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SIL 3-EP-17, Rev. C
September, 2017
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SUBJECT: Replacing Gate Drive Cards Inside the Dual Power Inverter Module 2 (DPIM2)

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

Tools Required

- Electrostatic Discharge (ESD) Wrist Strap (refer to Figure 3)
- Pick or Small Flat Blade Screwdriver
- Torx-Plus® T8 Bit
- Torx-Plus® T10 Bit
- Torx-Plus® T20 Bit
- Torx-Plus® T25 Bit
- 8mm Hex Socket
- Loctite® 242
- Loctite® 425

Introduction:

This Service Information Letter (SIL) announces the availability of the Gate Drive Card (P/N 29559319) and includes the procedure to replace the Gate Drive Cards located inside the DPIM2. The availability of this kit may eliminate the need for a complete DPIM2 replacement under certain failure conditions.

Refer to Table 1 for related part numbers.

Table 1. DPIM2 Gate Drive Card Parts Information

Part Name	Part Number	Quantity (per DPIM2)
Gate Drive Card	29559319	6



NOTE: Perform the necessary diagnosis prior to ordering a Gate Drive Card(s) P/N 29559319. Contact Allison Technical Assistance Center (TAC) at (800) 252-5283 to confirm the failure.

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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.

Warranty Claim Information:

1. When a Gate Drive Card, P/N 29559319, is utilized to repair a failed DPIM under warranty, use Gate Drive Card P/N 29546784 as the PFP and claim the P/N in the Service Parts subsection of the AWAARE claim.

Diagnosis:

A Gate Drive Card may become damaged in various ways but typically it is due to a board-level component failing, either visually or internally. Visual examples include any of the tantalum capacitors (refer to Figure 1) or resistors burning. Board-level components can fail internally without any physical signs of damage.

DTCs that can set due to a failed Gate Drive Card include 73-58 and 74-58. At this time, unless there is visual damage to the card, there is no way to determine which of the three (3) Gate Drive Cards have failed. If there is no visual indication of which card has failed, all three (3) Gate Drive Cards will need to be replaced.

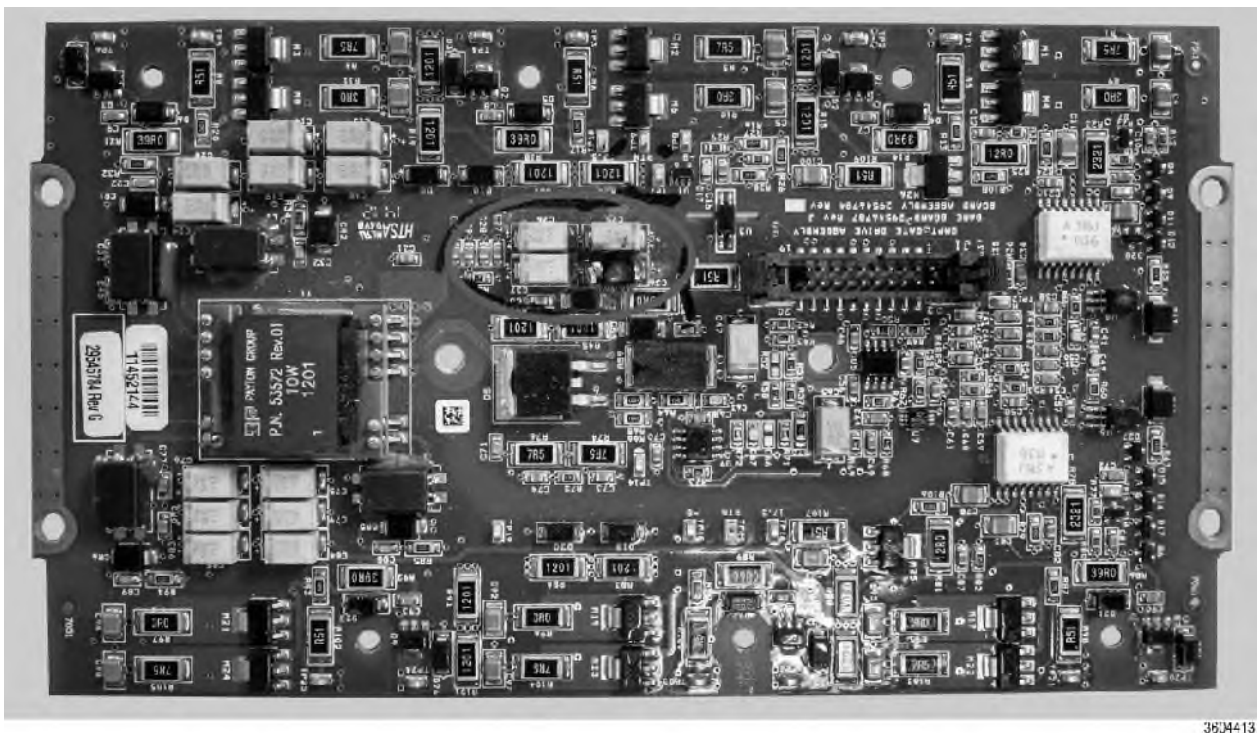


Figure 1. Burnt Tantalum Capacitor on Gate Drive Card



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.



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 Gate Drive Card replacement should NOT be performed if smoke and/or water damage are present.



CAUTION: The spring pins (refer to Figure 2) located in the SKiM® module that contact the bottom of the Gate Drive Card are NOT available for replacement if lost or damaged. Extreme caution must be used during removal of any Gate Drive Cards to ensure no spring pins are damaged or lost.



3604543

Figure 2. SKiM® Module Spring Pin

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 Gate Drive Card
- Section 4: Installation of Gate Card Drive
- Section 5: Installation of BCA Card Mounting Shelf
- Section 6: Installation of Main Cover and HVIL Circuit Card

Section 1: Removal of Main Cover and HVIL Circuit Card



NOTE: All circuit cards in the DPIM2 are sensitive to 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 3).



426411

Figure 3. Electrostatic Discharge (ESD) Wrist Strap (Typical)

1. Using a Torx-Plus® T25 bit, remove twenty-six (26) M5 x 18mm machine screws that secure the Main Cover to the DPIM Housing (refer to Figure 4). Set the screws aside for reassembly. Remove the Main Cover. Discard the cover gasket.



421911

Figure 4. DPIM Main Cover

2. Exercising care, cut one (1) wire tie at location shown in Figure 5. 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 5. HVIL Circuit Card – Wire Tie Location

3. Cut the two (2) wire ties at locations shown in Figure 6 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.



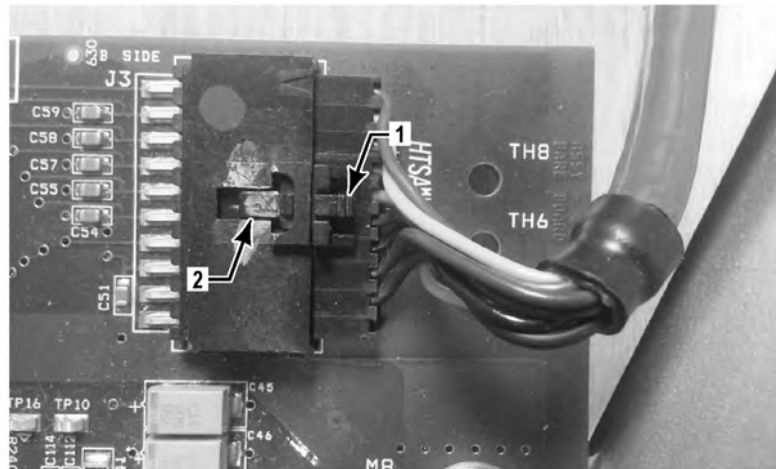
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Figure 6. HVIL Circuit Card – Two (2) Wire Tie Locations



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 7).



