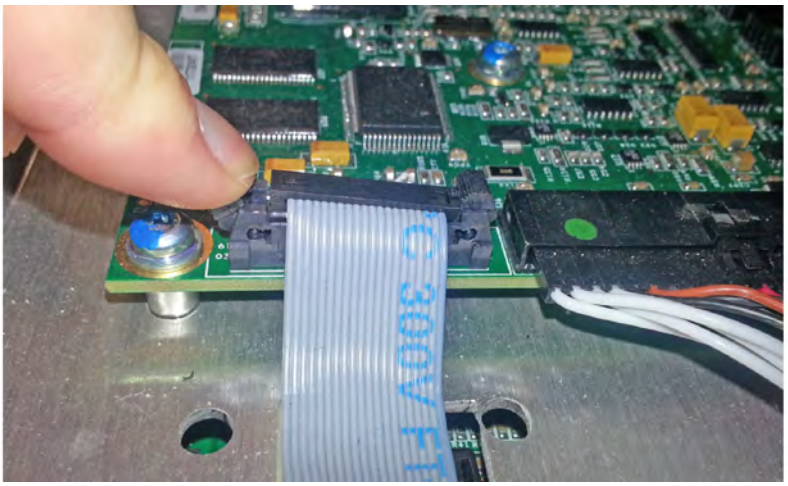

Figure 73. GATE Drive Card Cable Connector Installation (BCA Card Cable Connector Shown for Clarity)

5. Move BCA Mounting Shelf to its final location. Using a Torx-Plus® T25 bit, install the seven (7) M5x14mm screws that secure the BCA Mounting Shelf (refer to Figure 74). Torque the seven (7) M5x14mm screws to 3.1-3.5 N·m (27.4-31.0 lb in.).

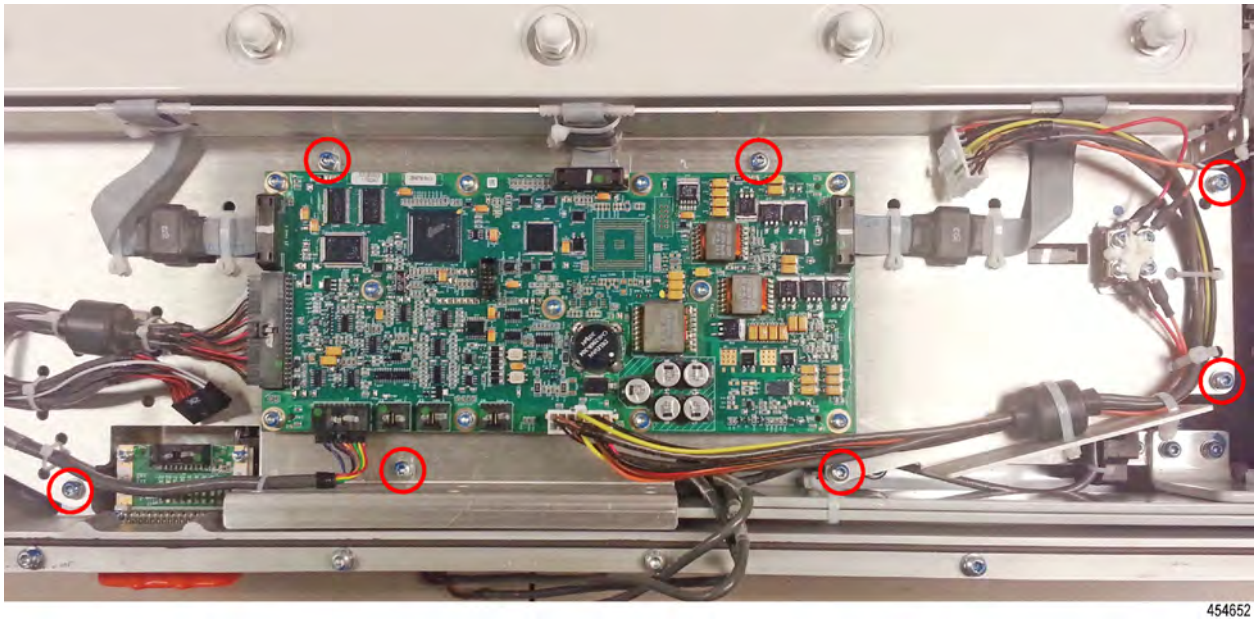

Figure 74. BCA Mounting Shelf Fastener Locations

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6. Install five (5) wire harness connectors to circuit card surface mount connectors (refer to Figure 75, Figure 76, and Figure 77).