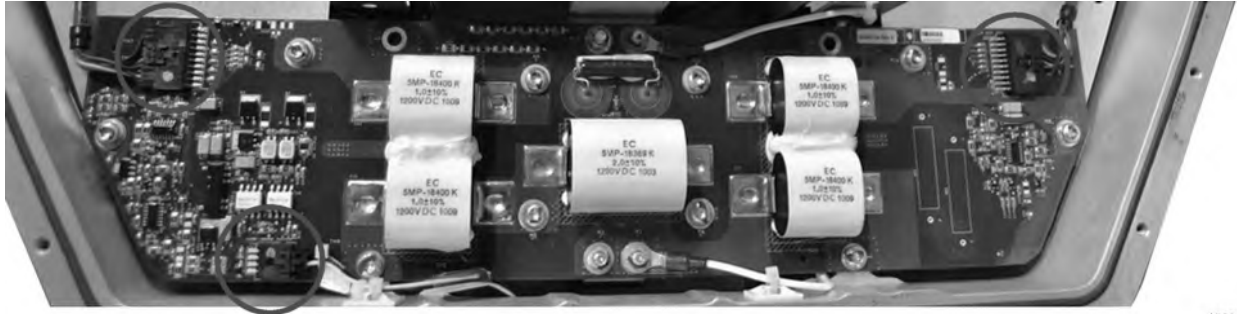
454544

Figure 7. 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 8).



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



422350

Figure 8. 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 9. Disconnect the two (2) wire ring terminals from the studs.



422390

Figure 9. HVIL Circuit Card – Four (4) Mounting Nut/Washer Locations (M5)

7. Using a Torx-Plus® T25 bit, remove the four (4) M5 x 30mm screws securing the HVIL Circuit Card as shown in Figure 10.



422540

Figure 10. HVIL Circuit Card – Four (4) Mounting Screw Locations (M5 x 30mm)

8. Using a Torx-Plus® T25 bit, remove the two (2) M5 x 14mm screws securing the HVIL Circuit Card as shown in Figure 11.



422564

Figure 11. HVIL Circuit Card – Two (2) Mounting Screw Locations (M5 x 14mm)

9. Using a Torx-Plus® T25 bit, remove the four (4) M5 x 22mm screws securing the HVIL Circuit Card as shown in Figure 12.



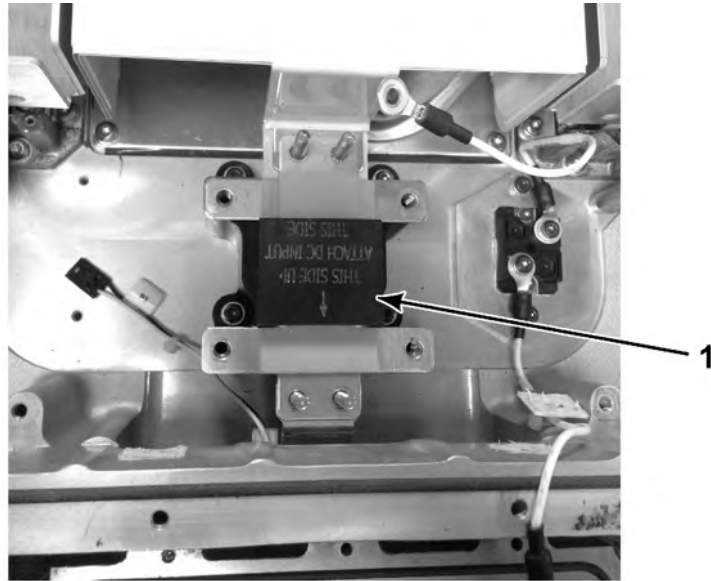
422586

Figure 12. HVIL Circuit Card – Four (4) Mounting Screw Locations (M5 x 22mm)

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 13.



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 13. The choke must be installed with the arrow pointing toward the DC lug box.



437484

(1) – Choke

Figure 13. Verification of Choke Installation

Section 2: Removal of BCA Card Mounting Shelf



NOTE: Only the BCA Card Mounting Shelf corresponding to the inverter (A or B) needing repairs needs to be removed.

1. Carefully cut and remove the wire ties retaining the wire harnesses (refer to Figure 14).

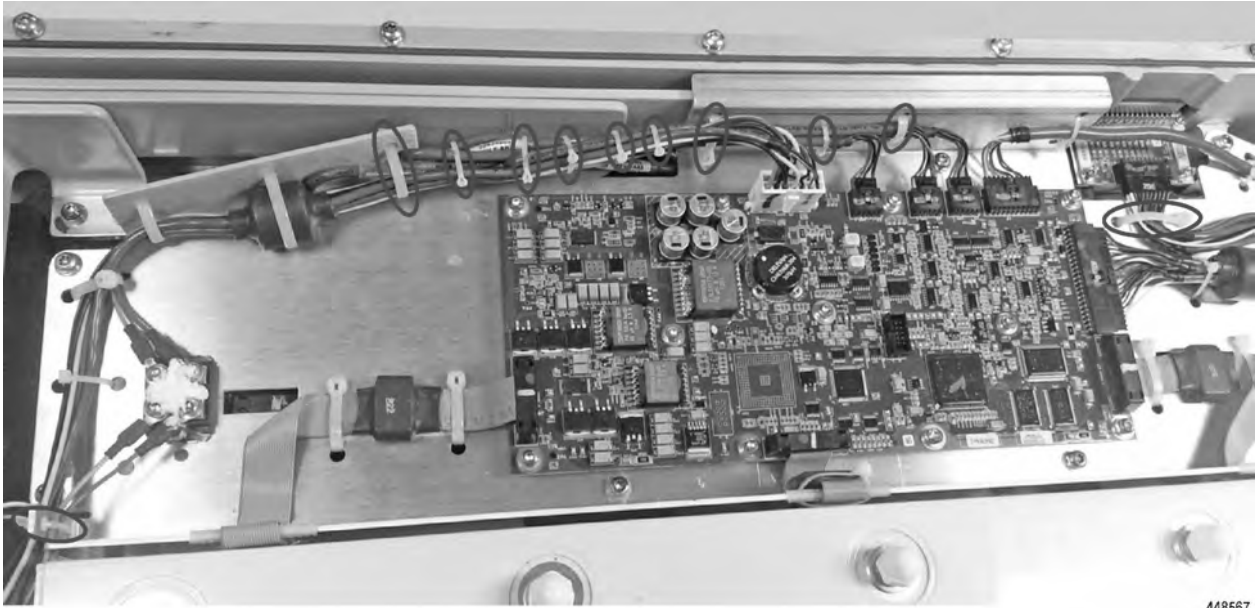


Figure 14. Wire Tie Locations



NOTE: Label the wires on connectors 2, 3, and 4 (refer to Figure 15) 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 15 and Figure 16).



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

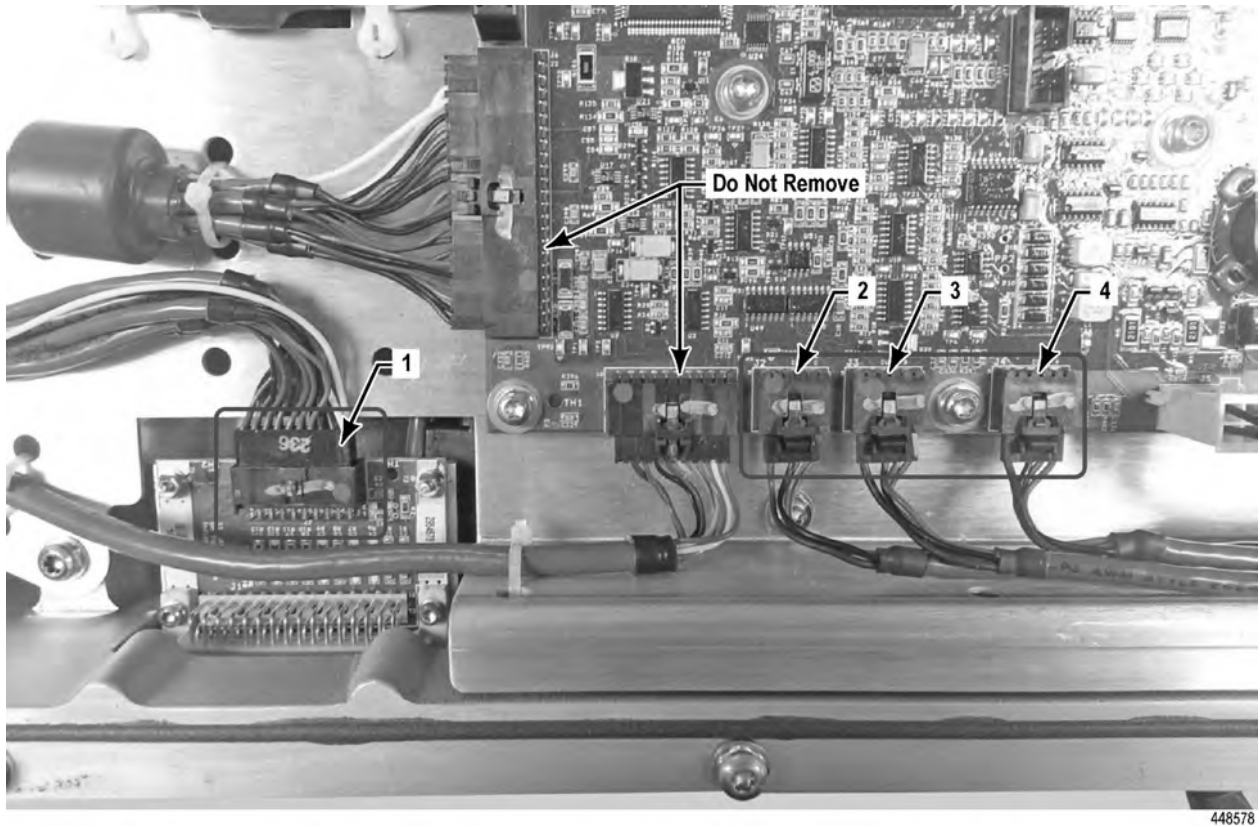


Figure 15. Wire Harness Connector Removal (4 Locations)