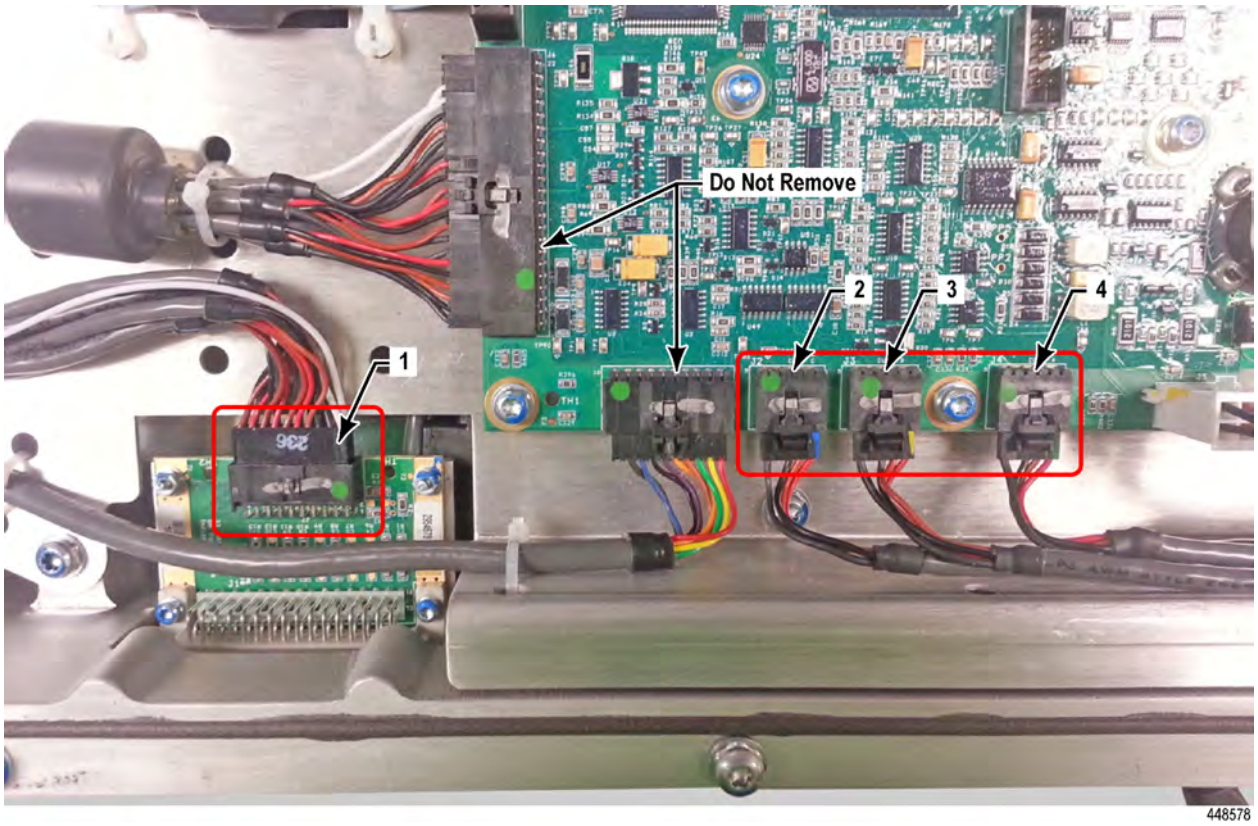

Figure 75. Wire Harness Connector Removal (4 Locations)

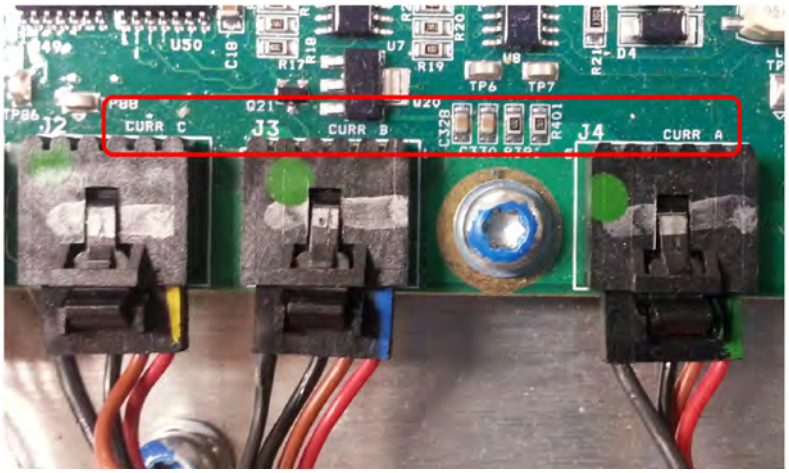

Figure 76. Current A, Current B, and Current C Locations

NOTE: Each current sensor phase (A, B, and C) MUST be plugged into the appropriate connector (CURR A, CURR B, CURR C).

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CAUTION: Permanent damage to the H 40/50 EP™ Drive Unit or DPIM can occur if the current sensor harnesses are plugged into the wrong connectors.