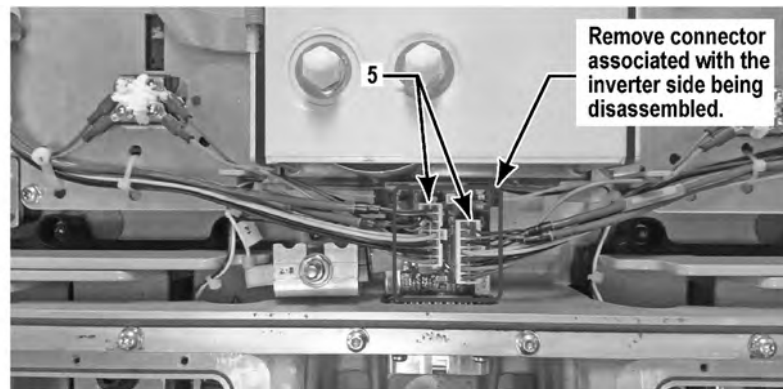


Figure 16. Wire Harness Connector Removal

3. Using a Torx-Plus® T25 bit, remove the seven (7) M5 x 14mm screws securing the BCA Mounting Shelf (refer to Figure 17).

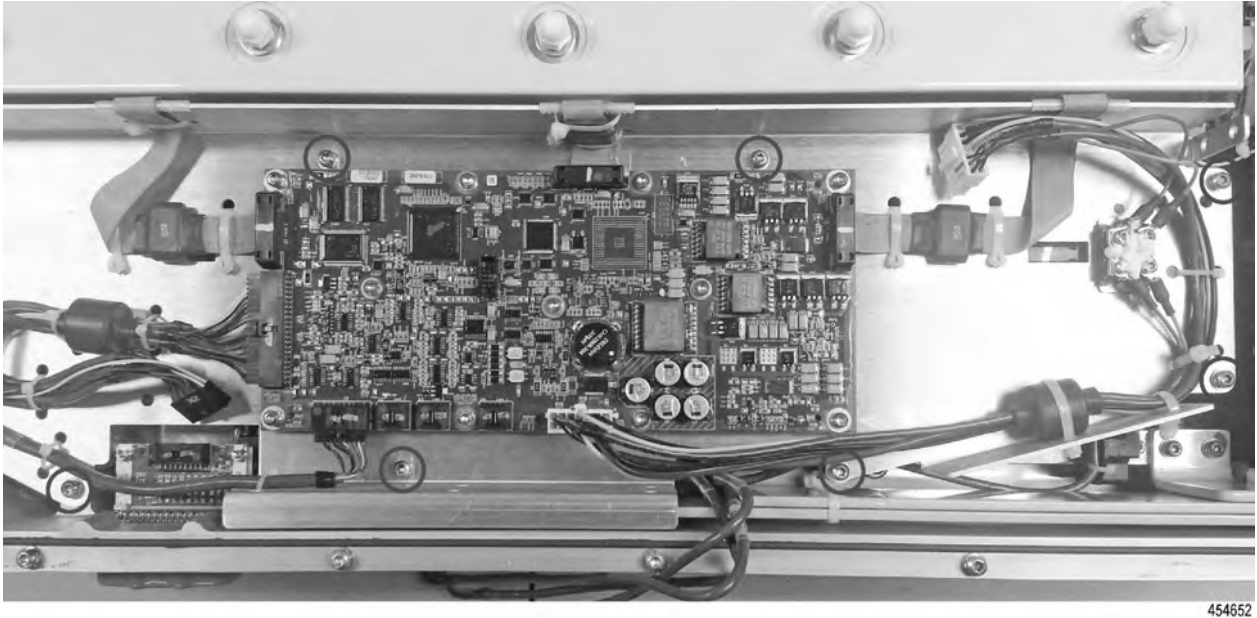


Figure 17. BCA Mounting Shelf Fastener Locations

4. Carefully lift the BCA Mounting Shelf and set it on the side of the chassis as shown in Figure 18.



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 18.

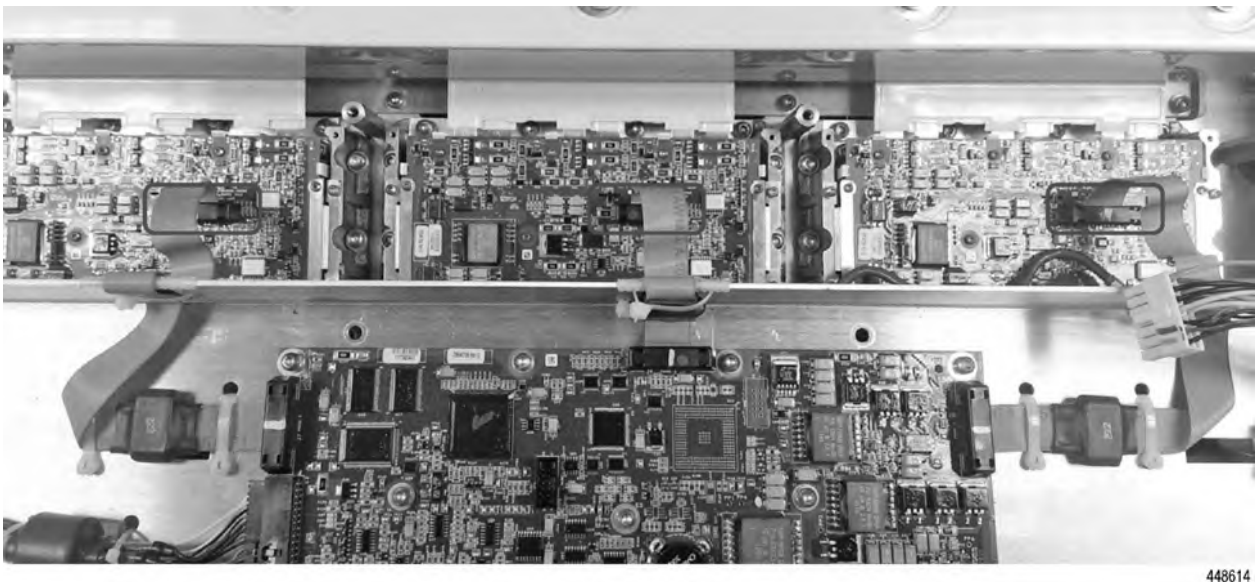
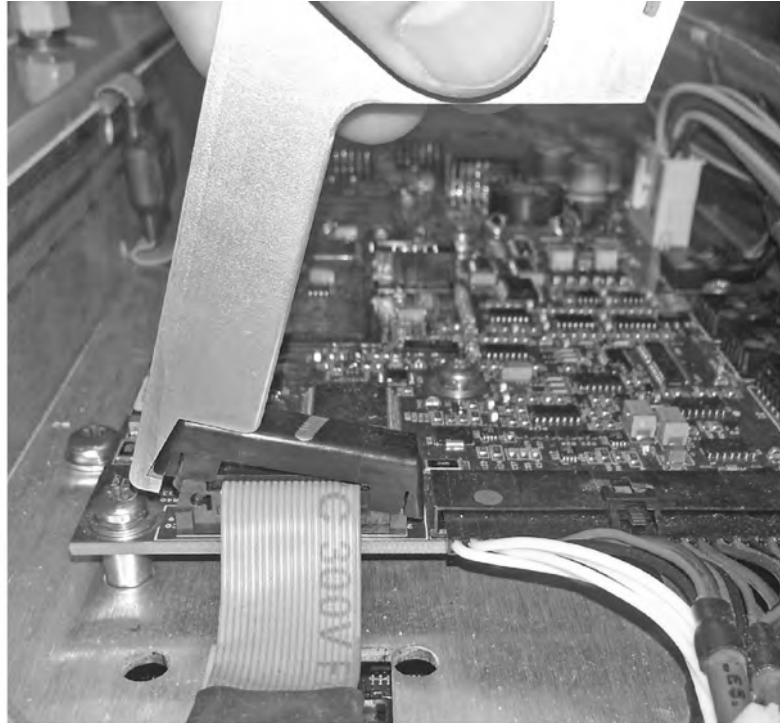


Figure 18. BCA Mounting Shelf Relocation

5. Remove three (3) ribbon cable connectors from the Gate Drive Cards (refer to Figure 18) as follows:
 - a. Use the handle of Tab Bending Tool J-51586 to disengage and remove the cable strain relief cap (refer to Figure 19).

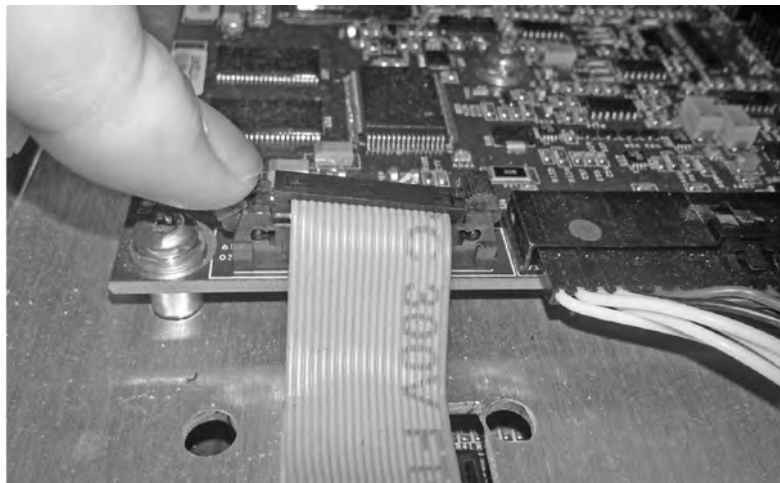
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448897

Figure 19. 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 20).



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Figure 20. 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.

Section 3: Removal of Gate Drive Card



NOTE: Refer to Figure 21 for DPIM2 Phase Locations.

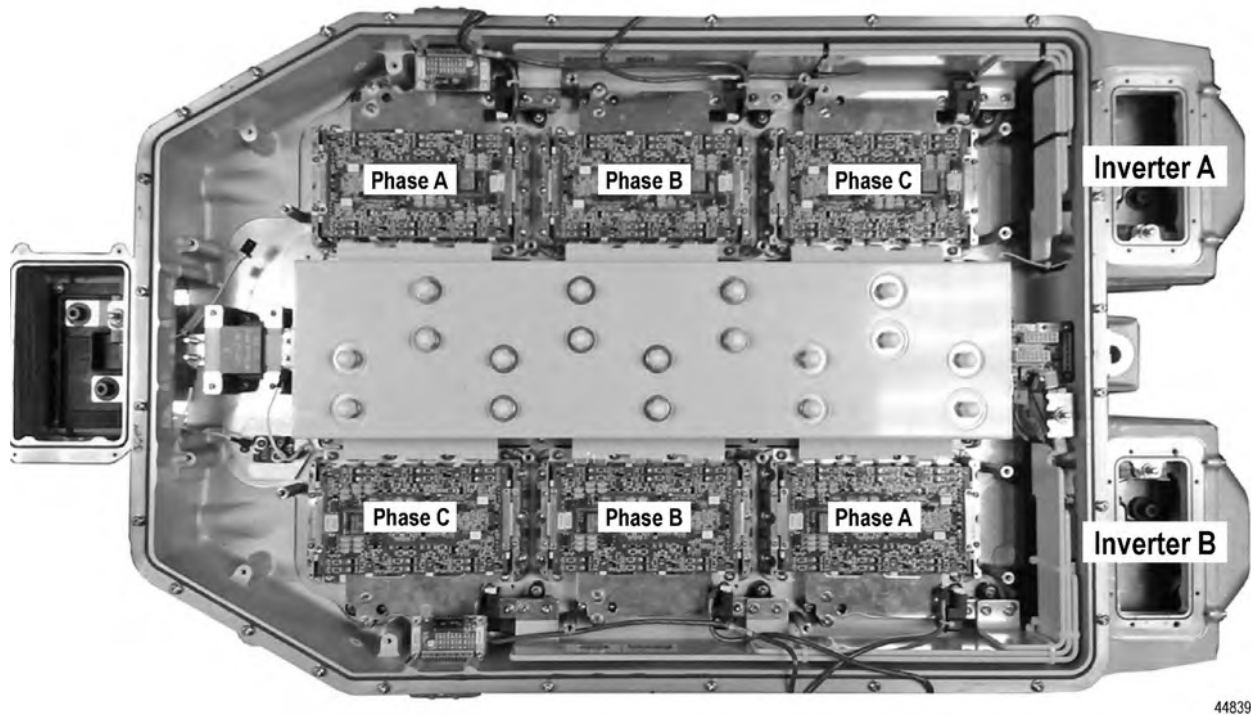
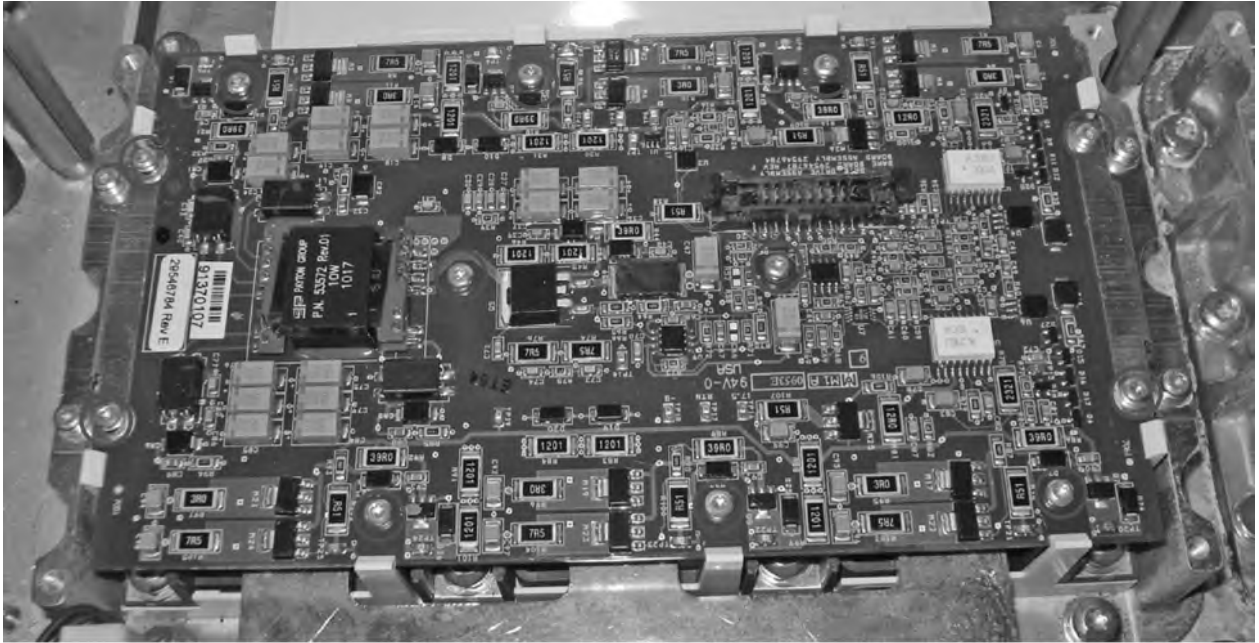