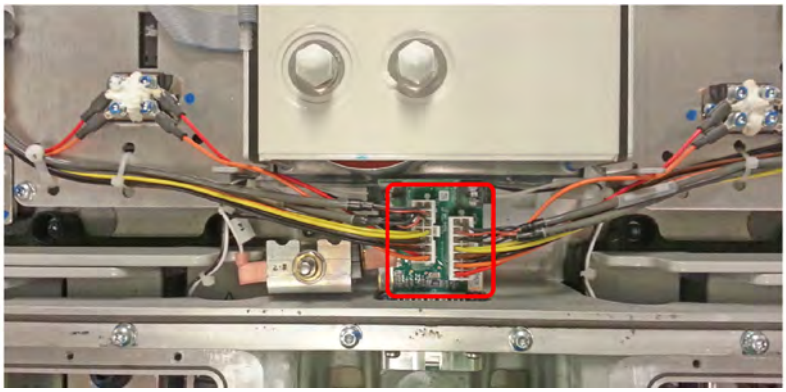

Figure 77. Wire Harness Connector Installation

7. Install NEW wire ties to retain the wire harnesses (refer to Figure 78).

Figure 78. Wire Tie Locations

Section 13: Installation of HVIL Circuit Card and Main Cover

1. Insert one (1) new wire tie into the new HVIL Circuit Card at the same location as shown in Figure 79.

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NOTE: To ease assembly, the new wire tie must be inserted through the hole in the circuit card prior to installation in the DPIM Housing.

Figure 79. HVIL Circuit Card – Wire Tie Location

2. Install HVIL Circuit Card into the DPIM Housing.

NOTE: Ensure that the wire harnesses and individual wires are NOT pinched under the circuit card during installation.

3. Connect the three (3) wiring harness connectors at locations shown in Figure 80.

Figure 80. HVIL Circuit Card – Three (3) Harness Connector Locations

4. Using a Torx-Plus® T25 bit, install and finger tighten the ten (10) M5 screws that secure the HVIL Circuit Card to the DPIM Housing. Torque all M5 screws to 3.1-3.5 N·m (27-31 lb in). Refer to Figure 81 for fastener sizes and locations.

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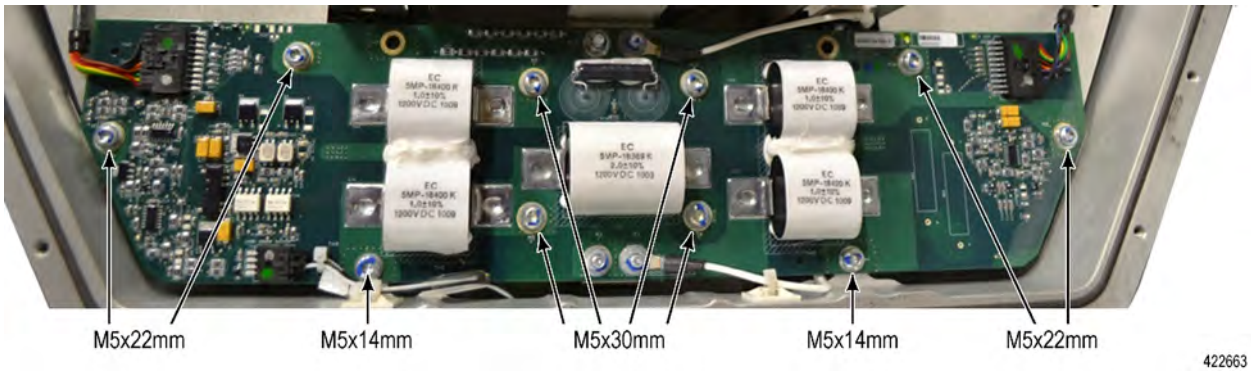

Figure 81. HVIL Circuit Card – Fastener Sizes/Locations

5. Install the two (2) wire ring terminals onto the studs at locations shown in Figure 82. Using an 8mm socket, install four (4) M5 nut/washer assemblies onto the studs as shown in the same figure. Torque the nuts to 3.1-3.5 N·m (27-31 lb in).

Figure 82. HVIL Circuit Card – Four (4) Mounting Nut/Washer Locations (M5)

6. Secure wiring with new wire ties and clip excess length as required. Refer to Figure 79 and Figure 83 for wire tie locations.

Figure 83. HVIL Circuit Card – Two (2) Wire Tie Locations

7. Install new Cover Gasket P/N 29540714, included in Electronic Service Kit P/N 29556119. Using a Torx-Plus® T25 bit, install and finger tighten the twenty-six (26) M5x18mm machine screws that secure the Main Cover to the DPIM Housing as shown in Figure 84. Torque the screws to 3.1-3.5 N·m (27-31 lb in).

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Figure 84. DPIM Main Cover

NOTE: For additional information refer to H 40/50 EP™ System Service Manual SM3602EN Appendix E.

8. Complete the DPIM check sheet again to verify the repair before installing the DPIM on the bus.

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