Figure 21. DPIM2 Phase Locations

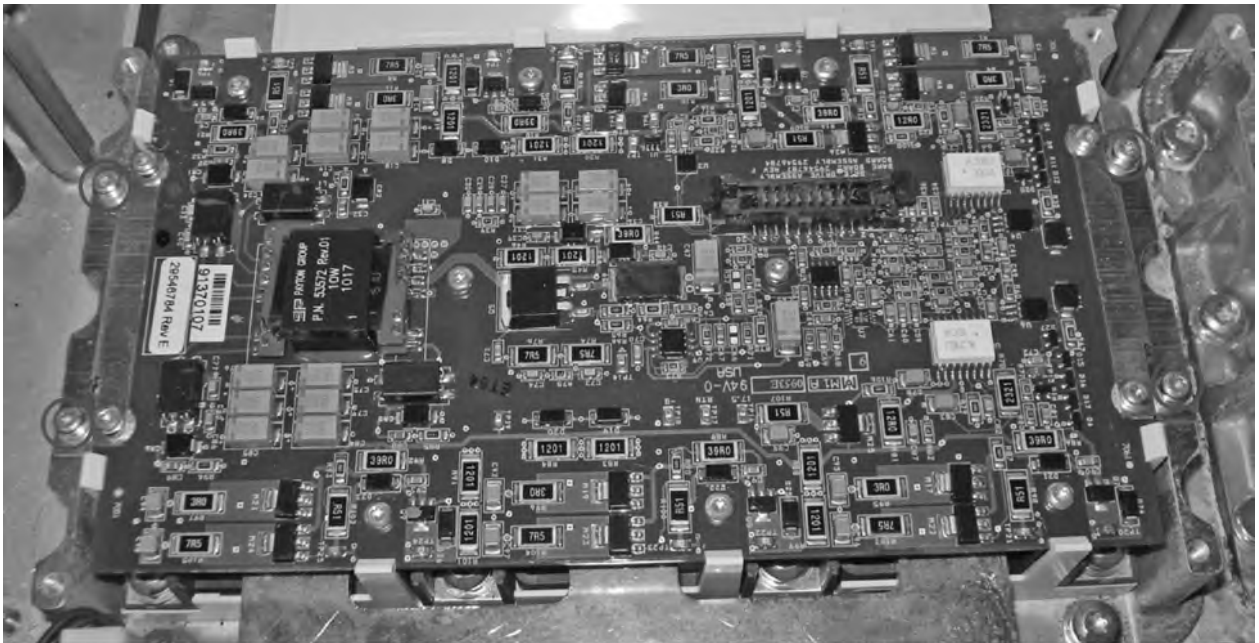
1. Using a Torx-Plus® T8 bit, remove the twelve (12) M3 x 8mm (coarse thread) screws from the Gate Drive Card (refer to Figure 22).



448655

Figure 22. Gate Drive Card Fastener Locations (M3 x 8mm Coarse Thread – Quantity 12)

2. Using a Torx-Plus® T10 bit, remove the four (4) M3 x 8mm (fine thread) screws from the Gate Drive Card (refer to Figure 23). Set the two (2) grounding brackets aside.



448657

Figure 23. Gate Drive Card Fastener Locations (M3 x 8mm Fine Thread) – Quantity 4

3. Carefully pry back the ten (10) white locking tabs (refer to Figure 24) to release the Gate Drive Card from its mounting location and gently lift the card straight up and away from the DPIM.

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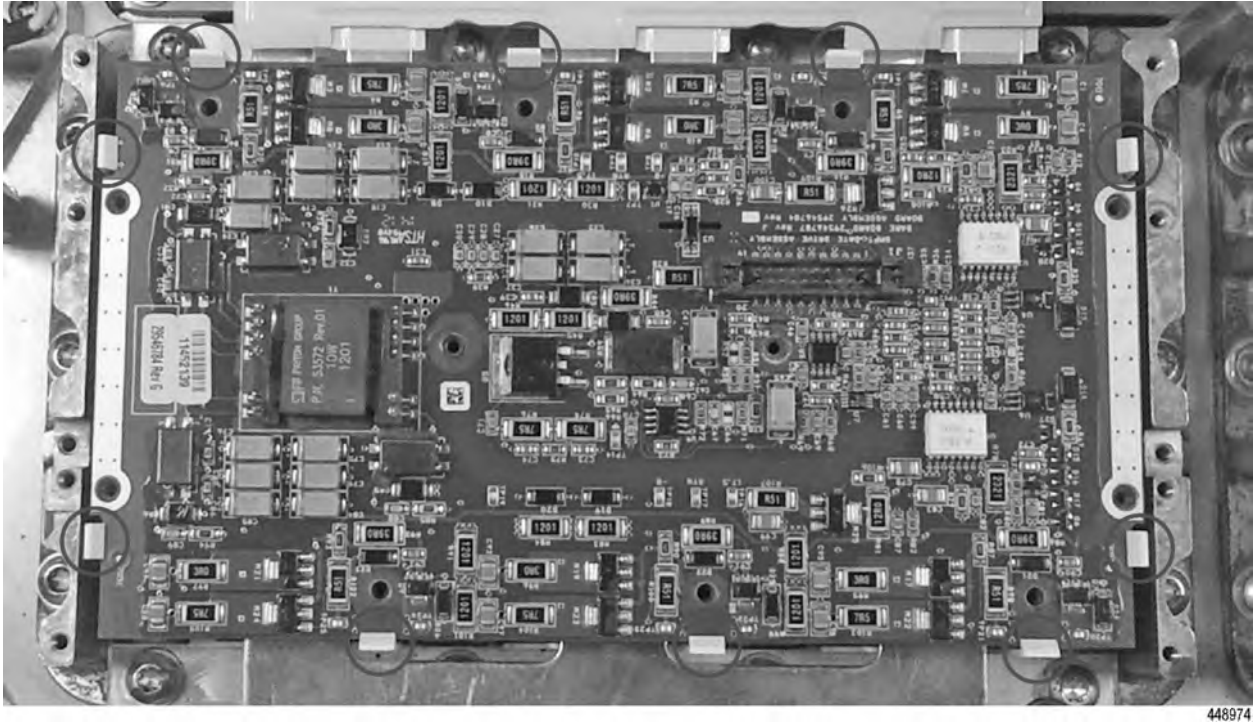


Figure 24. Gate Drive Card Locking Tab Locations



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.

4. Verify that all fifteen (15) spring pins are still present in the SKiM® module (refer to Figure 25).

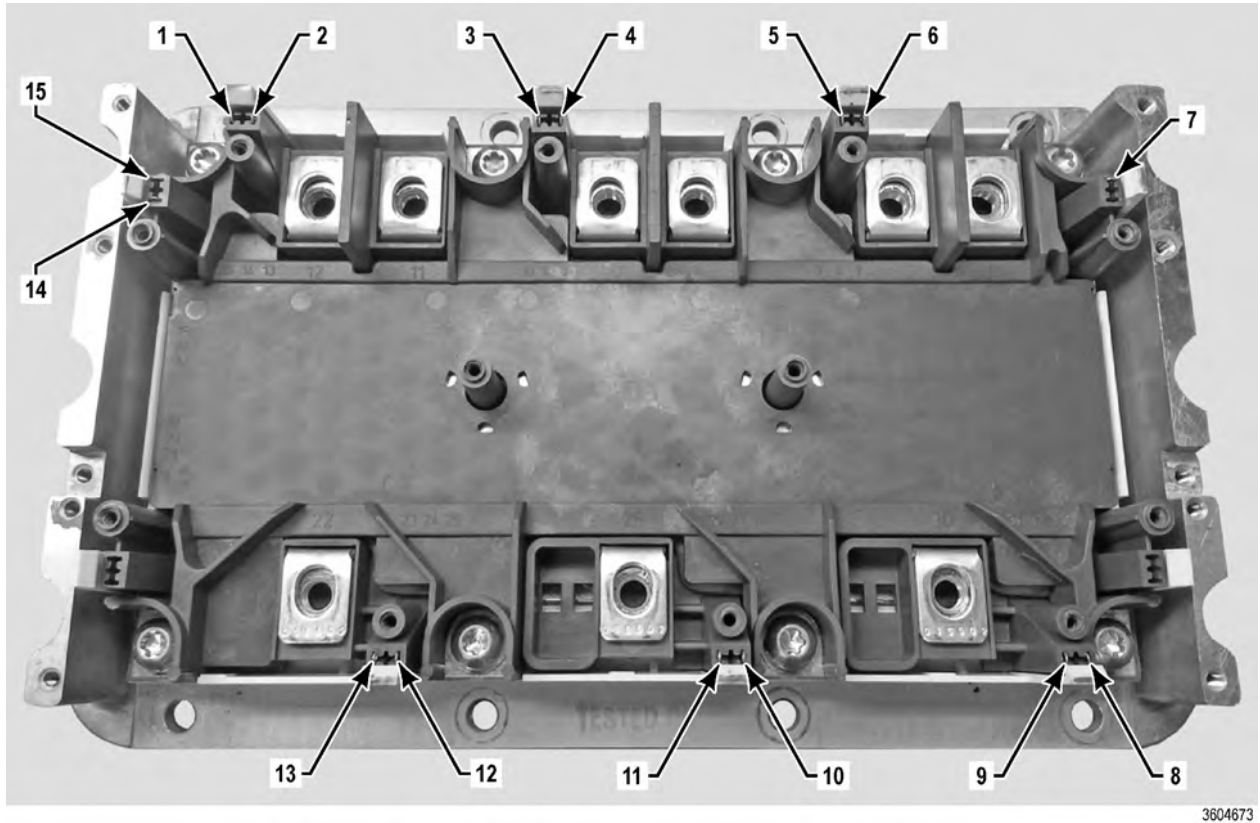
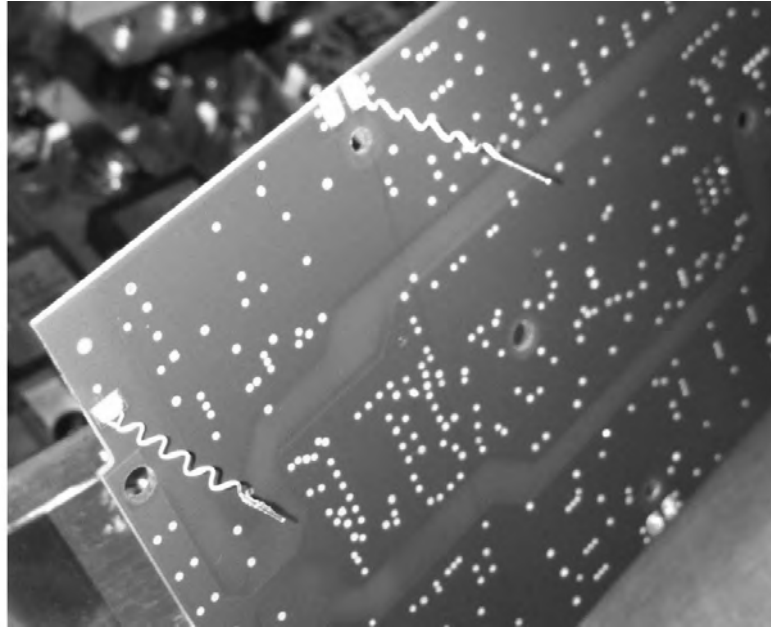


Figure 25. SKiM® Spring Pins Locations

5. If any spring pins are stuck to the bottom of the card (refer to Figure 26), remove them from the solder pad taking care not to bend or lose the pin. Reinstall the spring pin into the corresponding hole in the SKiM® module (refer to Figure 25).



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Figure 26. Spring Pins Stuck to Gate Drive Card Solder Pads

Section 4: Installation of Gate Card Drive

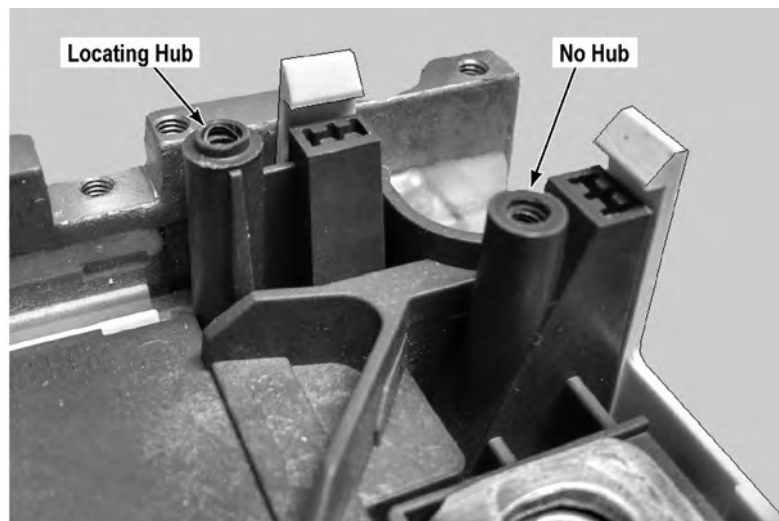
1. Position the Gate Drive Card over the locating hubs on the SKiM[®] module (refer to Figure 27). Carefully press the new Gate Drive Card straight down over the ten (10) white locking tabs (refer to Figure 28) so the card is fully seated.



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.



3327600

Figure 27. Locating Hub Identification on SKiM[®] Module



Figure 28. Gate Drive Card Locking Tab Locations

2. Place the two (2) grounding brackets into position of the SKiM[®] module. Using a Torx-Plus[®] T10 bit, install the four (4) M3 x 8mm (fine thread) screws to the Gate Drive Card (refer to Figure 29). Torque all four (4) M3 x 8mm (fine thread) screws to 0.6-0.8 N·m (5.3-7.1 lb in).



Figure 29. Gate Drive Card Fastener Locations (M3 x 8mm Fine Thread) – Quantity 4)

3. Using a Torx-Plus® T8 bit, install the twelve (12) M3 x 8mm (coarse thread) screws to the Gate Drive Card (refer to Figure 30). Torque all twelve (12) M3 x 8mm (coarse thread) screws to 0.3-0.6 N·m (2.7-5.3 lb in).

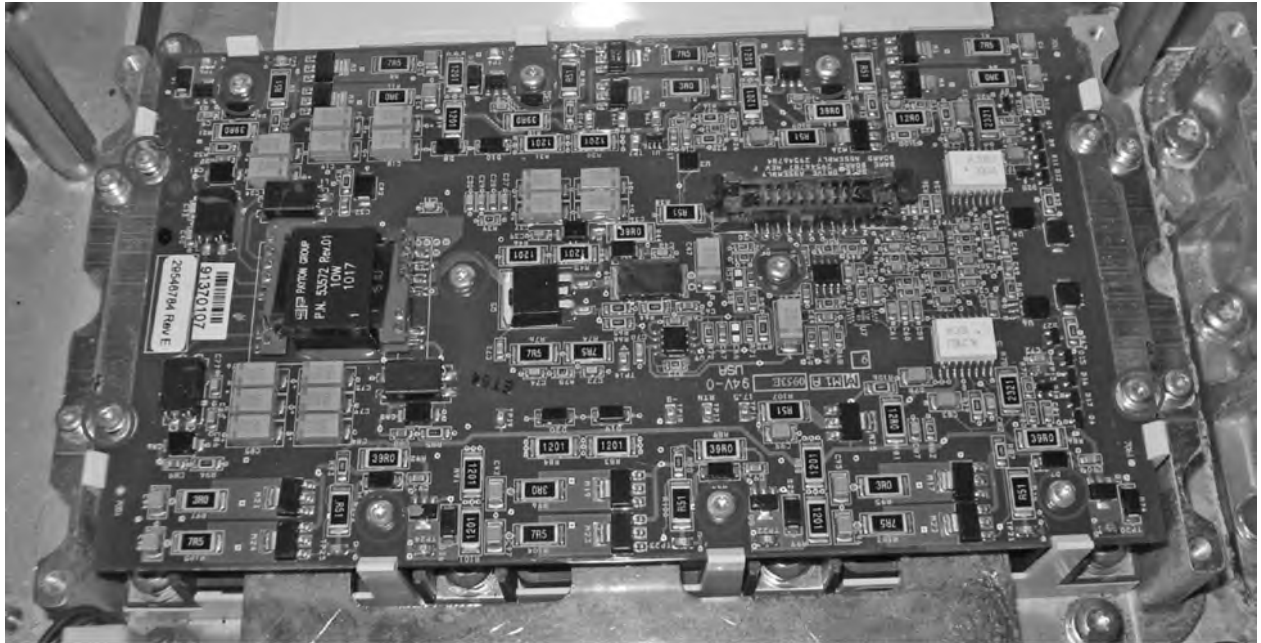
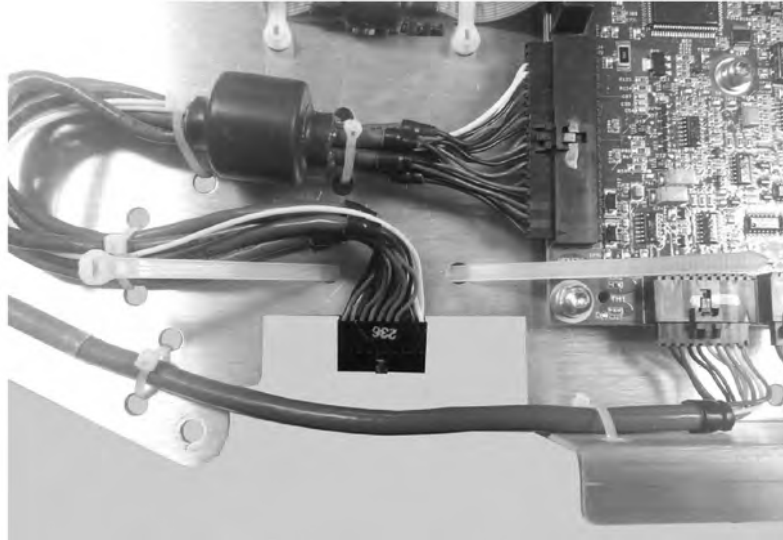


Figure 30. Gate Drive Card Fastener Locations (M3 x 8mm Coarse Thread – Quantity 12)

Section 5: Installation of BCA Card Mounting Shelf

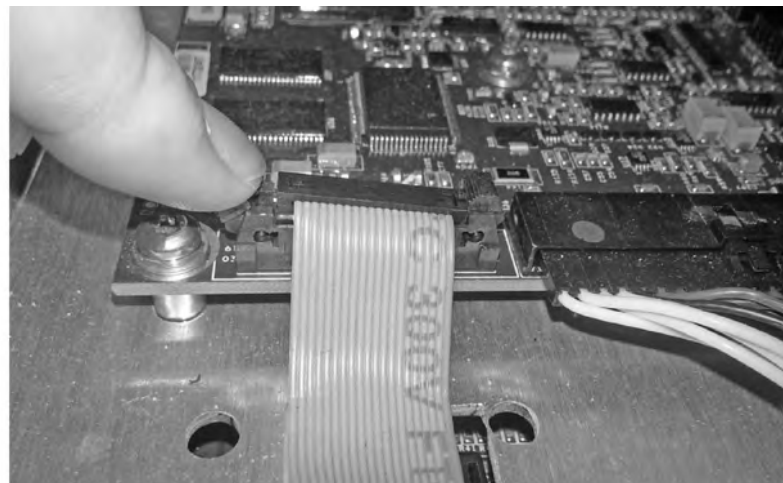
1. Feed all tie wraps through the BCA Card Mounting Shelf (refer to Figure 31).



454668

Figure 31. BCA Card Mounting Shelf Tie Wrap Location

2. Place the BCA mounting shelf onto the side of DPIM chassis and connect three (3) Gate Drive Card Connectors to three (3) Gate Drive Cards (refer to Figure 32) and install the cable strain relief caps.



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Figure 32. Gate Drive Card Cable Connector Installation (BCA Card Cable Connector Shown for Clarity)

3. Move the BCA Mounting Shelf to its final location. Using a Torx-Plus® T25 bit, install the seven (7) M5 x 14mm screws that secure the BCA Mounting Shelf (refer to Figure 33). Torque the seven (7) M5 x 14mm screws to 3.1-3.5 N·m (27.4-31.0 lb in).

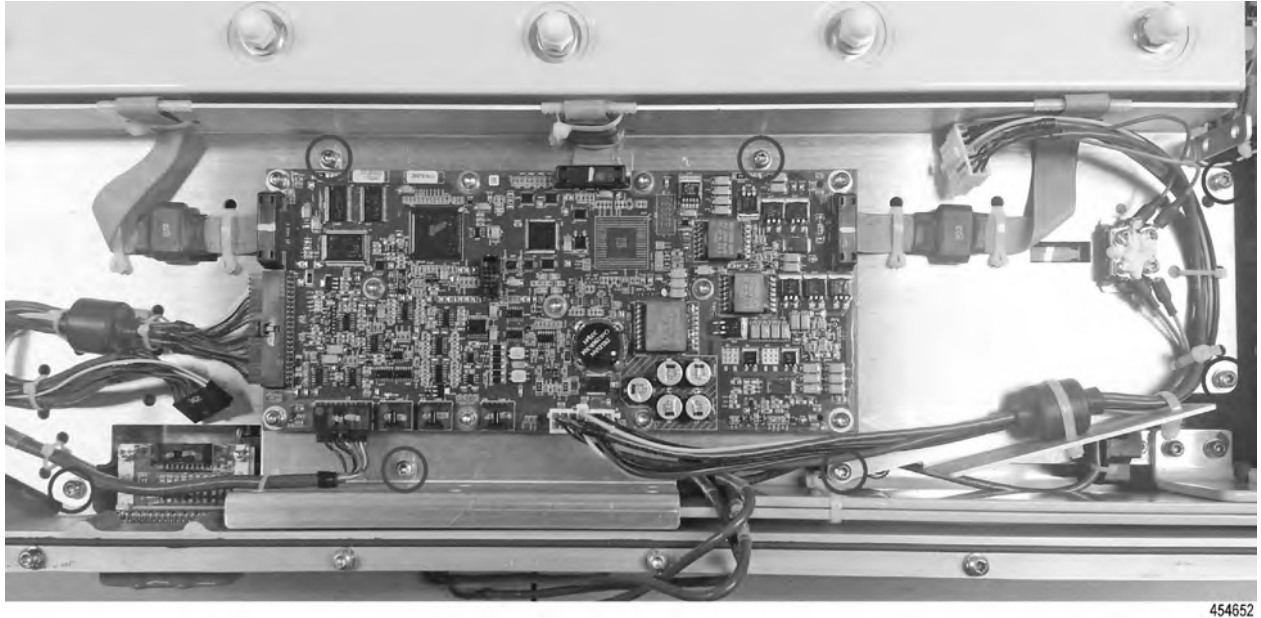


Figure 33. BCA Mounting Shelf Fastener Locations

4. Install five (5) wire harness connectors to circuit card surface mount connectors (refer to Figure 34, Figure 35, and Figure 36).

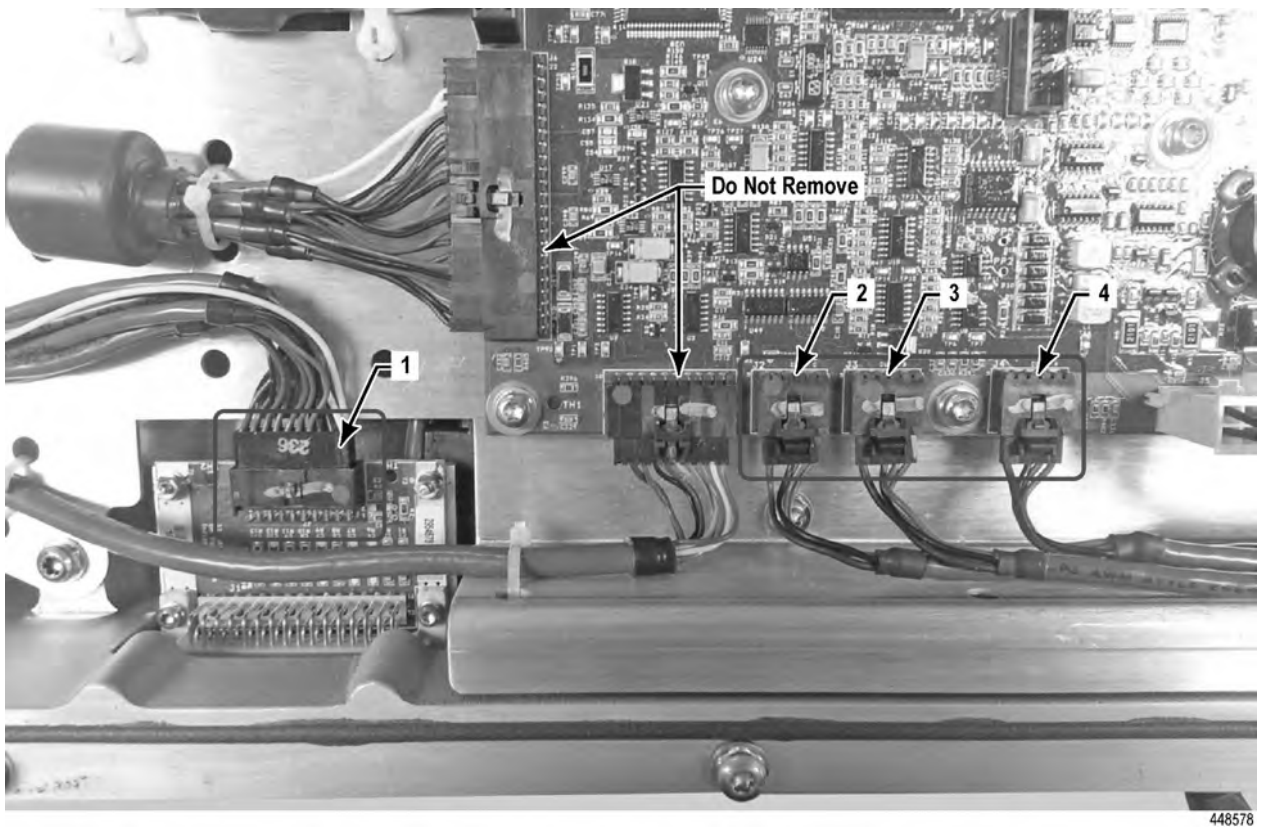
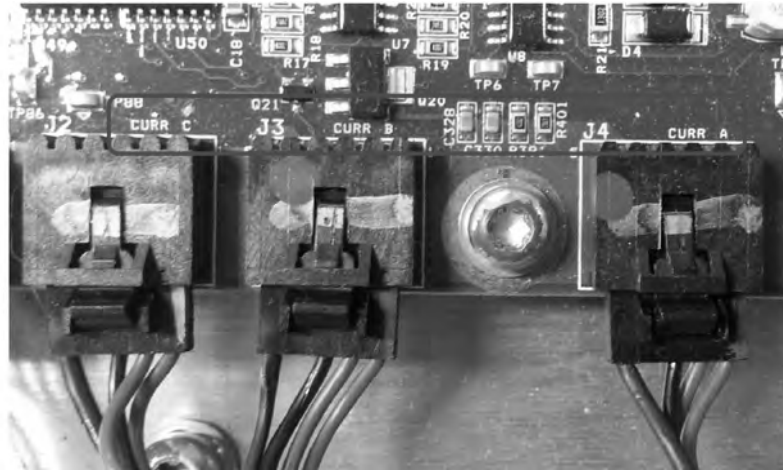


Figure 34. Wire Harness Connector (4 Locations)

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Figure 35. Current A, Current B, and Current C Locations



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Figure 36. Wire Harness Connector Installation

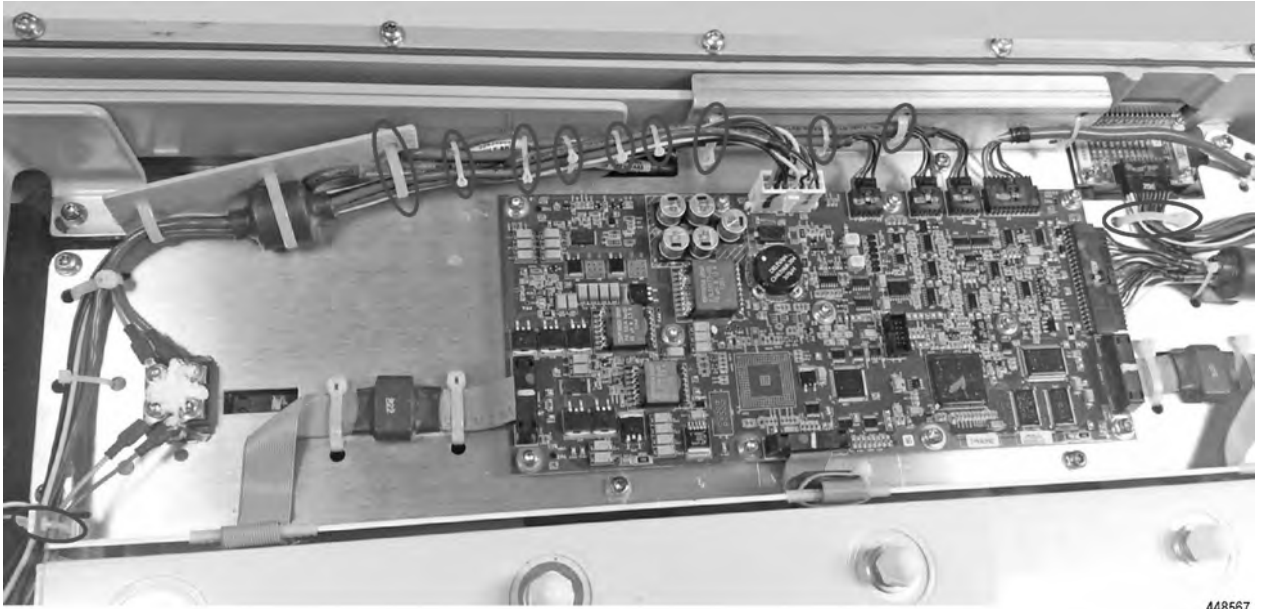


NOTE: Each current sensor phase (A, B, and C) **MUST** be plugged into the appropriate connector (CURR A, CURR B, CURR C).



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

5. Install new wire ties to retain the wire harnesses (refer to Figure 37).



448567

Figure 37. Wire Tie Locations

Section 6: Installation of Main Cover and HVIL Circuit Card

1. Insert one (1) new wire tie into the HVIL Circuit Card at the same location as shown in Figure 38.



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.



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Figure 38. 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 39.



422350

Figure 39. 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 40 for fastener sizes and locations.

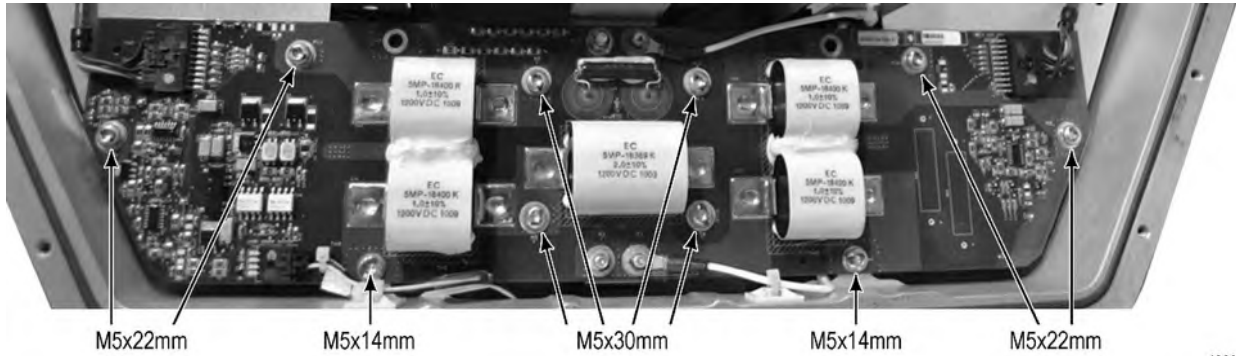


Figure 40. HVIL Circuit Card – Fastener Sizes/Locations

5. Install the two (2) wire ring terminals onto the studs at locations shown in Figure 41. 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 41. 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 38 and Figure 42 for wire tie locations.



Figure 42. HVIL Circuit Card – Two (2) Wire Tie Locations



NOTE: Verify that all eighteen (18) white protective caps are installed over the capacitor studs in the center of the DPIM. Reinstall or replace any missing caps as necessary.

7. Install new Cover Gasket P/N 29540714. Using a Torx-Plus® T25 bit, install and finger tighten the twenty-six (26) M5 x 18mm machine screws that secure the Main Cover to the DPIM Housing as shown in Figure 43. Torque the screws to 3.1-3.5 N·m (27-31 lb in).



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



421911

Figure 43. DPIM Main Cover

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

NOTE: This illustration is to be used for identifying the name and location of components within the Dual Power Inverter Module 2 (DPIM2). It is not intended to be used for disassembly and assembly procedures.

DPIM2

Levels of Assembly

